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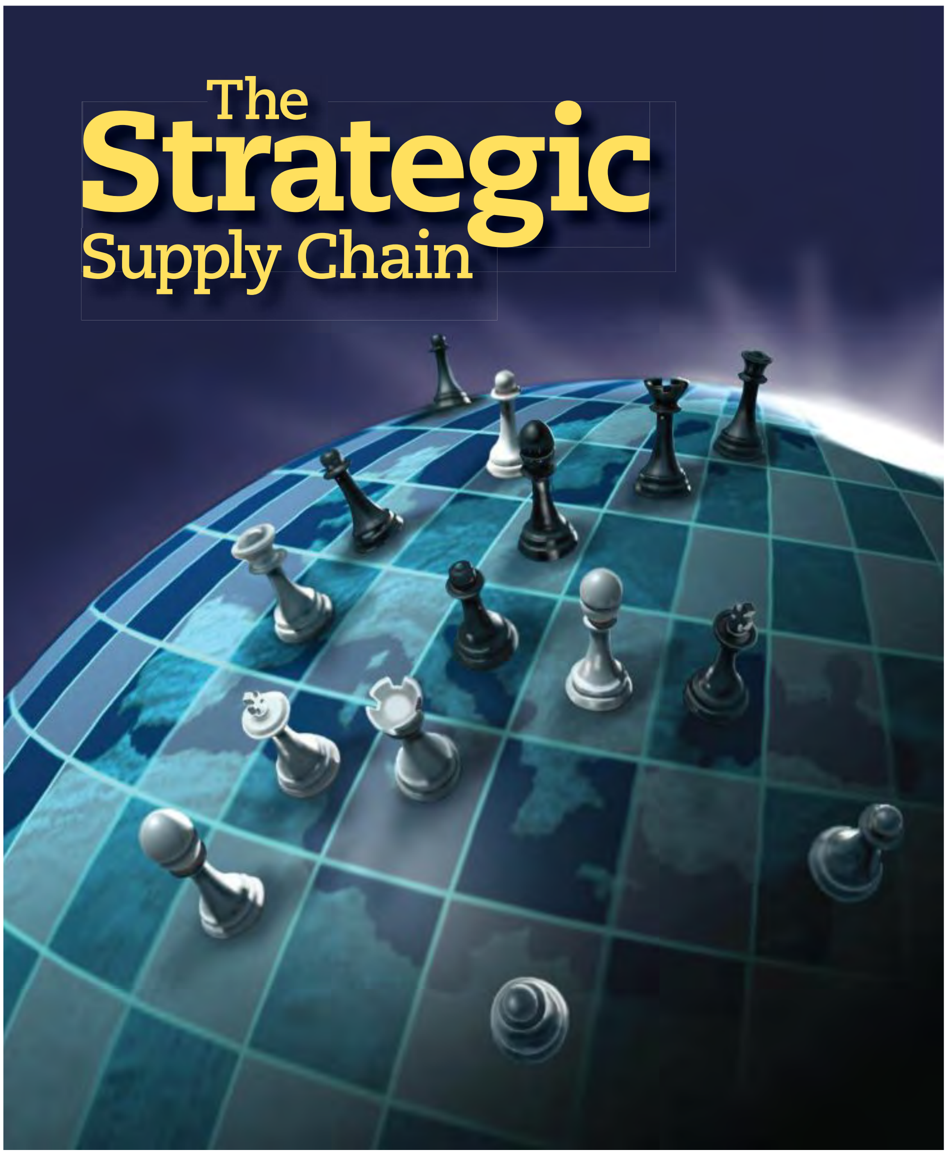

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The strategic, collaborative and integrative supply chain

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Is supply chain management strategic or tactical? Are the best supply chains collaborative? Should the goal be an integrated supply chain or an integrative supply chain?

Those are questions I've heard posed by thought leaders ever since I took the helm of *SCMR* three years ago. The answers are a mixed bag, according to this month's contributors. Let's start with the strategic supply chain. For years, most supply chains were tactical, focused on the most efficient and cost effective way to get product into the hands of customers. Increasingly, albeit slowly, there is a recognition that the best supply chains are those that enable a company's go-to-market strategy. While that sounds well and good, the profession is better at turning out tacticians than strategic thinkers, contends Steven Melnyk, who argues that its time to turn our focus to training strategic managers.

When it comes to collaboration, who remembers the ad produced by ERP provider JD Edwards during the tech boom? It showed an executive running for his life down a city sidewalk over the tag line: Collaborate or die! Within a few years of that ad, JD Edwards was out of business. That may sum up the state of collaboration, according to Stanley and Amydee Fawcett, Sebastian Brockhaus and A. Michael Knemeyer, who present the conclusions of a 14-year longitudinal study that included 135 interviews with managers. They write: "After 20 plus years of talking about collaboration: 'Are we there yet?' The answer, quite simply, is 'no.'" The authors identify the key roadblocks that must be cleared if a collaborative relationship is going to succeed.

Many companies have focused their efforts on creating an "integrated" supply chain managed by a "supply chain czar." What we need instead, writes long-time columnist Larry Lapide, are integrative supply chains, where "a small cadre of 'unbiased' managers would help coordinate, synchronize and integrate the supply-side, demand-side and financial organizations to achieve corporate objectives." That sounds an awful lot like a strategic supply chain to me.

We round out the issue with timely articles on supply chain's emerging role as a protector of the company brand; a look at the emerging market for on-demand warehousing; and a take on Amazon's entrance into the freight forwarding and air transport businesses.

As always, I look forward to hearing from readers. Keep leading the way in your organization's supply chain.

Bob Trebilcock

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Defend the company brand, too

Looking back at 10 years' worth of columns, I see two related supply chain trends that need to evolve more quickly.

I am completing my 10th year as the "Insights" columnist. Those of you who have followed the column during my tenure, or have possibly attended one of my numerous presentations, already know that I am passionate about supply chain management (SCM). I began my career in marketing management where I stayed until I joined Accenture's logistics and supply chain consulting practice in 1990. Since then, I've been lucky to be involved in SCM's phenomenal evolution—fostered by the growth in global trade and consumerism. SCM is a profession with noble goals, benefiting the world by fulfilling the needs of global citizens, while efficiently using Earth's precious resources.

When I look back over 10 year's worth of columns, I see two important trends that need to evolve more quickly. One is the transition from integrated to integrative supply chain management, while the other is supply chains' emerging role as a defender of the company brand. I believe the two are related to each other. When I look forward, my expectation for the profession is a tall order for managers to fulfill—but it is one that is shared by most of my colleagues.

Dr. Lapide has extensive experience in the industry as a practitioner, consultant, and software analyst. He is currently a lecturer at the University of Massachusetts' Boston Campus and is an MIT Research Affiliate. He received the inaugural *Lifetime Achievement in Business Forecasting & Planning Award* from the Institute of Business Forecasting & Planning. He welcomes comments on his columns at llapide@mit.edu.

Integrated versus integrative SCM

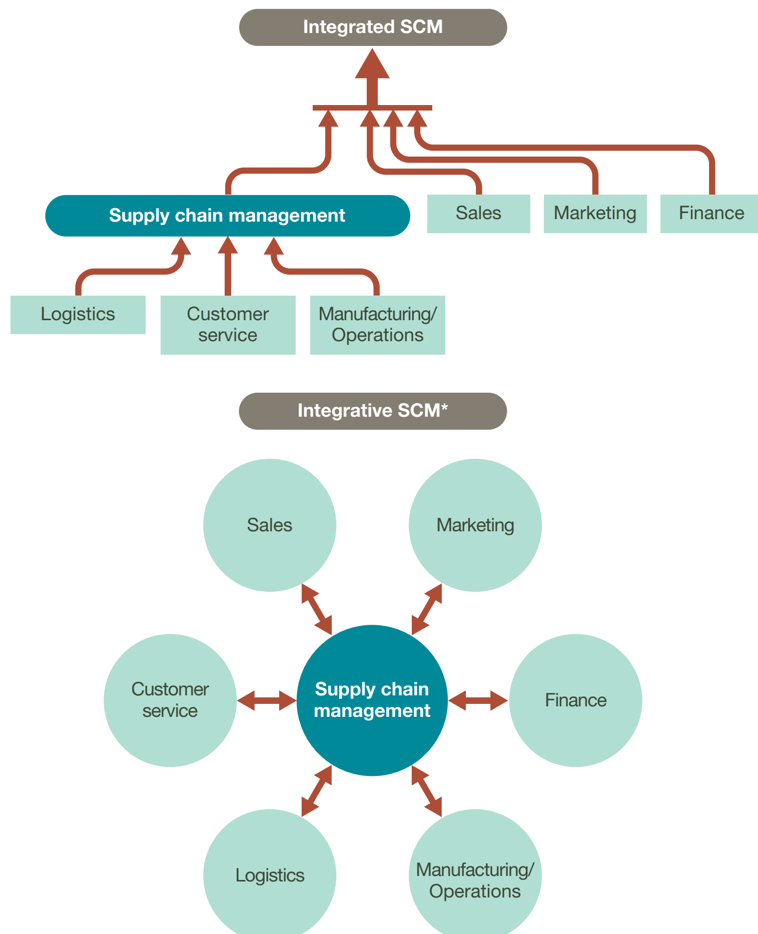
Let's start by looking at integrated versus integrative SCM. Historically, SCM's major goal has been to ensure that a company balances its supply-side activities to most effectively and efficiently create supply to match customer demand, while meeting corporate objectives such as financial performance targets. Companies have traditionally organized SCM groups around this goal. However, our "noble goals" are broader and more important than just that one. Ultimately, our goals ought to include such things as creating the most competitive supply chain in our vertical—something I have written about extensively—and producing the highest quality for all products and services sold by our companies. The latter does not just include a physical product's quality, as purchasing and manufacturing organizations are responsible for that. SCM groups need to organize around fulfilling these additional goals as well.

In "Time for Integrative SCM," an early column published in October 2007, I showed a chart attributed to Rick Blasgen, president and CEO, of the Council of Supply Chain Management Professionals (CSCMP) that is reproduced in Figure 1. The chart depicts the difference between an integrated versus an integrative SCM organizational structure. The integrated structure on the top depicts how SCM initially evolved over time by focusing on integrating supply-side activities such as manufacturing/operations, logistics and customer service. Many companies did this by creating a supply chain czar to manage the organizations, synchronize operations and get rid of the legacy silos that were often in place. However, that approach just resulted in one large supply chain silo that replaced multiple silos.

Having a career that started in marketing (a

FIGURE 1

SCM should be integrative, not necessarily integrated



*Source: Rick Blasgen, President and CEO, Council of Supply Chain Management Professionals (CSCMP)

demand-side function), I always felt the most important silos to bridge were between supply chain on one side and sales and marketing and finance on the other side. The SCM function does not have to be one big organization of supply-side functions; rather, it should be an organization that collaborates with all of the functions, as shown on the bottom of the figure—termed the "integrative" SCM organization. Thus, rather than one supply chain silo, a small cadre of "unbiased" managers would help coordinate, synchronize and integrate the supply-side, demand-side and financial organizations to achieve corporate objectives. This group would be involved in three demand management processes: sales and operations planning (S&OP), order promising and fulfillment, and customer segmentation and service program processes.

Supply chain groups have made significant strides in implementing an integrative SCM approach, especially with regard to S&OP processes. However, they often struggle to influence demand-side management to the degree needed to ensure that sales and marketing plans are truly in the best interest of the corporation—even with regard to brand image. As illustrated by the following examples, this is what I mean by defending the company brand.

Negatively affecting some brands

In three of my past columns, I discussed situations in which companies took actions that had unintended (yet significantly likely and predictable) consequences that negatively affected their brand images. These are situations that might have been prevented by a strong "integrative" SCM organization.

In my most recent column in the Sept./Oct. issue of *SCMR*, "E-tailing Update: Thinking Fulfillment Strategies," I discussed Amazon's faux pas when it added same-day delivery for a portion of its Prime customers. What happened? As noted in a story in *Bloomberg Business Week* this past April, Amazon added free same-day delivery for certain zip codes, in what appears to have been an innocent attempt to enhance its Prime service to geographies where sales volumes were sufficient enough to be cost-effective. Unfortunately, the strategy came across as discriminatory after "an analysis of the zip codes eligible for Amazon.com's premium, same-day delivery service reveals that the company doesn't serve black neighborhoods in several major U.S. cities as well as it does white ones."

Traditionally, most companies leave all brand-influencing decisions to demand-side management. Supply-side managers are usually not consulted about whether or not demand-side decisions might put brand images at risk.

I believe Amazon's demand-side management made a mistake in not charging extra for same-day delivery. This is a position I first staked out as far back as November 2007 ("Free Service: Could It Be A Bad Idea?") when I argued that a company should not provide extra service to a portion of customers without some type of quid quo pro. For example, a company should either charge extra for the service or have customers take actions that reduce a supplier's cost to serve them. Otherwise, one segment of customers is effectively subsidizing the service enhancements given to the portion of customers that receives them for free. In this instance, Amazon's change led to less-affluent customers subsidizing a free service for more-affluent ones—an unintended yet predictable consequence. In short, Amazon's demand-side managers should have simply instituted an extra charge for all same-day deliveries.

Amazon is certainly not alone. In a column titled "Holiday e-commerce: Innovation Required," published in July 2014, I discussed the delivery mishaps that occurred during the 2013 holiday season—especially with regard to retailers that promised next-day delivery on on-line orders that were taken as late as the day before Christmas Eve. An unfortunate series of events led to a lot of presents being delivered after Christmas. The major parcel carriers were dubbed the "Grinches that Stole Christmas" by the press and their operational groups took the brunt of the fallout. I suspect that demand-side managers set retailers' expectations too high, and they in turn promised next-day delivery to on-line shoppers for orders that were placed too late to be realistically delivered on time. This left parcel carrier operations in an untenable position and ultimately blamed for ruining Christmas for many families.

In "Supply Network Compliance a Must," an Insights column published in September 2013, I discussed the need to protect one's brand from supplier mishaps. This was written after 1,000 impoverished apparel workers in Bangladesh died in the collapse of a garment factory building and over 100 died at two garment factory fires. The world was in an uproar over the industry's working conditions and safety, and blamed Western retailers that used the factories to manufacture their private-label products.

The lesson discussed in that article was that companies should not outsource what they don't know. I suspect that rather than just buy goods from Bangladesh's manufacturers selling their own branded apparel, the retailers' (demand-side) merchandisers decided to put their own label on the goods. Thus, when things went tragically awry the retailers' brands were tarnished. Because retail supply chain groups are masters of distribution—and not experts in manufacturing—they apparently were not consulted about whether the factories met safety standards.

What do these three illustrations have in common in addition to negatively affecting brand images? It appears that demand management decisions tarnished their company's brand image in direct or indirect ways. Traditionally, most companies leave all brand-influencing decisions to demand-side management. Supply-side managers are usually not consulted about whether or not demand-side decisions might put brand images at risk.

Had these illustrative companies had an "integrative" SCM group, they (hopefully) would have argued against making the decisions that put their brands at risk. Currently many supply chain groups have learned over time to be more forceful during S&OP meetings; arguing for developing supply-demand plans that best meet overall corporate objectives. I doubt, however, many are the staunch defenders of the brand that they should be.


WHAT DOES
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LOOK LIKE?
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Innovation is a team activity

Successful innovation projects include team members who can collaborate across multiple functional areas. How is your supply chain team performing?

BY ROBERTO PEREZ-FRANCO

Supply chain management is a team endeavor, and developing an effective operational team is a challenge for any organization. But including innovation in the mix compounds that challenge.

A study conducted last January by the MIT Supply Chain Strategy Lab sheds light on the dynamics of supply chain teams, and the factors that impact their performance. The study indicates that to successfully tackle innovation projects, a supply chain team should be composed of members with the knowledge, visibility, commitment and competence necessary to collaborate across multiple functional areas in the pursuit of shared objectives.

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Simulation exercise

The sample for the study was a group of 112 master's students from the MIT Global SCALE Network, an international alliance of supply chain education and research centers, which at the time had four centers in the United States, Europe, Asia and Latin America (the Network has since added two centers in China and Luxembourg). Over a period of three weeks that these students spent at MIT's campus in Cambridge, Mass., they took part in a supply chain simulation known as The Fresh Connection. Students were grouped in teams of four members, chosen by a third party to maximize the diversity of centers represented in each team. The typical team was composed of students from four different centers who had never met each other.

The Fresh Connection simulation revolves around a fictitious company based in the Netherlands that manufactures and sells orange juice. At the beginning of the game the company is operating at a loss, and the mission of the team is to rescue it by making it profitable again. In the simulation, there are four functional positions in the company, focusing respectively on purchasing, operations, logistics and sales. Each function is helmed by a different student. Although they do have visibility into each other's decisions, each one of these four positions controls only the decisions that correspond to their respective functions. Because there is no fifth position overseeing and coordinating the efforts of the previous four, the members have to find a way to work as a team—as opposed to operating as independent functions—in order to achieve the common goal of maximizing the company's return on investment (ROI).

A total of 28 teams took place in the simulation, each one starting with an identical ROI of negative 8.5%. The teams competed against each other over six rounds—each round more complex than the previous one—to bring their companies back into the black and push their ROIs as high as possible. The simulation was set so that over the first four rounds, separate teams could not affect each other's results: Each company's performance was based on their own decisions. (So, for example, when by the end of the fourth round a given team had actually worsened their company's ROI from -8.5% all the way down to -23.3%, they had nobody to blame but themselves.) The level of realism, however, was increased in the last two rounds, by allowing more successful teams to steal market share from less successful ones.

Research opportunity

In theory, it would have been possible for all teams to end the game with positive ROIs; in practice, only half of the teams managed to bring their companies into the black. By the end of the six rounds, companies in our simulation had ROIs as high as 10.7% and as low as -19.7%, giving us a wide spectrum of performances and the perfect opportunity to test some ideas about what features were common to the better performing teams. Before the last round, the students participating in the exercise were asked to complete (individually) a survey with two dozen questions about the internal dynamics of their team.

The preparation of the survey administered to students in January 2016 actually started four years before. Back in January 2013, the first time The Fresh Connection was used with MIT SCALE Network students, one of the teams went on to manage their supply chain exceptionally well. In-depth interviews were conducted with the members, which suggested some traits that could be behind their success as a team. This preliminary list of traits was expanded during the second time the simulation was run in January 2014 by conversations with members from some of the best performing and worst performing teams of that year's cohort. In January 2015, during the third simulation, a pilot survey including over two dozen questions derived from the insights gleaned from the last two years was administered to that year's cohort. Before administering the survey again in January 2016, the least relevant questions were removed, and a few were added or reworded for clarity. A total of 103 students (out of 112) completed the survey; a response rate above 90%.

Performance ranking

The findings are very interesting. Out of 17 hypothesized relationships between reported traits of the teams and the reported performance of their supply chains, 10 were found to be statistically significant predictors of good performance, at the p=5% level. These are shown in Table 1 below, ranked according to the statistical significance of the relationship between that trait and the performance.

Whereas the amount of time that the team members dedicated to making decisions was found not to be a good predictor of superior performance, the amount of effort that the students gave to the simulation was strongly correlated with good performance. The study found that having common goals and a figure of leadership were also predictors of superior performance in the supply chains of The Fresh Connection, as were good communication and a team spirit.

However, the five strongest predictors of good performance in the supply chain teams, all of them significant at the p=1% level, were: having an agreed-upon strategy, a good enough understanding by each team member of the challenges of their own function, giving high enough priority to the decision making, having a good capacity for analyzing the problems faced and having a good knowledge of the challenges facing the other functions. This last trait was the single best predictor.

These findings may be especially relevant to those undertaking innovation projects. A clear strategy, sufficient priority, analytical competence and good knowledge of both one's own function and those of others: These are the traits that allowed the student teams in our study to perform better than their peers. They may also be the key factors for making supply chain teams better at facing the challenges of innovation.

TABLE 1

Statistically significant predictors of good performance

Rank	Predictor	p-value
10	**Effort:** The team members put a good amount of effort into making each round's decisions.	3.40%
9	**Leadership:** In the team, there was one member that played the role of a leader for decision-making in the round.	3.10%
8	**Common goals:** The team had a set of common goals that were pursued jointly across roles as a team.	2.40%
7	**Team spirit:** In my team, we have a sense of belonging to something.	2.20%
6	**Communication:** The team members communicated well with each other in this round.	1.10%
5	**Strategy:** The team members agreed on a strategy that would be pursued in each round's decisions.	.54%
4	**Own knowledge:** The team members understood the challenges of their own function rather well.	.49%
3	**Priority:** The team members gave high enough priority to making each round's decisions.	.35%
2	**Analytical capacity:** The team members showed a good capacity for analyzing problems.	.05%
1	**Knowledge of others:** The team members understood the challenges of other functions rather well.	.01%

Source: MIT Supply Chain Strategy Lab

Steven A. Melnyk, Ph.D. is a professor of operations and supply chain management in the department of supply chain management, Michigan State University. His most recent article, "Myths And Truths: Misadventures In Supply Chain Management," was published in January 2016. He can be reached at melnyk@msu.edu. For more information, visit broad.msu.edu/facultystaff/melnyk.

The emergence of the strategic leader

BY STEVEN A. MELNYK

The strategic supply chain requires a new kind of leader; one with skills and orientations not currently found in many supply chain managers. Here's what we need to complete that change, and the steps to get there.

Supply chain management is on the cusp of a metamorphosis. For as long as the term has been in use, supply chain practitioners have been tacticians. They focused on making sure that the production lines rolled and orders were filled in the most cost efficient and timely manner. Execution and firefighting were highly valued skills. The profession even had its own language and metrics, apart from those used at the C-level.

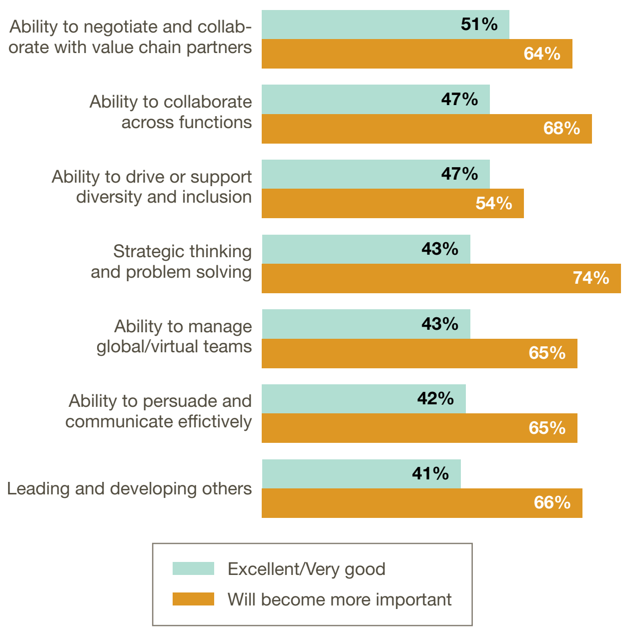
Whether those same skills will serve tomorrow's supply chain manager is very much up in the air. That is especially true as supply chains are transforming from tactical to strategic. In this new model, the key challenge is to harness the supply chain to deliver on a business' go-to-market strategy by focusing on a broader set of outcomes—outcomes such as responsiveness, innovation and sustainability. Indeed, many supply chain managers are questioning whether they or their organizations will have what it takes to make this change.

In a recent survey of supply chain issues published in *CIO Journal*, Deloitte noted that the major concern facing the executives it surveyed was the lack of adequate supply chain talent. Indeed, only 38% of the respondents were confident that their

FIGURE 1

Wanted: Leadership capabilities

Leadership and professional competencies of company's employees; current performance versus expected change in importance



Source: Third Annual Supply Chain Survey, Deloitte, 2015

organizations had the required competencies today. They were even less optimistic about the future: Only 44% felt confident that they would have the skills required to meet their needs five years from now. On one hand, this finding emphasizes the fact that there is a supply chain talent crisis—a fact of which most supply chain managers are only too painfully aware. Yet, of more importance than the numbers is the nature of the skills respondents believe will be required of supply chain leaders in the future.

As can be expected, being technologically savvy is seen as important (including the ability to understand and integrate the technological capabilities offered by such developments as Big Data analytics, 3D printing, artificial intelligence and wearable technology); but the management skill that causes the greatest amount of concern is that of critical thinking and problem solving (Figure 1).

This finding leads to three critical conclusions:

1 The supply chain is changing; metamorphosing from a tactical entity that is often seen as more risk than benefit—a necessary evil where the "best" supply chain is the one that you never hear of—to being seen as a strategic capability that enables and enhances the ability of a firm to gain a significant competitive advantage in the marketplace.

2 The existing supply chain manager is not up to the task of managing or tapping into the promise of this new supply chain.

3 A new type of leader is needed to manage this new supply chain.

While that may sound simplistic, there is other evidence to support these observations. Currently, the department of supply chain management at Michigan State University, in conjunction with APICS, has undertaken "Supply Chain Management: Beyond the Horizon," a multi-year study focused on identifying the developments that will affect the supply chain of the future. The findings to date support these three conclusions. This crisis exists in part because of the inability of the current generation of supply chain managers to clearly articulate that supply chain management is not a solution (like Lean or Total Quality Management) but rather a set of capabilities that can determine what the firm can and cannot do. In a recent article in *Forbes*, SCM World's Kevin O'Marah contended that the supply chain should be aligned with the desired outcomes prized by the key customers and the strategic promises made by the firm, as contained within the value proposition.

We could not agree more that in tomorrow's supply chain, strategy will be as important—if not more important—than tactics and execution. And tomorrow's manager will need to understand how to speak the same business language as senior management.

In this article, we intend to expand on the three major conclusions previously presented. We will examine how the supply chain is changing (and the factors that are causing this change). We will look at why the current crop of supply chain managers will have difficulty meeting the challenges and demands created by this new supply chain. Finally, we will explore the skills and capabilities demanded of the new supply chain manager; requirements that transform the supply chain manager of today into the supply chain leader of tomorrow.

As part of this final discussion, we will discuss the challenges facing firms, educational institutions and professional societies as they struggle to develop this new generation of strategic leaders. However, before we discuss the challenge of creating the leaders of tomorrow, we must begin by understanding the changes now taking place in the supply chain.

The new supply chain

Since the term was first introduced in the *Financial Times* in 1982, the supply chain and how it is perceived within the firm has greatly changed. Initially, managers outside of the supply chain saw it as tactical, consisting of terms such as planning horizons, capacity, advanced delivery notices and Lean. At the heart of supply chain was a combination of boxes, trucks, factories and shipping orders. CEOs and senior managers only became aware of their supply chains when there was a disruption, especially one that made the news. They learned the hard way that supply chain disruptions can hurt their firm operationally and strategically. Thanks in a large part to academic research, they also learned that a supply chain disruption was often followed by a 40% drop in their stock price that took nearly two years to recover. This led to an interesting phenomenon—the attractiveness of the "invisible" supply chain: Because the only time senior management ever heard about a supply chain is when something went wrong, the "best" supply chain must be one that they never heard about.

That view is changing—and changing radically. Managers and corporate leaders are starting to recognize the strategic value of their supply chain to their firms. This change can be attributed to the following factors:

- **Increasing rate of technological advances that are rooted in the supply chain.** The media is awash with articles about the Internet of Things (IoT), 3D printing, Big Data and analytics and autonomous vehicles (self-driving trucks and cars). These new technologies are changing how firms design, build and deliver products, and how they interact with their customers. Tire manufacturer Pirelli has introduced sensors into truck tires that collect information about the durability and performance of its products. That is allowing Pirelli to offer its customers new capabilities for better vehicle protection and control and should lead to better tire designs in the future. Similarly, Amazon is experimenting with 3D printing on trucks so that goods can be built as they are being delivered to customers, while online clothier M-Tailor draws on the improved photographic power of cell phones to help its customers design, make and deliver shirts specifically configured to their unique physical characteristics.

If a customer is willing to pay for something done in a unique way, the firm can make the customer aware of the hidden costs and dangers but ultimately, it needs to deliver.

- **Acceptance of complexity as a business driver.** In the past, complexity was viewed as something to be avoided at all cost because it added cost. Now, firms recognize that their customers are driving the demand for complexity. If a customer is willing to pay for something done in a unique way, the firm can make the customer aware of the hidden costs and dangers but ultimately, it needs to deliver. In part, the ability of the supply chain to deal with this increased demand for complexity is being enhanced by the new technologies discussed above.
- **New competitive pressures.** How a firm serves and interacts with its customers is being influenced by the experiences of its customers with other providers, especially Amazon. This has given rise to the "Amazon effect"—the impact exerted on both customers and firms by Amazon's relentless emphasis on quickly connecting its customers to new and innovative solutions. Once Amazon rolls out a new service, its customers come to expect the same level of service from their other providers. For example, at the 2015 Supply Chain Outlook Summit, a supplier of industrial equipment explained that when one of its customers was told that there would be no customer service on weekends, the customer threatened to pull out of negotiations. The customer argued that if Amazon could provide

support on the weekend, then the equipment supplier should also. Dealing with the Amazon effect often requires changes to the supply chain.

- **New methods of dealing with customers.** Increasingly, the customers of B2B and B2C

To a large extent, the success or failure of delivering on an omni-channel strategy depends on the supply chain system and its leadership.

businesses expect to be able to place orders and find information through various means, whether through brick and mortar retail locations, on-line or through smart phone apps. This "buy from anywhere, anytime and on any device" mentality has led to the emergence of the omni-channel experience. To a large extent, the success or failure of delivering on an omni-channel strategy depends on the supply chain system and its leadership.

- **Recognition that cost is no longer enough.** Traditionally, delivering a product or service at the lowest cost was the primary measure of supply chain performance. That view is now changing. As this author and others noted in the *MIT Sloan Management Review* in 2010, supply chains can achieve more than just cost reductions; they can offer improved security, innovation, responsiveness, sustainability, resilience and quality. To understand the competitive value of these other outcomes, consider the impact of Zara on the retail apparel industry. The fast fashion producer became a global powerhouse by emphasizing responsiveness with production near the markets it serves at a time when its competitors were focused on cost, and, as a consequence, outsourcing to low cost countries such as China.
- **Customer demands for greater supply chain visibility.** Customers, especially in North America and Europe, want assurances that their products are being produced safely and without adverse impacts. Companies such as Disney now recognize that they are accountable for actions taken anywhere in their supply chain, whether those involve first tier or fourth tier suppliers. That is one reason why Disney announced in 2013 that it was pulling production out of Bangladesh, Pakistan, Ecuador, Venezuela and Belarus due to concerns over safety standards for supply chain workers in those countries.

When these and other changes are taken as a whole, what we see is a transformation of the supply chain from a necessary evil and source of risk to a strategic asset that enhances a firm's competitiveness in the marketplace by offering one or more of the following three advantages:

- deliver goods and services faster, better and cheaper (the lowest form of competitive advantage);
- enable the firm to address customer needs that are currently being met poorly; and
- enable the firm to address customer needs currently not being met at all (the highest form of advantage).

The traditional supply chain leader

While that all sounds good, the biggest hurdle to completing this transformation is that many of the supply chain managers currently in leadership positions are not prepared to harness the capabilities of this new supply chain. In part, this is because many have not been formally trained in supply chain management. More importantly, these problems can be traced to their functional orientations and preparation—preparations that have imparted in them the traits below.

- **Strong functional orientation.** These are managers who feel most comfortable working with other similar people. Interactions with other functions are handled through hand-offs, best described as decisions that are "thrown over the wall" to other groups with little or no input from them.
- **Strong focus on cost.** Cost reduction is the universal benchmark. But just as no good deed goes unpunished, this can have unintended consequences. That was the lesson learned by one major farm equipment manufacturer after it implemented a world class Lean/Just-in-Time system with the stated goal of driving down cost. Unfortunately, a laser focus on cost reduction adversely affected the manufacturer's ability to be responsive during a time when demand was greatly changing (thus hurting the company's competitive position in the short term).

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- **Strives for supply chain excellence.** The goal to develop a best-in-class supply chain on specific measurements, such as cost, may not necessarily result in better overall corporate performance, especially if the goals of the supply chain are not aligned with the strategy of the business.
- **Strong focus on execution.** This supply chain is focused on implementing decisions made elsewhere in the firm, without having any input or effect on those decisions.
- **Speaks a language that is very functionally oriented.** Current supply chain managers speak their own language, one that is rooted in terms like capacity, throughput, bottlenecks, inventory and ppm. This language hinders the ability of current supply chain managers to effectively interface with the other functions of the firm and with top managers who measure performance in different ways.
- **Strives to simplify and avoid complexity.** In the traditional supply chain, complexity is seen as something that adds cost and lead-time and must be resisted whenever possible.
- **Deliberate decision-making.** The traditional supply chain manager believes that it takes time to make decisions. Haste makes waste.
- **Optimal solutions are the best.** There is something "optimal" about an optimal solution.
- **Stability.** It is highly valued.
- **Toolsmiths.** Many current supply chain leaders are well grounded in solutions that they can quickly apply to any situation or problem. They are masters of ERP, MRP, DDMRP, Six Sigma, Total Quality Management (TQM), Theory of Constraints (TOC) and Lean/Just-in-time.

What we have here is a broad brushed view of the typical supply chain manager. But while these traits might help get things done, they are not the traits needed by leaders of the new strategic supply chain.

The emerging supply chain leader: Strategic in focus; outside/in in orientation

The emerging supply chain leader—such as those we encountered in the "Beyond the Horizon" project and the one hinted at in the Deloitte supply chain survey—has a very different set of skills and orientations, namely those outlined below.

- **Excels at managing at the interfaces.** The new supply chain leader recognizes the need to work with other functions within the firm. Specifically, they must be prepared to engage with groups such as engineering, marketing, finance, accounting and top management. This engagement is bi-directional. On one hand, they need to understand the requirements of these other groups because their needs have to be translated into capabilities that the supply chain must provide. On the other hand, the new supply chain leader must be prepared to educate these other groups on the capabilities of the supply chain—what the supply chain can and cannot do. They must also be able to communicate how actions taken by these other groups affect the performance of the supply chain. For example, they must be able to show how promotions can adversely affect the ability of the supply chain to ensure that there is adequate stock on the shelf once the promotion becomes active. If a change in supply chain capabilities is required, then it is the responsibility of the new supply chain leader to communicate to the other areas how long it will take and what it will cost. In other words, the new supply chain leader must excel at educating, informing and coordinating.

The new supply chain leader must be prepared to educate these other groups on the capabilities of the supply chain—what the supply chain can and cannot do.

- **Focus on asking the "right" question, rather than on the "right" solution.** This is where critical thinking shines. As Charles F. Kettering, the brilliant designer and engineer at General Motors, once said: "A problem well stated is a problem half solved." Here, the supply chain leader is more interested in ensuring that there is a clear and concise understanding of the desired outcome, rather than focusing on a specific solution. This means ensuring that everyone understands what the goal is, and then soliciting the input of the various members of the supply chain to identify how best to achieve this goal. The solution becomes secondary to the desired outcome because it is driven by this outcome.

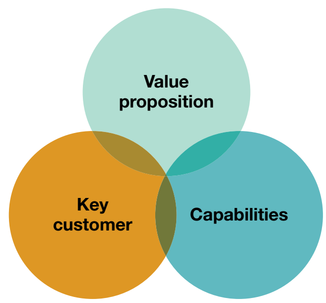
- **Strives for business excellence, rather than supply chain excellence.** Here, the goal is to help the firm better compete at the business model rather than the supply chain level.

The business model, which can be viewed as a highly operational restatement of the strategy (see Figure 2), identifies three critical components that must be consistently maintained in alignment for the firm to compete:

  - **The key customer.** The customer is the ultimate judge of what is produced. Here, the new supply chain leader must identify who it is that the firm is specifically targeting—whose needs will it try to profitably satisfy.
- **The value proposition.** This is what the firm offers to attract and retain key customers.
- **Capabilities.** These are the resources, skills, processes and assets that the firm draws on to deliver the value proposition that is expected by its key customers. It is here that the supply chain resides, along with corporate processes, measurement, capacity and corporate culture. The new supply chain leader understands that it is their task to ensure that what the key customers expect, what the firm has promised and what the supply chain can deliver are continuously in alignment over time.

FIGURE 2

The business model



Source: Deloitte

Outside/in as compared to inside/out. A strategic supply chain manager views the capabilities of the supply chain through a different lens. The traditional lens is from the inside/ out, where the leader understands what the supply chain can and cannot do and tries to convince key customers that this is what they really want. The new, strategic lens is from the outside/in: It looks at what the key customers want and what type of outcomes they wish to achieve. These new leaders understand that it is these key customers who drive the firm, its strategy and ultimately the supply chain. This identification with key customers takes its most immediate form in terms of how communication is implemented—through measures and metrics.

Effective at communicating with others in terms of performance measurement, measures and metrics. To effectively communicate within the firm, the new supply chain leader must recognize the importance of measures and metrics as communication. Measures and metrics, as noted by management experts Joan Magretta and Nan Stone, restate the business strategy and the business model into what each group or person must do to achieve this strategy. Increasingly, we are recognizing that effective communication within the firm occurs at this level, not in terms of measures such as capacity, throughput and utilization. The new supply chain leader uses these measures to show how the actions of the supply chain can affect how others perform. Furthermore, in many cases, the new supply chain leader takes this emphasis on performance to a new level by adopting the customers' own measures as their own. When this occurs, communication is immediately enhanced between the supply chain and the customer because both are using the same set of measures. More importantly, supply chain impact can be seen immediately because these actions can be translated into how they affect the performance of the customer. Since both parties are using the same numbers (so to speak), the opportunity for conflict is minimized.

Recognizes the need for complexity but still strives to identify and eliminate complications. Because the new supply chain leader closely knows and identifies with the key customer, there is an acceptance of the need for complexity. Complexity is a trait that comes from the key customer and is something that the supply chain must be able to accommodate. The leader does try to communicate the downside risks of complexity through a cost of complexity approach (see Figure 3). However, the leader is able to differentiate between complexity, which comes from the customer, and a complication, which occurs because of the actions of people within the supply chain.

As an example of a complication, consider the following situation. A firm has a short-term quality problem with a component supplier. To address the immediate issue, it modifies its manufacturing process to include an inspection activity. The problem is eventually addressed but the inspection is not removed. This inspection is an example of a complication—something that plagues most supply chain systems. The new supply chain leader may have a purpose to add complications, such as increasing the number of backup suppliers, but these actions are often driven by the need to protect the system from disruptions and to improve resilience.

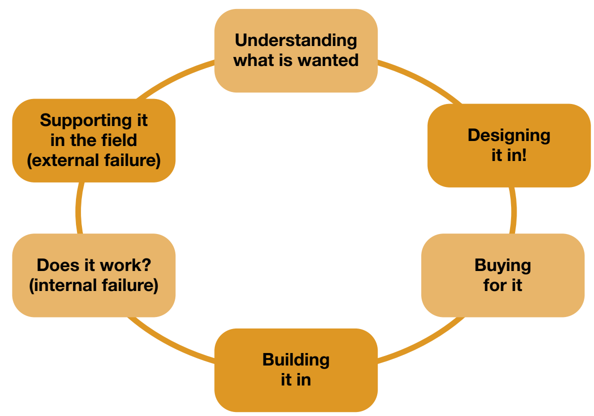
Recognizes and accepts the presence of uncertainty and change. Uncertainty is viewed as the natural state of things when it comes to making a decision. After all, you never have enough time; the information is never complete or sufficiently accurate; and something is always changing before you make your decision.

Strives for robust rather than optimal systems. Optimality is nice. However, in many cases, optimality results in fragile systems. That is, as long as things have not changed from the conditions that were used to derive the optimal solution, all is well. However, as soon as something changes in the environment, the optimal system sputters. Instead, the goal should be a robust system, one that may not generate optimal performance but is able to respond to changes without extracting a severe penalty in performance. Robust systems are the natural complement to the preceding trait.

The focus is on the future. In this new environment of change and uncertainty, the past is viewed as a lesson to be learned, and not as the basis for punishment. As one manager in the "Beyond the Horizon" project put it: "The past is something you cannot do anything about. Learn from it; get over it; focus rather on the future." That is the attitude assumed by the new supply chain leader. This focus and concern about the past is also reflected in planning. The new supply chain leader recognizes the importance of that basic supply chain dictum—today's supply chain is the result of investments made in the past; tomorrow's supply chain will be the result of investments made today.

FIGURE 3

Cost of complexity: a total cost approach



Source: Deloitte

Fast decision making is the key. In this environment, you do not have the time to wait until changes shake out. Rather, you have to make decisions quickly and be willing to live with the fact that you will be wrong on occasion. This is becoming the natural state of affairs. As one manager put it: "You make decisions quickly, you fail fast, you learn quickly, you move on." This was best illustrated during the "Beyond the Horizon" project by one interview that took place at a fast fashion goods operation located in the Midwest. The manager who was leading research team members on a plant tour stopped to point out a new $1.7 million line. He asked the research team to guess how long it took to go from problem awareness to the time that this line was up and running. The team members answered with numbers ranging from two to three years. The answer: Seven months. When questioned, he brought out the key lesson: If the company had waited to make sure that the issue driving the need for the investment was real, it would have been too late. A new, faster method of decision-making is demanded.

The challenge

The evidence, as summarized in Table 1 is clear. While there will always be a demand for tacticians and fire fighters, the new strategic supply chain needs a different type of leader, perhaps a Chief Supply Chain Officer (CSCO) who is well prepared by skills, temperament and preparation to sit at the same table as the CEO, CIO, the CFO and other similar leaders.

And that is where the real talent crisis lies. That is because generators of the current supply chain talent, such as professional societies like APICS, ISM, CSCMP, firms and educational institutes at the community college, college and university levels, are for the most part structured and organized to deliver the traditional supply chain manager. Their focus is on tools and content.

TABLE 1

Comparing supply chain leaders

Traits	Traditional supply chain manager	Strategic supply chain leader
Orientation	Functional; strongly internal	Cross-boundary; coordination
Performance stance	Cost/cost minimization	Outcome-driven/revenue maximization
Definition of excellence	Supply chain excellence	Business excellence
Stance	Focus on execution	Asking the right question Making sure the desired outcome is understood and made inevitable
Dealing with the customer	Inside/out	Outside/in
Communication	Very functionally oriented Capacity, throughput, bottlenecks, inventory, ppm	Performance measures and metrics Use the customer's metrics as ours.
Complexity	Strives to eliminate or simplify complexity	Accepts complexity as a fact of life that must be master. Strives to elimination unnecessary complications.
Uncertainty	Desires stability; manage change	Accepts uncertainty and change
Decision-making style	Deliberate	Fast decision-making
Desired types of solutions	Optimal	Robust
Overall stance	Toolsmiths–masters of tools	Problem masters–define the problem that the rest of the supply chain will focus on.

Source: Deloitte

While those are important, they are not enough—they can be viewed as the cost of playing the game. What makes future supply chain leaders so different are their thought processes and approaches. They are coordinators and orchestrators; they educate and communicate; they see the supply chain not as capacity but as capabilities (what the supply chain can do well and what it does poorly); they focus on the desired outcomes rather than on the solutions.

Finally, they recognize that ultimately the supply chain is strategic, not because it is the best example of Lean or Total Quality Management, but because it supports the firm's value proposition and helps the key customers succeed. The challenge for the current generators of supply chain talent is to develop a system that can create such leaders. However, for those firms and organizations that can meet this challenge, the future is indeed bright.

About "Supply Chain Management: Beyond the Horizon"

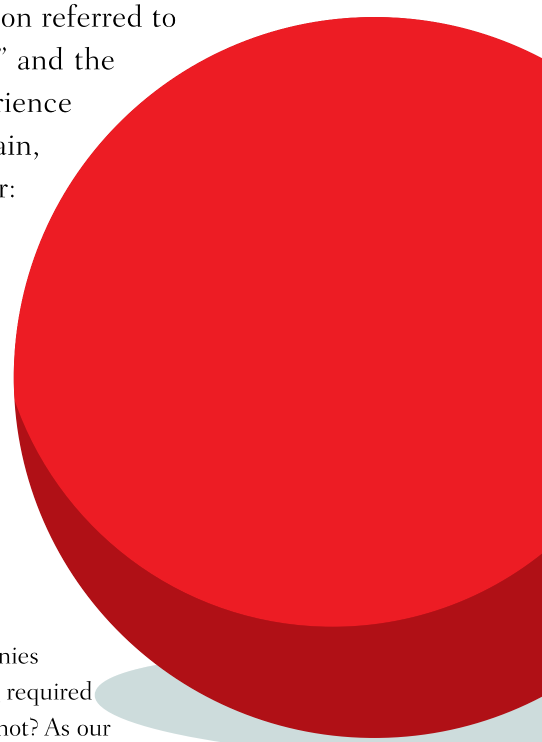
"Strategic Supply Chain: Beyond the Horizon" (SSC:BTH) is a long-term project aimed at identifying and exploring emerging issues in supply chain management both domestically and internationally. This project, jointly sponsored by department of supply chain management, the Eli Broad School of Business and APICS, has over a three-year span studied over 60 leading supply chain management organizations. The results and insights obtained from this project have been fine-tuned and tested in a series of focused workshops. This project has been led by David Closs and Pat Daugherty of the Department of Supply Chain Management at Michigan State University.

The collaboration journey: Are we

BY STANLEY E. FAWCETT, AMYDEE M. FAWCETT, SEBASTIAN BROCKHAUS AND A. MICHAEL KNEMEYER

After 20 plus years of talking about collaboration, there is still a long way to go.

TWENTY YEARS AGO, Boston Consulting Group's Harold Sirkin warned that competition is no longer "company vs. company but supply chain vs. supply chain," inviting a new era of supply chain collaboration. Pundits soon referred to collaborative supply chain design as the "ultimate core capability" and the "enabler of winning business models." Based on your own experience with the day-to-day tussles that occur in the typical supply chain, you may wonder: "What on earth were they thinking?" The answer: Industry watchers had witnessed the stunning success of Honda and Toyota and viewed collaboration as inevitable.



For instance, as Honda prepared to bring the 1998 Accord to market, Honda's internal analysis revealed two key points:

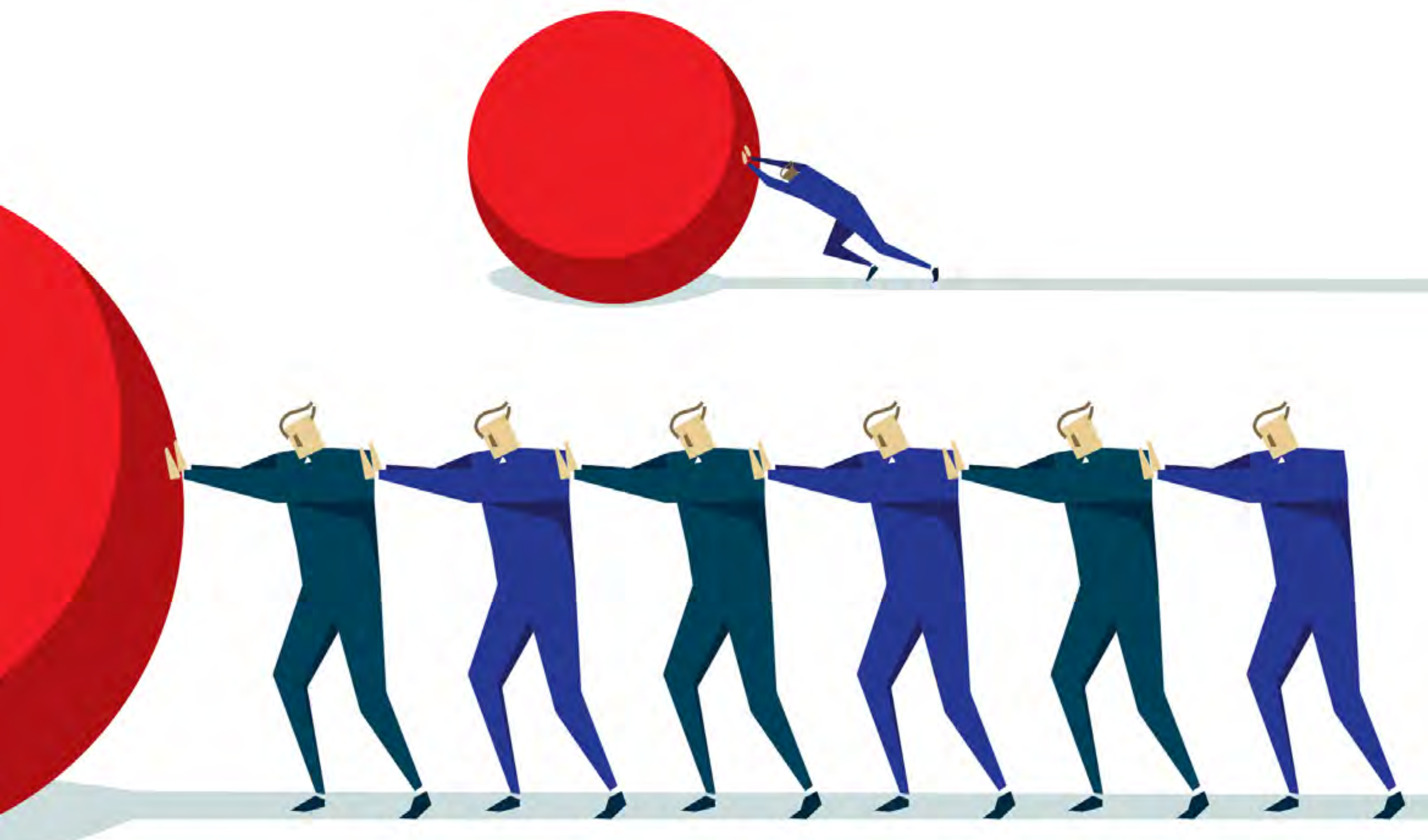
THE GOOD NEWS. Honda designers had developed an outstanding, customer-pleasing car.

THE BAD NEWS. As designed, the Accord would be too pricey. Honda needed to cut costs by 25%.

Because 80% to 85% of the typical Honda is sourced from suppliers, Honda had only one option: Ask suppliers for help. And that's exactly what Honda did. Working with suppliers, the automaker lowered the cost of the '98 Accord by almost 30%. The launch was a success. Many of the technological advances developed for the 1998 Accord appeared in the next iteration of the Civic, a model that became a huge cash cow for Honda. The bottom line: Honda and its suppliers had shown that supply chains that work together win together.

However, relying on close working relationships with suppliers to co-create value contrasted sharply to the American way, which emphasized arm's-length, adversarial buyer/supplier relationships. Thus, despite the pundits' predictions, most companies weren't ready for the heavy lifting required to successfully collaborate. Why not? As our 14-year longitudinal study reveals (see sidebar), collaboration wasn't part of the corporate DNA and managers weren't ready to embrace new ways of working together. Neither nature nor nurture had prepared them to treat other members of the supply chain as partners in profit. The result: Writing in *SCMR*, Robert E. Sabath and John Fontanella pronounced supply chain collaboration as "the most popular—and the most disappointing—strategy that has come along to date."

there yet?



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Are we there yet?

Naturally, you should expect transitioning from adversarial buyer/supplier relationships to value co-creation to take time—it is a journey, not a single leap. This reality raises a question: After 20 plus years of talking about collaboration: "Are we there yet?" The answer, quite simply, is no. Recent headlines reveal that companies still struggle to work together.

- **Developmental delays.** After successfully launching the iPhone and iPad, Apple spent years working to bring its next big thing to market—the Apple watch. Yet, the taptic engine, a key component supplied by AAC Technologies, was defective. Apple sent a memo to Apple-store employees explaining that although the watch could be ordered online, it wouldn't be in stores for another month. The taptic glitch occurred less than a year after Apple's partner in the development of synthetic sapphire filed for bankruptcy.
- **Delivery glitches.** Pratt & Whitney spent a decade and $10 billion to reestablish a presence in the commercial jet engine market. As it ramped up production, 44% of its supply base initially failed to meet Pratt's delivery and quality targets. The result: Pratt missed several deliveries to Airbus—its customer. The delays led Qatar Airways to cancel several A320neo orders. Of note, General Electric was simultaneously ramping up production of a rival engine, forcing parts suppliers to choose which engine maker would be allocated scarce capacity.
- **Divorcing partners.** Sixteen years after Costco and American Express began an exclusive co-branding partnership, Costco ended the relationship. What happened? The two megabrands couldn't agree on fees. AmEx CEO Ken Chenault argued that AmEx was Costco's "trusted partner." Costco viewed AmEx as dispensable. The breakup underscores how difficult it is to co-create value over time, sharing risks and rewards along the way.

What is your takeaway? Working together to co-create value is hard work—whether you are developing a technology, managing day-to-day operations or cultivating a long-term relationship. The good news: It doesn't have to be this way. But, before you can fix the broken chain, you need to diagnose why it breaks in the first place. Diagnosis precedes prescription.

FIGURE 1

Collaboration's roadblocks

Source	Emerging	Entrenched
Organization	**Routine deficits** • Defining relational intensity • Role shifting • Managing complexity	**Structural characteristics** • Misaligned goals/measures • Functional siloes (i.e., turf) • Poor systems integration
Individual	**Skill deficits** • Leadership deficit • Collaborative skill gap	**Cultural behaviors** • Inability to build trust • Hoarding of information • Opposition to change

Embeddedness

Source: The authors

Spotlighting collaboration's roadblocks

Strategic initiatives that sputter along making little or no progress typically get relegated to fad status—before being forgotten. Value co-creation, however, is too important to walk away from. Global competition makes learning how to collaborate imperative. The time has come to delineate collaboration's roadblocks and demystify why they are so hard to remove (see Figure 1). Let's begin by evaluating the entrenched roadblocks, beginning with structural characteristics.

Roadblocks: The way companies organize

Boundaries—whether functional or organizational—kill collaborative momentum. From the first interview to the last, managers described to us how silo thinking impedes collaborative mindsets and mechanisms. Even so, they recognized that boundaries are necessary. Boundaries help firms achieve economies of scale and minimize transaction costs. Within the firm, boundaries build deep skills. Mike Wells, a former vice president of logistics at The Hershey Company, described the challenge, saying: "If you ask me what I stay awake at night thinking about, its cross-functional processes. The challenge is to become more process focused while maintaining functional expertise." Interview managers discussed three roadblocks that stand in the way of achieving this balancing act.

Misaligned goals and measures. Although supply chains compete against each other in a global market, they don't share a common stock price. A tug of war emerges as buyers strive to minimize costs and suppliers work to protect margins, both in the name of improving profits. One manager commented on the result: "We are too finance-oriented.

The result is a short-run mentality. Keeping our eyes on long-term goals is difficult." Another reiterated the power of metrics, saying: "Each group has its own metrics, so each group does its own thing." The bottom line: Modern measurement incents counterproductive behavior.

Turf protection. Structures that promote turf cripple collaboration. Managers highlighted three consequences of turf protection:

- People are more concerned about who will get the glory or the blame rather than evaluate whether or not a decision will benefit the entire company.
- We have good people who do not accept that others do great work.
- Once you create turf, it is tough to take it away. That guy isn't going to give up his power.

Silos buttressed by local metrics become immovable roadblocks.

Poor systems connectivity. Technology investments are often defensive. Nobody wants to fight today's competitive battles with yesterday's technology. Yet, despite the investments in IT, alliance partners are often unable to connect. One manager succinctly summarized it as follows: "Systems are the biggest barrier. Not everyone has the capability to seamlessly communicate." When partners can't connect, enthusiasm for collaborative strategies dissipates.

One final point: Managers are fully aware of each of these roadblocks. Yet, they seldom realize how they reinforce each other. This interplay, which isn't always obvious, discourages managers from expending the resources, making the sacrifices or taking the risks needed to collaborate. Now, let's consider how organizational culture deters collaborative behavior.

Roadblocks: The way we perceive

Culture, according to anthropologists, is learned attitudes and behavior patterns. Sadly, the typical organizational culture neither demands nor encourages collaborative attitudes and behaviors. By contrast, collaboration creates resource dependency, which increases risk—and vulnerability. Many companies say that they encourage risk taking, but few actually do. Managers emphatically told us that risk and vulnerability elicit strong resistance. Decision makers focus more on the risk of change than on the risk of failing to change. The result: They opt for the status quo.

Three behaviors in particular thwart collaboration.

Inability to build trust. Managers know that trust undergirds collaboration, but feel trust is the most overused and abused word in the supply chain lexicon. They lament that they live in a "what-have-you-done-for-me-lately" world and the answer to the question: "Can we trust someone outside our firm to do what is best for our company?" is "no." One manager explained: "If the goal is only to save money, you can't build trust." In the typical manager's mind, "It all comes down to power—at the end of the day, power rules." The result: Companies don't know how to invest in trust-based relationships.

"If you ask me what I stay awake at night thinking about, its cross-functional processes. The challenge is to become more process focused while maintaining functional expertise."

—Mike Wells, former vice president of logistics at The Hershey Company

Information hoarding. Investments in IT have improved connectivity. However, managers now realize that being connected is not the same as being collaborative. Indeed, because information is power, managers are often unwilling to share sensitive strategic and tactical information. Ironically, they wish partners would share the same types of information they withhold, arguing that open information sharing would improve their ability to plan for and invest in new capabilities. The failure to share feeds mistrust, inviting managers to walk away from high-risk, high-reward collaborative initiatives.

Opposition to change. Not surprisingly, absent trust and lacking shared information, managers don't just avoid collaborative change, they oppose it. Most simply aren't prepared for the ambiguity and role shifting brought on by collaboration. One manager warned: "Some people need to get their butts kicked by the competition before they will make the needed changes." Unfortunately, as in the story of Little Red Riding Hood, by the time they see the competition's teeth, it is often too late to learn to collaborate.

As you might guess, managers are fully acquainted with each of these cultural barriers. They see them everyday.

But, they have been unable to overcome them. They are entrenched because they are thoroughly intertwined. You can't remove them one at a time. You have to attack them simultaneously—a hurdle too high for most companies to overcome.

Now, imagine you persist to the point that you can look beyond the entrenched cultural and structural barriers. What will you see on the other side? Dishearteningly, you realize a whole new set of stumbling blocks stand in your way. Let's take a look at these emerging roadblocks.

"Suppliers don't trust purchasing because purchasing means cost, but they must trust you. Suppliers must develop confidence in you. Suppliers may not trust purchasing, but you want them to trust you."

—Teruyuki Maruo

Roadblocks: The way companies work

Companies design workflows and invest in the training to get critical jobs done. Over time, organizational memory emerges, embedded in planning processes, measurement systems and human resource policies. These routines define how a company works. Yet, the pursuit of deep functional skills and a desire to cut costs has led companies to underdevelop three routines managers view as vital to collaboration.

Relational intensity. Managers can easily get caught up in the collaboration hype, forgetting that not all relationships are created equal. The result: Companies squander scarce resources in relationships that don't possess unique value co-creation potential. A poor ROI naturally results, discouraging future collaboration. What's on managers' wish lists of collaborative routines? Consider the following:

- the willingness to view suppliers as a source of advantage;
- the ability to assess the potential of value co-creation;
- the ability to evaluate partner collaboration capability;
- the ability to dedicate time to collaborative strategies; and
- the willingness to mutually share risks and rewards.

One manager summarized the dilemma as: "We don't know how to work together."

Role shifting. Value co-creation relies on the creative comingling of competencies. As this happens, managers ask: "What if?" Answers typically require that companies take on new roles. Tangible tension often emerges. One manager grumbled: "We are constantly arguing with other managers over revenue streams and P&L responsibilities." Another concluded that role-redefinition "is not just passing the baton from firm to firm, but we must consider how to hold the baton so the receiving firm gets it in a way that supports their strength."

Complexity management. Managers referred to complexity as the 21st-century supply chain challenge, calling it a "nightmare." They complained they "lack the resources and discipline to manage complexity." What makes complexity a nightmare? Managers lack the wherewithal to analyze the following:

Needed versus excessive complexity. Managers talked about the need to reduce complexity. But, some complexity is needed. Global supply chains are, after all, complex. Managers, however, struggle to tell the difference between good and bad complexity.

Detail versus dynamic complexity. Managers derided detail complexity—e.g., thousands of SKUs. Concealed in their comments, however, were hints that the big problems are driven by dynamic complexity. For example, managers don't own the costs associated with complexity—especially those costs that occur in "someone else's sandbox." It's thus easy to make bad decisions and never know their real consequences.

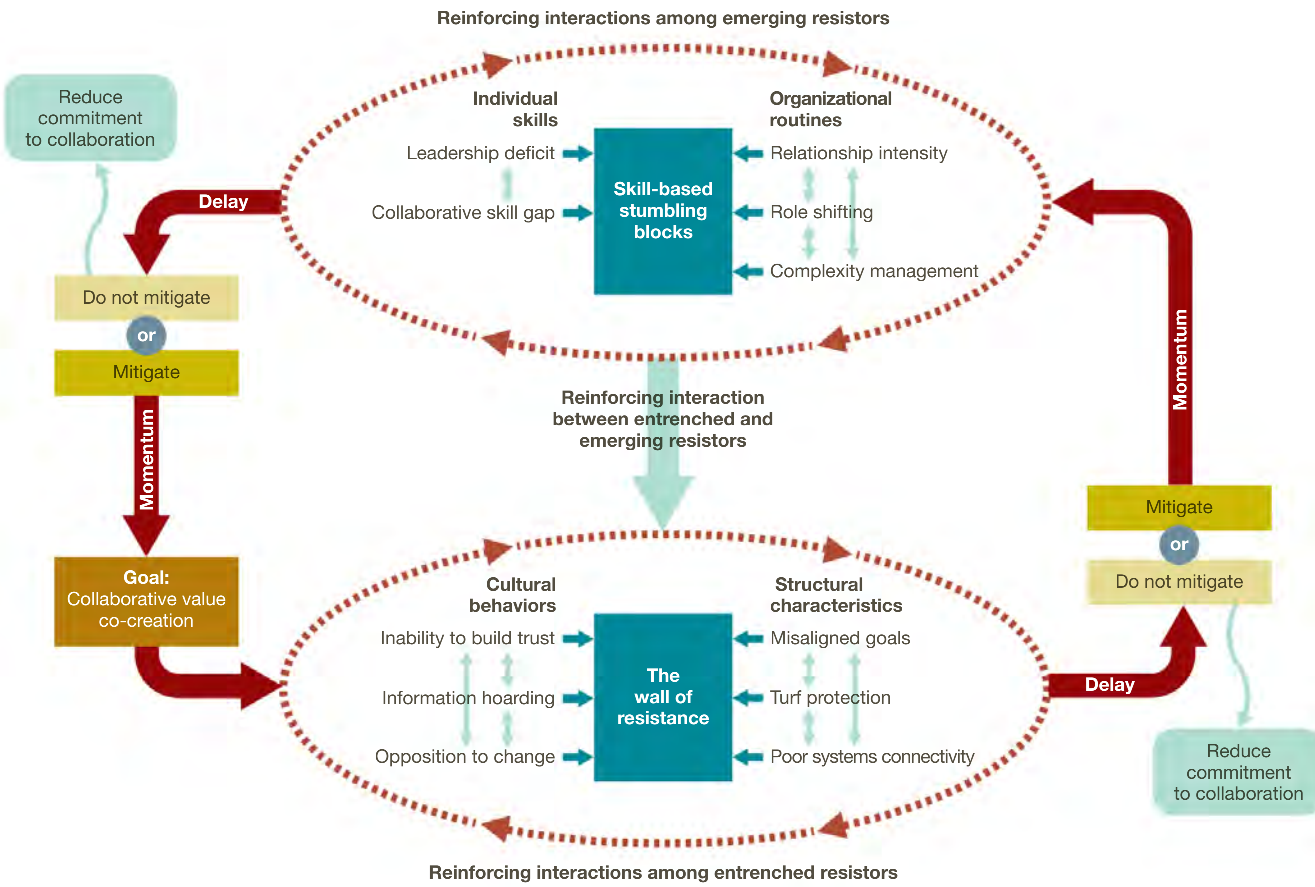
Building the right relationships with the right partners is hard work. Getting everyone to accept—and excel at—new roles is even more daunting. Value co-creation really does require new ways of working together. Companies, however, haven't yet caught the vision. The result: They haven't invested in the right collaborative routines—and yes, you need all three to achieve relational advantage.

Roadblocks: The way we make decisions

Speaking to the Honda supply team, Teruyuki Maruo hammered home a critical point: "Suppliers don't trust purchasing because purchasing means cost, but they must trust you. Suppliers must develop confidence in you. Suppliers may not trust purchasing, but you want them to trust you." Maruo's message is clear: Where the

FIGURE 2

How the roadblocks stifle collaboration



Source: The authors

rubber meets the road, people execute value co-creation strategies. Sadly, too many companies have yet to figure this out. The challenge begins with leadership. It extends to all supply chain managers.

Leadership deficit. If executives don't set the tone and commit the resources, collaborative initiatives fail. Even if some managers grasp collaboration's potential, the conviction is not held widely enough to change mindsets and behaviors. One manager underscored the result: "We lack the collaborative mindset, the understanding, and know-how. We are still stuck in the old school." Managers repeatedly focused on leaders' incessant drive to cut costs: "We are constantly bombarded by mandates from top management to 'CUT COSTS!'" Managers caught in a cost-cutting vice have neither the time nor the incentive to pursue difficult collaboration initiatives.

Collaborative skill gap. Managers described the ideal collaborator as someone who possesses strong functional skills, sees the big picture, analyzes tradeoffs rigorously, executes with discipline, leads by example and embraces change. Few managers who touch critical processes possess this skill set. Worse, neither business schools nor the typical corporate training program is designed to cultivate collaborative mind and skill sets.

The bottom line: A collaborative talent crisis is looming. The lack of enthusiasm for collaboration at the executive level has a trickle-down effect on the entire workforce. And non-collaborative organizational routines stifle efforts to cultivate collaborative behaviors. Organizational memory stands in the way of collaborative change.

Why we can't get traction

Let's pause to review what we know about the roadblocks that stand in the way of winning collaboration. We know they are numerous. We know they are diverse. And we know that each in its own right undermines holistic thinking and deters collaborative behavior. If we stop here, however, the story is incomplete. The rest of the story is that roadblocks reinforce each other. As Figure 2 shows, they reinforce each other to keep companies from gaining traction in the pursuit of value co-creation. In the real world, you never encounter a single roadblock. You always run into more than one, but some remain in the shadows, exerting unseen influence. The result: Managers wonder why collaboration—something that makes so much sense on paper—is so hard to do in daily practice. Let's take a closer look.

Overcoming inertia so that you can move the flywheel is always hard work—thus, the poor success rate of deep change initiatives.

In his 2002 bestseller, "Good to Great," Jim Collins introduced the metaphor of the flywheel to explain why so few companies made the leap from good to great. The metaphor applies beautifully to most change initiatives—including building a collaborative capability. Specifically, flywheels are big, heavy and hard to get moving. To nudge a flywheel forward, you have to push—and push hard. If you get some help and persist, the flywheel budges, moving forward ever so slightly. If you keep pushing, you eventually build momentum. The weight of the flywheel begins to drive rather than hinder change. The hard part is generating enough momentum to change the dynamics.

Now, let's apply the flywheel metaphor to collaboration and introduce our roadblocks. The structural characteristics act as overlapping and reinforcing bricks. Similarly, the cultural behaviors act as the mortar that holds the bricks in place. Together, the bricks and mortar create an almost immovable roadblock, even a wall of resistance. Rather than expending energy to tear down an imposing wall, managers focus on what one interviewee described as "their own little gardens." Consider Procter & Gamble's 2013 policy to stretch out supplier payment terms from 45 days to 75 days. Delaying payment improved P&G's cash-to-cash cycle, freeing up as much as $2 billion in cash to invest in R&D. But, what did the free cash flow cost? Suppliers, in effect, took a price cut. Capital needed to fund supplier operations and innovation dried up. So did suppliers' willingness—and ability—to help P&G bring new hit products to market.

At some companies, collaborative champions keep pushing the flywheel. Some eventually find a way to move a value co-creation initiative beyond the wall of resistance. When they do, they discover that the entrenched roadblocks have suppressed investments in critical organizational routines and managerial skills. Capability deficits result, becoming serious stumbling blocks that trip up collaborative efforts. For example, Volkswagen had to halt production for the Golf, arguably VW's cash cow in Central Europe, in August 2016 because of ongoing legal battles with a supplier. Despite the $10,000-per-minute cost of shutting down an auto assembly line, VW couldn't resolve a dispute over a joint development effort. As a last-ditch effort, VW tried to obtain a court order to force the supplier to deliver needed parts—hardly a move that motivates future value co-creation.

What does it all mean? Overcoming inertia so that you can move the flywheel is always hard work—thus, the poor success rate of deep change initiatives. Now, imagine you invest the effort, money and time to dislodge the flywheel. Just as you start to build momentum, you run into the entrenched wall of resistance. The momentum is gone in the time it takes to say "ouch." You're no quitter. You don't give up. You keep pushing. However, as you start to make progress, you trip over the skill-based stumbling blocks. Again, momentum is lost. You just can't break through all of the roadblocks. After a while, the stubbed toes and bloody noses create cynicism. Managers decide: "Collaboration just isn't worth it. It's too painful." Inertia and the status quo win.

The path forward

Collaboration stories can have a happy ending. Our findings, however, show that business as usual won't get anyone there; too many roadblocks stand in the way. One manager warned: "You have to understand what you are up against. You need to understand all the different things that can kill you." His point: Awareness is not enough. Managers have been aware of—and talking about—the entrenched barriers for years. But, despite well-intentioned efforts, they haven't been able to remove them. Why not? Simply put, managers haven't fully grasped the challenge imposed by the wall of resistance. The result is twofold.

Myopic decisions. Managers still take a short-term myopic approach to roadblock removal. But, you can't simply remove a single brick or chip away at a little mortar. To knock down the wall of resistance, you need to take a holistic approach that involves everyone. Otherwise, someone will try to replace every brick you remove.

Silver bullets. Managers succumb to the allure of silver bullets like consultancy and IT. Although each can enable certain capabilities, neither is suited to driving transformation. Value co-creation requires real change that cuts across culture and structure. You can't rely on consultancy or IT to change what your organization believes and how it behaves.

Companies that avoid taking either of these short cuts give themselves a fighting chance to build the deep collaborative commitment needed to transform cultures and behaviors. Sadly, only 10% of our interview companies actually achieved the transformative commitment needed to enable value co-creation. By contrast, 65% fell short, settling for a capability commitment that seeks strong enough relations to gain access to partner capabilities. But, they didn't engage partners to create distinctive value. The remaining 35% remained mired in instrumental commitment, relying on contracts to compel compliance, a practice that kills collaborative innovation.

What does transformative commitment look like? Critically, transformative commitment is shared commitment. Decision makers across the organization—executives, functional leaders, and workers in the trenches—all share the belief (and the experience) that it is best to fight tough competitive battles as part of a cohesive supply chain team. Equally important, key partners not only share the same belief but also the capabilities needed to execute a collaborative strategy. This point is crucial. Collaboration is a two-way path, traversed only by companies that are committed to each other's success. Both partners, after all, encounter and must overcome their own walls of resistance. Absent transformative commitment, companies will never change the measures or dedicate the resources needed for game-changing collaboration.

Finally, as commitment grows, collaborative champions make investments that their counterparts do not. Specifically, they invest in the employee skills and organizational routines that enable value co-creation. For example, employees become coaches. They learn to cultivate trust across functions as well as with valued suppliers. People begin to model collaborative behavior. They even embrace good risks, a critical behavior given that risk naturally accompanies value co-creation. And, ultimately, they learn how to tailor goals, align metrics and construct the right relationship architecture to break inertia, build momentum and bridge the roadblocks to collaboration. As they do, they unleash the power of the value co-creation opportunities that reside on the other side of the wall of resistance.

About our research

That companies still struggle to work as partners in profit became clear as we conducted a decade-long, three-phase longitudinal study of supply chain collaboration.

- **Study 1.** Our journey began at the turn of the millennium as we interviewed SC managers at 51 supply chain leaders. Mangers repeatedly talked about the need to do things differently, but lamented that they were ill prepared to co-create value with supply chain partners.
- **Study 2.** Six years later, we replicated the study with managers from 61 companies. Our goal: To find out if companies had learned to co-create value. Companies had invested in a lot of technology, but little else had changed. Collaboration capabilities hadn't matured notably.
- **Study 3.** Again, six years later, we returned to the field to interview managers from 23 companies, focusing on dyads—that is, companies that were actively striving to co-create value. Despite the collaborative rhetoric, organizational cultures and structures still didn't promote winning value co-creation.

After pouring over the data, what did we learn? We identified 11 roadblocks that stop collaboration in its tracks. Two points stood out:

1. Over half of the roadblocks were embedded in company culture and structure. From the very first interview, managers recognized them. But, most seemed helpless to remove them. We call these entrenched roadblocks.

2. Companies on collaboration's leading edge were frustrated by critical skill deficits. Managers expressed dismay that they had invested so much money and time, but still couldn't work well together. We label these emerging roadblocks.

Regarding the source of the roadblocks, half were grounded in organization structure. Individual decision-maker behavior drove the other half.

Protectors of the BRAND

In a world where Tweets go viral, supply chain professionals are charged with more than having two sources of supply. They must also have strategies and processes in place to deal with a new world of risks that can leave their organizations reeling.

BY HANNAH KAIN

IN AUGUST OF 2015, Chipotle was riding high. Perceived as a healthy food choice for its use of local, farm fresh ingredients, the Mexican food chain was one of the three most respected limited service restaurants in the world. Neither diners, who flocked to its locations, nor investors, who drove the price of a single share of stock to more than $750, could seem to get enough. Of course, that was before an outbreak of Norovirus in Simi Valley, Calif. that affected nearly 100 customers.

As if that was not enough, the California outbreak was followed by more outbreaks of food borne illnesses linked to Chipotle locations in at least 12 states. The low point may have been reached in February 2016, when the chain temporarily closed all of its locations to address the issue.

Soon, Chipotle's stock had dropped 47%. The company had lost $10 billion in market capitalization along with its reputation as the healthy restaurant choice. Now dubbed "the most dangerous restaurant stock in the industry," it was among the least respected restaurant brands among investors. While the Centers For Disease Control and Prevention looked for the culprit, a sign posted in the window of one Chipotle identified the cause: "FYI: We are sorry, but we are temporarily closed due to a supply chain issue."

The sign, and the damage to Chipotle's image, are stark reminders to supply chain managers that risk is everywhere, regardless of the industry. Whether it's faulty air bags forcing Takata to the brink of bankruptcy or Samsung's stock price taking a nose dive due to exploding smart phone batteries, negative news stories can lead to lasting damage to a company's reputation as well as its stock value.

Supply chain managers, especially those involved in risk mitigation and risk management initiatives, are no longer just tasked with making sure to have two sources of supply; they are now protectors of their organization's brand and value. In this article, we will examine this broader definition of risk management.

3 rules of risk management

Supply chain history teaches us that there are three risk-related rules:

Rule No. 1: The overlooked risk often presents the most immediate danger.

Rule No. 2: The risks keep coming and require constant vigilance.

Rule No. 3: Risk and complexity go hand-in-hand.

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Lessons learned

Supply chain history teaches us that there are three risk-related rules:

- **Rule No. 1:** The overlooked risk often presents the most immediate danger.
- **Rule No. 2:** The risks keep coming and require constant vigilance.
- **Rule No. 3:** Risk and complexity go hand-in-hand.

In fact, complexity drives risk. While risk can exist without complexity, risk factors increase disproportionately with increased complexity.

This is important because complexity in supply chains has increased tremendously in the last decade—a trend that is likely to continue. More than anything else, it has given birth to risk management as a supply chain discipline. Regrettably, practitioners of that discipline have largely focused their efforts on avoiding supply chain disruptions following earthquakes, weather-related events or the loss of a key supplier. But risk avoidance can also result in the kind of micro-management that can stifle the supply chain. Simply put, a sustainable supply chain cannot be built primarily on risk avoidance.

A quick look back at the last 20 years may provide some

The associated risk affecting brand value and customer loyalty has a significant and measurable impact on financial results and shareholder value. The supply chain has become a primary factor in reputational management.

perspective. For many companies, complexity arose with the advent of outsourced manufacturing to low-cost and low-wage regions of the world. The perceived risk then was the inability of a company to compete if it continued to produce in high-cost labor markets. The overlooked risk—Rule No. 1—was a string of quality problems. In those early years of outsourcing, companies spent significant resources to mitigate quality issues. But while outsourcing avoided the risk of high labor costs, the significant physical distance between manufacturing and markets prevented nimbleness; it was increasingly difficult to react to swings in demand and inaccurate forecasts—it's important to remember that risk avoidance can stifle the supply chain. It also became clear that the supply chain had become vulnerable to disruption because each of the many layers in the supply chain had created its own global supply chain for its suppliers and its operations. A disruption in a Tier 2 supply chain could bring a Tier 1 supplier to a halt.

The impact of supply chain disruptions became more apparent as companies started practicing Lean principles. Buffer stock and WIP were no longer maintained in large enough quantities to save the day. Instead, supply chain managers who forgot Rule No. 2 were buffeted by stock outages in one location and excess inventory in another. At the same time, SKU proliferation, customization and new fulfillment strategies like vendor managed inventory and smaller and more frequent deliveries added to complexity—Rule No. 3.

That describes the world that was. In today's world, with the growth of customer expectations and social media putting company practices under a potentially viral microscope, risks that may have been overlooked in the outsourced supply chains of the past are now potentially front and center. There is now an expectation that OEMs will manage multiple layers of their supply chains, including end-user facing. Omni-channel strategies, with their emphasis on delivery speed, customization and localization, add even more complexity. If manufacturers play to win, they must have a strategically-positioned delivery system. The perfect order is the order that is delivered to today's standards, in all that that entails.

Local laws and regulations, trade agreements, cross border regulations, associated tax laws and supplier compliance also exert a heavy impact on supply chain organizations. With the complexity and integration of other business areas, the responsibilities of supply chain organizations continue to expand. Gradually, supply chain scope includes new areas such as the responsibility for being a good corporate citizen or the responsibility for converting currency on the fly while processing orders around the globe. This scope creep within the supply chain organization has created new sub-disciplines; however, with few (if any) senior professionals trained in these areas, the profession is missing senior leaders who can develop talent.

Supply chain gets attention

Something else has changed. For years, supply chain managers felt ignored and underappreciated by senior management. Now, with CEOs getting called on the carpet when their stock value drops following a supply chain disruption, supply chain is getting the attention it has long sought, but for all of the wrong reasons. The message, delivered loud and clear from the C-Suite isn't "great job." It's "don't mess up."

The much craved attention has become a double-edged sword for many supply chain pros. Yes, the board is now interested in supply chain, but that also means that risk avoidance has become a significant element of the job. The pendulum has turned: It is increasingly difficult to find supply chain pros who are willing to stick their necks out. The stakes have gone up for everyone. Yet, in the midst of the decision paralysis, nimbleness and fast reaction times are crucial.

Reacting to new risks

To understand the new risks that supply chain pros face, we must face that we live in a world of transparency and instant communications. Simply put, our new vortex is the juxtaposition of the social media and instant communication combined with a highly complex supply chain.

The associated risk affecting brand value and customer loyalty has a significant and measurable impact on financial results and shareholder value. The supply chain has become a primary factor in reputational management. Reputational risk, in turn, has become a major element in a company's success as measured in brand loyalty and in stock value. The more valuable and important the brand, the higher the reputational risk. When consumers feel that management has broken the unspoken but perceived brand promise, the punishment can become severe. These new risks include:

Labor in the supply chain. Labor conditions have been a major issue for manufacturers. One corporation took a major reputational hit online when one of its second tier suppliers employed garment workers in an unsafe building that collapsed. Another corporation struggled with worker suicides at a contract manufacturer. Customers do not want to align themselves with companies that abuse workers. The connection is made instantaneously between the viral videos and their large corporate customers.

We are seeing regulations regarding labor conditions in the supply chain, including in California where corporations with more than $100 million in sales in California must publish how they keep the supply chain free of indentured and child labor. It is a daunting task; yet with between 20 and 30 million indentured workers and an unknown number of child workers worldwide, it is one that the public expects to be met. A major corporation was caught having indentured fishermen tricked into slavery. Reacting quickly and resolutely, the company was able to avoid the impact of a PR disaster.

Consumer safety issues. Consumers and business customers are not just concerned with worker safety; they also expect that the products they purchase are safe to use and, in the case of Chipotle, to consume. One need look no further than the hit to Toyota's sterling reputation following a handful of accidents initially attributed to the Prius braking system or the fallout to the auto industry over the ongoing airbag disaster. Recalls of unsafe children's products especially enrage consumers.

Cybersecurity. In one cyber-disaster after another, millions of credit cards have ended up in the hands of criminals because a supply chain partner had a security breach. The attack on Target's point of sale system sent the retailer into a tailspin for months. It's no surprise, then, that many supply chain executives have cited cybersecurity as their biggest concern—especially because lack of connectivity is not an option.

However, the cybersecurity threat is about to get much worse. As the Internet of Things grows, medical, personal, environmental and other sensors will be embedded into our everyday products. Remember when a Jeep driven by a reporter for Wired magazine was taken over by hackers while he was behind the wheel? The hackers found a vulnerability in the Jeep's entertainment system that allowed them to play with the radio, the windshield wipers and ultimately the transmission. Technologists fear that these "new technology" companies simply do not have the expertise to prevent intrusion. Once cybercriminals have gained a foothold in the consumer's world—perhaps through sensors embedded in an athletic shoe—they can then move on to create severe havoc.

Traditional technology companies haven't fared much better than consumer companies. Over the years, millions of home routers from leading technology companies were sold with software that was vulnerable to hackers. When breaches like that can happen due to an oversight by established technology companies, imagine what can happen when your mattress has technology to track your sleep patterns, your car is self-driving and your refrigerator is tracking the food on its shelves.

Corporate citizen. Sustainability and environmental issues are other areas where brand names are vulnerable. Originally, everyone could wash his or her hands once a product was outsourced. Now environmental concerns and corporate culpability are discussed on social media.

Originally, everyone could wash his or her hands once a product was outsourced. Now environmental concerns and corporate culpability are discussed on social media.

Just think about the impact of the 2014 Elk River chemical spill in West Virginia on Freedom Industries. Within a week of the spill the company filed for Chapter 11 bankruptcy and faced mounting lawsuits.

Consumers expect their favorite brands to be good corporate citizens. They expect diversity among suppliers, staff and executives; community involvement; and a reasonably equitable market strategy. Pharmaceutical companies such as Mylan and Turing have endured hits to their reputations after significant increases to the cost of life-saving drugs. Supply chain professionals must be conscious about whether their suppliers and their employees are being treated fairly, and whether their suppliers act as good corporate citizens. Volkswagen's disclosure of its software rigging emission test results is an example of a broken brand promise at a time when consumers take pride in supporting the environment. The company just settled for $15 billion but is not done with lawsuits and reputational damage; recovery will be long and expensive.

Temptations to shortcut laws. It goes without saying that corporate citizenship at a very minimum means following laws and regulations, no matter how cumbersome and difficult that might be. Throughout the supply chain, managers need to solve these issues in real-time while grappling with stressful practical, ethical and business dilemmas. If you have promised delivery to a wholesaler that launched a big promotional campaign, how do you deal with the corrupt Customs officer who is demanding an under-the-table payment? For U.S. corporations, it is clearly illegal to comply with the request for a bribe under the Foreign Corrupt Practices legislation. Yet, when the yelling starts, it may be tempting to let the local subsidiary or brokers take care of the problem. Another temptation faced by companies involves how to declare products for border crossings: If the Customs charges brings the product's price point into a non-competitive zone, is it acceptable to declare the product "slightly" wrong to avoid the Customs charge, for instance as a slightly different commodity subject to smaller Customs and duties charges? Don McCabe, a professor of management and global business at Rutgers University, found that 74 % of undergraduate business students had cheated during their studies. It is not farfetched to assume that they would cheat to achieve business and career goals later in life. Without clear direction, local managers may make the wrong decisions—even with the best of intentions—thinking that they in fact are looking out for their employer.

Supply chain professionals must ask themselves how the public will perceive each of their decisions. No doubt, there may be different levels of judgment based on whether any deviation from acceptable practice came about due to deliberate actions, negligence or an unfortunate coincidence.

In the internal or external parts of the supply chain, the temptation to circumvent safety, security, laws and ethics in order to expedite product or save money is one of the major risks that supply chain executive must face. In fact, many still speculate that the desire to be seen as a problem solver was what ultimately caused Volkswagen employees to develop deceptive software for their certification.

Supply chain professionals must ask themselves how the public will perceive each of their decisions. No doubt, there may be different levels of judgment based on whether any deviation from acceptable practice came about due to deliberate actions, negligence or an unfortunate coincidence. Assuming that supply chain professionals don't take deliberate actions to upset their constituents, it is tempting to simply focus on negligence. However, for prominent brands the presumption is that a high level of due diligence is exercised and that they avoid even the slightest coincidental exposure.

Proactive and reactive risk mitigation

Now that we have identified some of the new and complex risks that supply chain managers must contend with, what can be done to mitigate those risks? We believe that there are proactive and reactive strategies that supply chain managers and their organizations should consider.

One simple solution is to decrease complexity. While much complexity comes from outside sources, a few elements can be controlled within the supply chain organization. For instance, SKU proliferation can be reined in, the number of suppliers can be controlled, the location of warehouses can be optimized and concessions to customers can be done collaboratively with supply chain involvement. When new complexities are inserted, we must make sure that the gain in supply chain value justifies the increased risk.

Risk mitigation can and should be proactive, especially in established public companies. The first step is to identify the risk. Using tried and true FMEA and other risk assessment tools, we can certainly rate the risks and then put in place processes to mitigate them. Beware: As easy as that sounds, it is a daunting task.

The first problem is identifying the risk. Remember Rule No. 1: The danger comes from the overlooked risk. The second problem is that some situations simply spread like wildfire on social media with the potential to cause irreparable harm to the company brand. While it may not be game over, the damage can persist for years. Most analysis tools do not consider how to react to very rare but catastrophic events. The third problem is to identify up front which risks are important to mitigate. Being proactive requires corporations to employ highly qualified supply chain professionals. It also requires a long planning cycle. It may take years to qualify new suppliers, and most corporations are very conservative when it comes to adding new suppliers because of the high cost. The result is an opportunity cost in lost nimbleness.

Reactive risk mitigation must also be considered because the agility required in supply chains makes it virtually impossible to proactively and systematically identify all risks. Reactive risk mitigation requires constant vigilance internally and externally, empowerment and high-level involvement. Customer service oriented companies are now monitoring social media and taking complaints and individual concerns offline. Reactive risk mitigation involves the fast elevation of issues that can or are about to go viral, followed by expeditious and honest responses. One example of fast intervention occurred when Tesla's CEO Elon Musk contacted Tesla owners whose cars had caught fire and then sent Tweets about his conversations.

The strategy requires PR savvy and it is not enough to respond. When lululemon shipped sheer yoga pants to its stores and customers, the founder and CEO implied that the unfortunate see-through problem only happened to fat customers. The outrage knew no end and the CEO is no longer associated with the company.

Supplier management beyond questionnaire of the week

Supplier management relies heavily on technology to identify supplier related risks; most risks are identified by sending out questionnaires but with little follow-up. This is quite understandable as larger corporations deal with 10,000 or 100,000 Tier 1 suppliers. Thus suppliers are used to filling out endless questionnaires that require hours of valuable time to answer diligently.

Supply chain professionals think that they need to prove due diligence. Yet, they are faced with the questions of how to prove due diligence without micromanaging. A more strategic solution is to emphasize value alignment in the supply chain. Supply chain research has proven that the value alignment and relationship building approach generates higher profit for all parties. Instead of focusing on price points, procurement's role shifts from cost reduction to risk management and value creation. Indeed, some supply chain professionals are actually walking this walk.

However, most companies are still looking for the lowest bidder and measuring their purchasing staff by how they lower unit costs and not on mitigating risk or lowering total supply chain cost or increasing value.

Creating a sustainable supply chain: Lessons for executives

In most companies, supplier management is now on a track to create a staid, non-flexible supply chain that is simply not sustainable. The heavy-handed approach precludes the nimbleness and innovation that creates winning supply chains.

It is clear that just getting product out the door at the lowest possible cost doesn't cut it—especially if that means using suppliers that create brand disasters.

Supply chain executives simply have to review how they maintain control without stifling innovation. The supplier relationship and the oversight must change accordingly.

In the end, the shareholders, the board and the executives define what constitutes a job well done. It is clear that just getting product out the door at the lowest possible cost doesn't cut it—especially if that means using suppliers that create brand disasters. VW found itself in hot water because of executive pressure to meet U.S. requirements for diesel engines. Somewhere, somebody must have felt that the goal justified the means.

That should be a lesson for executives: As they push cost reduction as the primary goal in the supply chain, they may sacrifice a much broader risk that could affect their brands and put them out of business. Just as important, not all supply chain failures are the result of nefarious actions, like cheating to meet emissions requirements. Chipotle had the best of intentions when it used local farmers to source fresh ingredients rather than the larger corporate farms used by its competitors; what it lacked was the supply chain processes to identify and mitigate the risks presented by those suppliers, and a plan for how to respond if and when a problem arose.

Supply chain professionals at all levels must understand and monitor risk elements to fill this new role as protector of the brand. More importantly, the companies they work for must support them with the development of proactive and reactive risk strategies. Ignorance is no longer bliss as the world expects diligence and responsibility.

Fighting amazon's supply chain takeover

BY MICHAEL BENTLEY

In late 2015, Amazon received a license from the U.S. government to act as a freight forwarder for ocean container shipping. That approval came on the heels of Amazon winning a similar license from the Chinese Ministry of Commerce. Armed with licenses from both countries, the online retailer is now positioned to buy space on container ships at wholesale rates and resell at retail rates, which will allow the company to connect two of the world's largest markets while cutting out competitors.

Then came another bold step: Amazon signed a deal with Air Transport Services Group to lease 20 Boeing 767 aircraft to shuttle merchandise around the U.S. as part of the online retailer's efforts to reduce its high shipping expenses. Combined, these moves confirm earlier reports that Amazon is planning a global expansion of its "Fulfillment by Amazon" service, which provides storage, packing and shipping to small independent merchants that sell products on Amazon's Website—a project dubbed "Dragon Boat."

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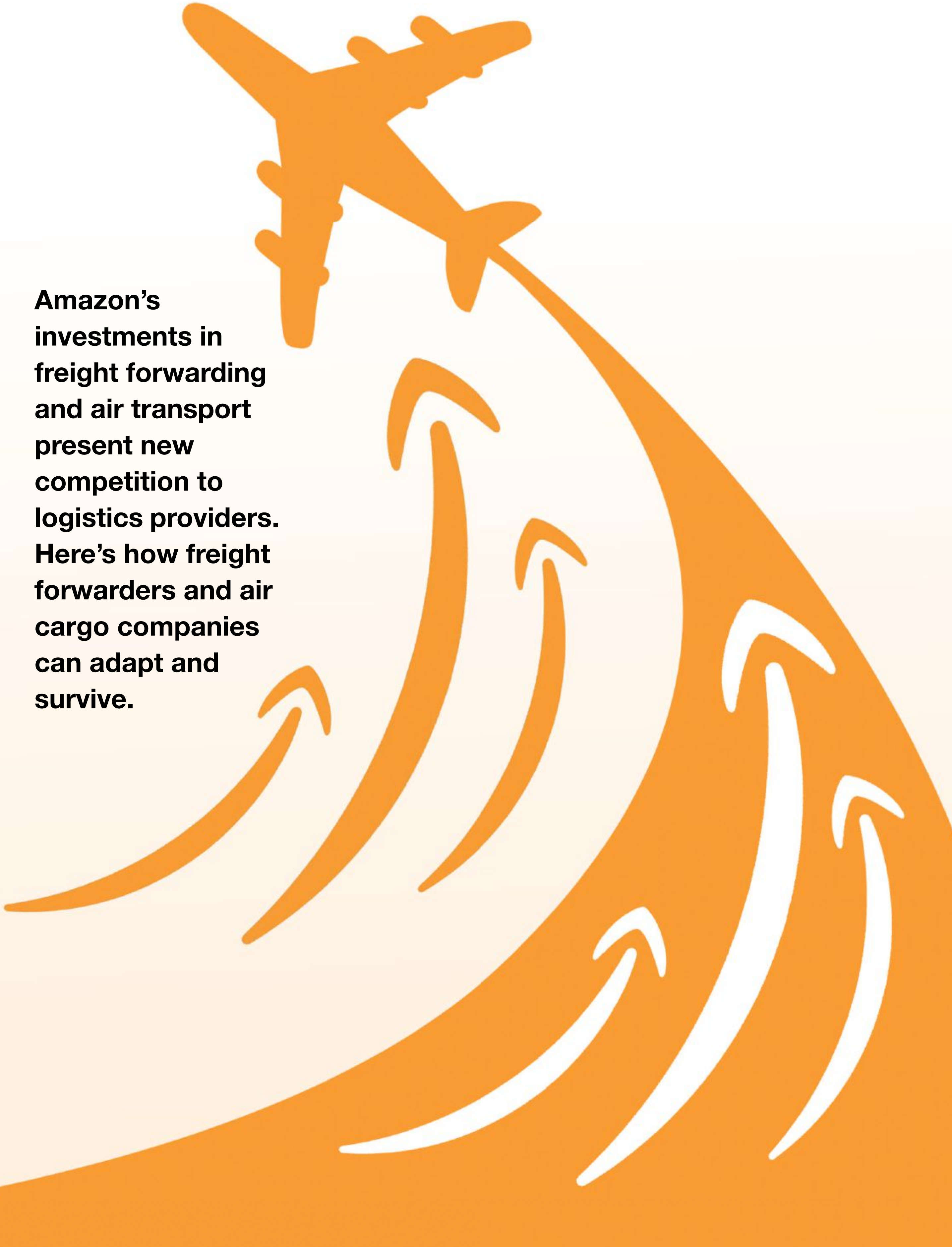
By signing the Air Transport Services Group deal and receiving a license to act as a wholesaler for ocean container shipping, Amazon once again can reduce its inflated shipping costs and reliance on third-party logistics providers. As evident from the recent Hanjin bankruptcy, shipping and air cargo companies can expect to see a continued shrinking market as Amazon enters the fray.

Just as Amazon's retail competitors have had to develop new strategies in order to survive, Amazon's newest competitors will need to determine what they can learn from the online retail conglomerate, and then move resources to the most advantageous and vulnerable areas of their industry.

Where do we stand?

Given Amazon's new deal with Air Transport Services, freight forwarders and air cargo companies have reason to worry that they are the next vertical to be disrupted. Because of this, the shipping industry can expect to see a decline in demand and heightened price competitiveness. In 2015, the top five ocean freight forwarders were listed, in order, as: Kuehne + Nagel, DHL, Sinotrans Limited, DB Schenker and Pantos Logistics. These companies should look to Amazon's e-commerce sales last year, which blew their biggest competitor—Walmart—out of the water, as an example of what their futures could hold if they don't make some drastic changes.

In fact, one freight forwarding giant has already fallen. As mentioned above,



Amazon's investments in freight forwarding and air transport present new competition to logistics providers. Here's how freight forwarders and air cargo companies can adapt and survive.

the world has just witnessed the largest container shipping bankruptcy in history with the collapse of South Korean shipping line Hanjin, the world's seventh-largest container carrier. While the full extent of the Hanjin fallout is not yet known, companies should be worried that, as competition decreases, Amazon will have an even greater opportunity to swoop in and dominate the market.

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As for the air cargo industry, the following are the number of planes in some of the biggest companies: United Cargo, over 700; FedEx, over 600; UPS, 237; and DHL, 120. While so far Amazon has only a small number of planes compared to these established companies, they must continue to monitor both the progress of Amazon's investments in the industry and how they perform at a comparable profitable rate.

There are steps, however, that the shipping and cargo industries can take to ensure they adapt, survive and even thrive in the world of Amazon. Below, I examine how this new endeavor will affect these industries and what both can do to combat the latest expansion of Amazon's ever-growing footprint.

Takeaway No. 1: You can't ignore this

The competition from Amazon comes amid a well-documented decline in revenue for shippers in the past several years. In 2014, revenue decreased 3% compared with 2013, following a 5% decline from 2012. As of 2015, industry revenue remains more than 16% below its 2008 peak, according to a report from AlixPartners.

With the freight forwarding industry already seeing downward pricing pressure and greater internal competition, the danger of some companies failing even before Amazon's entry was a real possibility. Given the fresh state of turmoil, Amazon will undoubtedly make things worse for companies that do not appropriately prepare.

In fact, freight forwarders that willfully ignore this move will not survive past the next few years, as Amazon sinks its highly analytical teeth into the market.

While the problem is less immediate for air cargo companies, those in the industry that take this change seriously will be better situated in the long term to compete with Amazon. This is largely because air cargo firms have a better business model than freight forwarders and have shown strong revenue growth in the past decade.

But, they shouldn't get too comfortable. Air cargo companies face many of the same challenges as freight forwarders in that Amazon will invest significantly in leveraging analytics and cost-cutting practices to become highly competitive with current companies. The best thing they can do is to establish a strategy that makes them well positioned to compete with the e-commerce goliath. If freight forwarders and air cargo companies follow the strategy outlined below, they will be well equipped to drive profitable revenue growth and remain competitive.

Takeaway No. 2: Imitation will get you nowhere

As many retailers have learned, freight forwarders and air cargo companies should not try to imitate Amazon. The online retail giant has a notable track record of beating incumbents in every market it enters, and that's largely due to the fact that companies mistakenly try to copy their strategies.

Additionally, Amazon uses some of the most sophisticated analytics and technology available. Freight forwarders simply do not have the resources to compete at the same level and those who try may not be able to maintain a reasonable level of competition.

It is expected that Amazon will replicate their existing small package business model in the United States. This means that they will buy at a higher capacity than their competitors and use more advanced analytics, resulting in a faster and more efficient delivery model. Based on volume, scale and buying power, Amazon will command more attractive pricing than other freight forwarders, enabling them to secure capacity at a lower cost and ensure profitability as they fill that space more easily than competitors.

Besides its sophisticated analytics, Amazon has another distinct advantage: The incredible support of its shareholders has allowed for a business model that places profits second to the goal of growing market share

first. No freight forwarders or air cargo companies can say the same. Many of these companies are already seeing a declining profit growth rate and any further cuts could result in a cessation of business.

Ultimately, companies that take on reactionary tactics to Amazon's moves in an attempt to retain market share will not be able to sustain them in the long term. These companies cannot compete with Amazon's boundless resources and will only lose money by trying to copy them.

Takeaway No. 3: Focus on where you can grow market share

As Amazon grows its presence in the market, freight forwarders will struggle to compete, and that means even more industry infighting. As mentioned earlier, the top ocean freight forwarders include Kuehne + Nagel, DHL and Sinotrans Limited—all of which already compete aggressively for market share.

Given this ultra-competitive environment, freight forwarders should focus on areas where they possess a strategic advantage in capturing and growing market share. The most obvious place to look is in commodities Amazon does not ship, such as agriculture, automotive, building supplies and heavy machinery. While the consumer goods and retail space will surely decrease for freight forwarders, companies that focus on capturing share in these less competitive segments will establish a position of strength, leading to the potential to drive significant organic revenue growth outside of Amazon's core segments.

However, freight forwarders exploring these spaces for the first time will face an uphill climb. With Amazon's expected impact on the market, these companies will no longer be able to use the project-by-project tactical approach that is the industry norm. Amazon's resources, especially in sophisticated analytics and data, will squeeze companies who refuse to change their business models.

Conversely, air cargo companies will have a stronger recourse for fighting Amazon. While UPS and FedEx both experienced strong growth in 2015, they should not become complacent. Companies that currently dominate the air cargo industry will eventually be forced to lower costs to compete with Amazon, and those with reputations for delays and logistical problems will see shrinking revenue streams. Although both UPS and FedEx are currently experiencing success, Amazon's foray into the market means they will no longer be able to maintain their current business strategies in the long term.

Both air cargo companies and freight forwarders must look for areas where they have a differentiated value proposition. Just as Amazon has built a reputation as an expert in retail products, companies that have known value in specific niches must leverage them to maintain, and possibly increase, market share.

The most obvious place to look is in commodities Amazon does not ship, such as agriculture, automotive, building supplies and heavy machinery.

Takeaway No. 4: Ramp up your analytics

Amazon uses advanced analytics in every aspect of its business. When they apply this analytical rigor to the shipping industry, companies that do not implement similar tactics will see their pricing actions consistently outmaneuvered and business taken away. As I mentioned before, companies cannot and should not exactly match Amazon's business practices. However, those that cannot present credible, high-level numbers to back up their business proposals and contracts will see clients begin to disappear.

There are two techniques freight forwarders should consider implementing:

1. **BEHAVIORAL SEGMENTATION.** Rather than relying on dated business segments and a one-size-fits-all solution utilized by much of the industry, those that leverage their unique business models and historical data to study which products and customers generate the most volume and profit will be able to use that information to adjust prices accordingly.
2. **PRICE SENSITIVITY.** Freight forwarders that use their wealth of transaction-level data to measure how sensitive customers are to price will allow them to make the necessary changes to streamline processes and determine how much they should raise or lower rates, driving profitable growth.

Air cargo companies should implement these same techniques. As Amazon invests more resources into understanding the industry, it will begin to realize where costs can be cut and prices can be lowered. Companies that prepare for this will be much better prepared to stay competitive and retain current clients. They can do this by leveraging available data to ensure that they have a holistic understanding of their own internal practices, as well as those being used by competitors.

While the full extent of the Hanjin fallout is not yet known, companies should be worried that, as competition decreases, Amazon will have an even greater opportunity to swoop in and dominate the market.

These bespoke solutions have seen huge success in the U.S. retail market. Using a myriad of competitor and merchant data, companies have been able to scientifically determine where and when lower competitive prices should be matched, as well as answering when value-added components offset higher prices. In fact, one leading consumer goods retailer saw a 6.8% revenue uplift when using this targeted approach, with a 30% uplift in select product lines, equating to tens of millions of dollars when extended across the organization.

Amazon didn't become one of the most sophisticated companies in the world overnight, and neither will anyone else. The best way to implement change at a company is to treat it as a unique entity. While some companies look to cookie-cutter approaches and generalized software, it is much more beneficial to invest in a bespoke solution specific to their own businesses. This approach will deliver organic revenue growth and a greater return on investment.

One major ocean freight company used comprehensive statistical analysis to develop an analytically driven pricing framework and corresponding strategy. This approach identified an opportunity to lift gross profit by 4.2% annually, driving change across analytics, data management, corporate strategy, business processes and operations.

These types of investments prove that profitable growth is still possible in the shipping industry. Companies that invest internally to identify where opportunities exist to drive revenue growth are much more likely to succeed than those who simply price match against competitors.

A first step

This is only Amazon's first step toward entering the $350 billion ocean freight market. Even when companies implement advanced analytics and figure out where they can compete with Amazon, there will be additional challenges as the conglomerate continues to pour money and resources into the industry in order to fully integrate across verticals.

Amazon's growth leaves up for grabs only a percentage of the demand that existed before for retail. Those in the space that continue to compete as before will be forced to price their services at unsustainable rates. This shaky business model will put them at significant risk of being out of business within the next several years.

Instead, the freight industry can best combat this by further exploring other B2B commodities that Amazon does not ship. Companies that focus on these areas will improve their chances of locking down those markets, and achieving market share growth. This will stall the inevitable rise in competition from companies shut out of the retail market and in need of fresh sources of revenue.

Although Amazon is still in the early stages of entering the air cargo industry, companies in the space should be concerned that Amazon will underbid them and fully integrate its shipping process, providing an end-to-end solution from warehouse to doorstep.

There is already significant downward pricing pressure in the shipping industry, and Amazon's entry is sure to create even more aggressive competition in the space. The best course of action is to push hard to leverage analytics in an effort to capture market share in products Amazon does not sell (cars, commodities, agriculture, etc.).

Only by establishing a position of strength in the remaining markets will these companies survive and potentially thrive. As Amazon prepares to extend its reach further into the retail supply chain industry, failing to act is no longer an option for shipping companies. This supply chain power play may be the catalyst that sends the industry into a Darwinian scenario of survival of the most analytically fit.

Dynamic warehousing involves buying warehousing services on a pay-per-use basis. Just as with Uber and AirBnB—exemplars of today's "on-demand" economy—users and providers meet and transact with each other via an electronic marketplace.

The "Uberization" of Warehousing

BY AMITABH SINHA

NO DOUBT many of this journal's readers already tap their mobile phones to get an Uber to the airport. Or they use the Airbnb app to find a nice place to stay for that long weekend. So it shouldn't be a big surprise for them to learn that warehouse services can now be acquired in similar ways.

Dynamic warehousing is emerging as a viable way of purchasing warehousing services on demand—paying only for what is used instead of owning distribution centers or signing contracts with third-party logistics providers (3PLs).* As with Uber, Airbnb and a host of other shared-economy services, the actual pay-per-use transactions occur in an electronic marketplace. The approach can extend to a company's entire warehousing strategy, or it may supplement an existing logistics network built on long-term contracts. In either case, it allows the company to adapt quickly to variable demand and cost conditions.

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* Note: This is also called on-demand warehousing, although in this article we use the term "dynamic warehousing" throughout.

Dynamic warehousing can be particularly useful for e-commerce, where retailers typically face high demand uncertainty and often have significant capital constraints. Additionally, dynamic warehousing allows e-commerce retailers to rent small units of capacity in many parts of the country, enabling quick delivery to wider pools of customers.

This article introduces the idea and demonstrates its value with a brief case study.

Warehousing tries to keep up with e-commerce

Before the advent of e-commerce, many retailers used warehouses as intermediate storage points (distribution centers or DCs) to supply their stores; it is still a common way to manage distribution. A retailer could use a network consisting of a few DCs, each serving a "region" comprising many states, with replenishment lead times of a few days.

According to the latest Annual State of Logistics Report from the Council of Supply Chain Management Professionals (CSCMP), total logistics activity in the U.S. in 2014 cost $1.45 trillion—roughly equal to 8.3% of gross domestic product. Of this, $900 billion was in transportation costs. Although warehousing alone accounts for only 10% of total logistics cost at $143 billion, its activities have a significant effect on transportation costs: A more extensive network reduces outbound shipping costs (which are generally more expensive per unit), despite some increase in inbound transportation costs.


NYC Warehouse
123 Ship Drive
New York, NY
Services include:
Labor Cost: Starting at $7.50 per pallet
Storage Cost: Starting at $7.00 per pallet per month

With the development of e-commerce, however, the traditional warehousing model began to fall short. E-commerce creates significant challenges in terms of customer expectations, compared to traditional retail. In general, outbound shipping with e-commerce features very small quantities sent directly to individual customers. Shipping time is absolutely critical: Many customers now expect their items to arrive inside two days, and more and more retailers are offering same-day delivery. As an example, Walmart is reportedly targeting free two-day shipping using a network of eight DCs, supplemented by its retail stores, according to *Fortune*. Furthermore, e-commerce demand can be highly variable, influenced by social media and faster news cycles in the Internet media. Moreover, the sheer acceleration of e-commerce presents logistics challenges: Total U.S. e-commerce sales in 2015 came to $340 billion, comprising 7.5% of total retail, and growing at nearly 15% year over year, according to the U.S. Department of Commerce.

> Dynamic warehousing is starting to emerge as a **viable way of purchasing warehousing services on demand—paying** only for what is used instead of owning distribution centers or signing contracts with 3PLs.

Such factors are forcing significant changes on the warehousing industry. The changes are not simply because e-retailers keep more inventory in warehouses because, by definition, they have no brick-and-mortar stores. Overall, demand for warehousing space is growing, as is the need for an efficient warehousing and distribution strategy. CSCMP's State of Logistics Report notes that the national vacancy rate had dropped by 2.7% to 7% from 2013 to 2014. In some areas, shortages are rapidly driving up warehousing costs; according to the *Wall Street Journal*, e-commerce has hiked rates by almost 10% in a year, with the San Francisco bay area seeing a jump of more than 28% in that period.

A need for alternative warehousing solutions

For e-retailers, shipment options have been challenging indeed. Traditionally, their options have been these:

- **Startup—drop ship.** If the retailer owns its own manufacturing/assembly facility, initially it may ship directly from that facility. Many small e-commerce retailers start this way.
- **Self-owned network.** If the retailer operates its own warehouses, it is unlikely to have the scale and financial resources to build an extensive network. As a result, the average distance to the customer is high, resulting in high shipping costs and longer delivery times.
- **Network outsourced to 3PL.** Although this offers a little more flexibility compared to a self-owned network, many 3PLs demand commitments of one year to three years. This effectively locks the retailer into a fixed structure for several years.
- **Distribution outsourced completely.** Amazon.com, for instance, offers a service called "Fulfillment by Amazon" (FBA) wherein it distributes other retailers' products through its network. Although this can provide speedy service to customers, the costs can be high and many retailers are wary of handing over a core part of the business to a top competitor.

A role for dynamic warehousing

Dynamic warehousing, quickly matching those needing space with facilities that have space available, is emerging to help facilitate the pace and scope of e-commerce's logistics needs. Several new companies have launched recently to provide the on-demand service. It is "dynamic" in the sense that the retailer can change the configuration frequently: based on demand conditions, warehouse space could be deployed at different locations, for different volumes, in a dynamic fashion. Its order management system and warehouse management system can link the retailer's systems with those of the warehouse provider.

The idea is that the shipper has access to a large network of warehouses, and can activate services "on the fly," ranging from bulk pallet handling to fulfillment, in small to large volumes and for relatively short times. For example, a small e-commerce retailer may decide to create half a dozen different distribution points, with as few as 50 pallets at each warehouse and little to no fixed time commitment. The warehouse provider would use its own labor and equipment to perform standard and optional services such as receiving, shipping, case pick, item pick and packing, and would charge the retailer on a per-unit basis.

In such a system, the retailer incurs no upfront fixed costs, and gains significant flexibility. Of course, the unit cost charged by the warehouse provider may be higher or lower than what would be incurred by the retailer if it operated its own high-volume, high-utilization warehouse. But this is the benefit of dynamic warehousing: The retailer gains flexibility and avoids capital expense, even if sometimes the per-unit cost is higher.

Dynamic warehousing is best suited to retailers with small but highly variable demand, such as emerging e-commerce retailers. For mid-size retailers, it can act as a buffer to handle unexpected demand variability, complementing a primarily self-operated and 3PL-based network. (It is of little advantage to the e-commerce activities of large retailers, such as Walmart and Target, which handle large volumes and see fairly predictable demand.)

The new flexible warehousing concept is a good example of what has been called "platform capitalism"—one of the fastest growing and most significant trends in the business-to-business (B2B) world, based on reports in publications such as *The Guardian* and the *Institute for Network Cultures*. Over the last decade, electronic marketplaces have proliferated, providing an ever-wider range of services and business activities. The earliest marketplaces were largely business-to-consumer (B2C), dealing in tangible products—Amazon.com started out with books, and Zappos with footwear. Increasingly, e-exchanges handle a host of services for businesses, ranging from basic administrative tasks to the outsourcing of large-scale manufacturing activities. For example, Kickstarter provides a platform for online fundraising; Innocentive crowdsources new ideas for participating companies. In much the same way, new platform providers such as Flexe.com "match-make" those in need of warehousing space with places that can provide it.

Compared to the warehousing services offered by traditional 3PLs, dynamic warehousing makes it possible to rent significantly smaller spaces for short time periods. This is analogous to what already happens in the trucking sector, for instance, where a retailer can operate its own fleet of vehicles, set up long-term contracts with large trucking companies or use a Web-based freight exchange to contract for individual loads with one truck at a time. Moving from running a fleet of trucks to using a freight exchange, capital expense decrease, unit costs rise and flexibility increases. Those tradeoffs are exactly the same with warehousing.

Value for warehouse operators

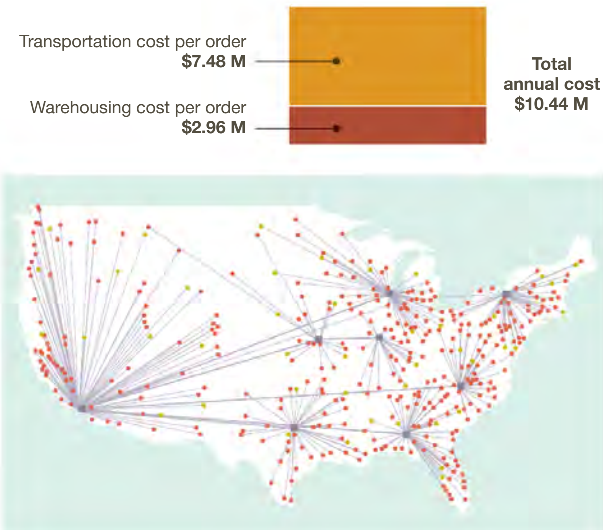
Dynamic warehousing is of real value for warehouse owners as well. Building a warehouse can be expensive; any unused space has an opportunity cost. Even if a warehouse owner/operator has long-term contracts with retailers or 3PLs for much of its space, any remaining space can be turned into a revenue-generating asset by "registering" it on a dynamic warehousing marketplace. Depending on its operating costs, opportunity costs and market dynamics, a warehouse owner can choose a price that may be more, or less, than the rates it charges its existing clients.

Case study: A growing e-commerce retailer that faces variable demand

To illustrate the economics of dynamic warehousing and compare it to a traditional operation, let's consider a simple case study of an e-retailer with a single plant in Ontario, California (the retailer imports all of its goods through the port of Los Angeles). We'll assume that the retailer has a SKU count of 500, a total annual order quantity of 1 million units, an average of 1.5 units per order; and customer demand mirrors that of the overall U.S. population. The Ontario facility spans 95,000 square feet and has a 95% utilization level. Let's look at three test cases to see how dynamic warehousing stacks up.

Dynamic warehousing is best suited to retailers with **small but highly variable demand, such as emerging e-commerce retailers**. For mid-size retailers, it can act as a buffer to handle **unexpected demand variability, complementing a primarily self-operated and 3PL-based network**.

FIGURE 1
Network structure and operating costs to guarantee 90% service within two days



Source: Vivek Rajeevan

Test case 1: One warehouse serving all customers in the U.S.

Early on, the retailer simply uses small package delivery to ship to its customers spread across the U.S. Using demand information, standard industry transportation costs and a fixed warehouse location near the Ontario plant, we can calculate the cost of operating the network. (For this, and all of the network design in our study, we use Tactician, a Web-based network optimization software.) Total cost per order comes to $11.89, with transportation costs per order of $9.53 and $2.36 in warehousing costs per order. One-time fixed cost is $225,000 (for operation start-up, equipment installation, etc.); the three-year locked-in lease for the warehouse costs $2 million. Total annual cost for the one-warehouse mode: $11.9 million.

Of that total cost, about 80% is outbound transportation, from the warehouse to the end customer. Inbound transportation rates are very low, but the distance is minimal. So, in order to reduce transportation costs and in turn to lower total costs and improve service levels, it would make sense to have multiple warehouses across the country. However, this also implies higher warehousing costs as the fixed costs would increase when more warehouses are added to the network.

Also note that the existing network delivers only 12% of orders within two days. As the e-commerce industry moves toward faster and faster delivery times, it is important for the e-commerce company that its customer service level is as high as possible while maintaining reasonable costs.

Test case 2: 70% and 90% orders fulfilled within two days

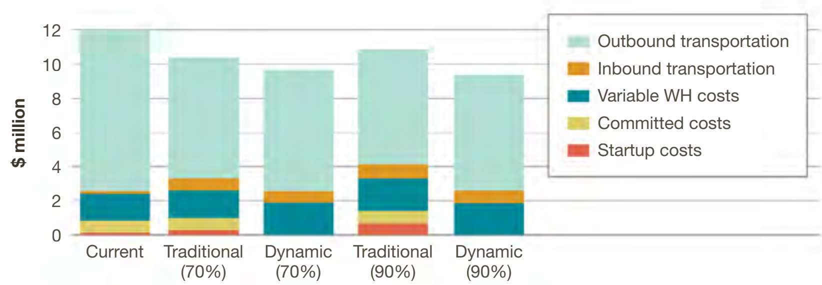
Let's now imagine that the e-retailer's goal is to deliver 70% of the orders within two days, at minimal cost. Our calculations, using the same demand and shipping information as described above, as well as industry standard warehouse costs, show that the retailer's optimal network has three warehouses, in California (22,000 square feet), Illinois (38,000 square feet) and North Carolina (34,000 square feet). Utilization of each is 95%.

Now the total cost per order averages $10.25, with transportation cost per order of $7.76. Warehousing cost per order is $2.49. The total annual cost for the three-warehouse set-up: $10.25 million.

But if the objective is to have 90% of orders delivered within two days, the calculations show that the e-retailer would require eight warehouses in all, reflecting the need to get closer to the customer. (See Figure 1.)

Given that more and more e-commerce retailers are starting to offer same-day shipping capability, the company might aim to serve 90% of customers within one day; in that case, it would need a network of 16 or so warehouses.

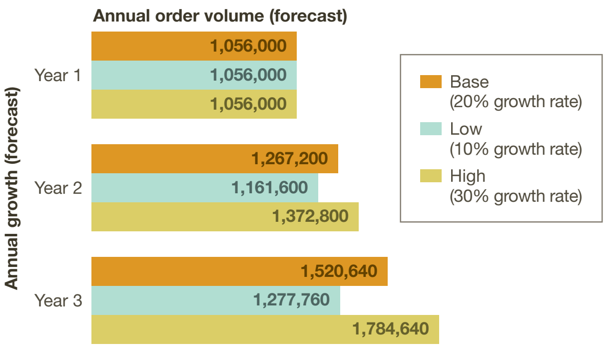
FIGURE 2
Comparative costs of network models with and without dynamic warehousing



Source: Vivek Rajeevan

FIGURE 3

Order volumes under different growth scenarios



Source: Vivek Rajeevan

For a small e-commerce retailer, the capital expense required to build out such a network would be prohibitive. Locking into long-term leases with 3PLs may also be risky, especially if volumes are insufficient to gain economies of scale. Which brings us to dynamic warehousing. What if the retailer was able to rent space, using current marketplace rates, for a warehousing network of equivalent size?

We can calculate the costs of the three networks examined above, as well as the latter two networks operated using dynamic warehousing (see Figure 2). For dynamic warehousing, the network structure is the same (that is, warehouses are located in the same places as in the corresponding traditional network). The immediate difference is that there are no start-up or warehouse leasing costs; the dynamic network uses marketplace costs for warehouse space, which are only slightly higher per-unit than in a traditional network.

Of course, the relative advantage of the dynamic network depends on many factors: the actual marketplace rates for warehouse space, demand variability, etc. As noted earlier, marketplace rates for warehouse space may be greater than, or less than, standard rates with a 3PL. If the warehouse provider has surplus space that will be otherwise unused, it may well offer below-market rates in the short term. On the other hand, in a high-demand location, marketplace rates are indeed likely to be higher than 3PL rates. With those realities in mind, it's important to consider demand variability and the effect on dynamic warehousing.

Test case 3: Growth scenarios

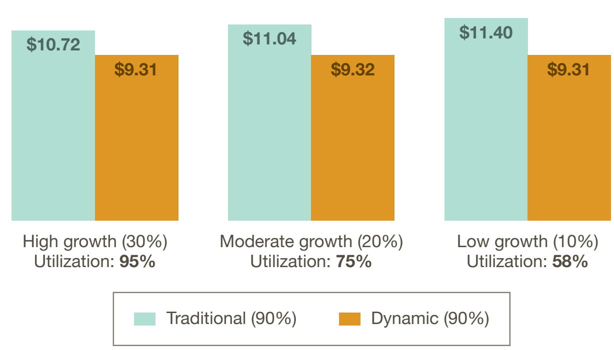
To properly assess the value of dynamic warehousing model when demand is uncertain, let's consider three scenarios in which the e-retailer has annual growth rates of 10%, 20% and 30% respectively. The resulting annual volumes are calculated using the same assumptions and methods cited above. (See Figure 3.)

To model the traditional system, we assume that the retailer is locking in capacity for three years with sufficient capacity to meet peak demand. This means that the retailer would lock in sufficient space to meet annual demand of 1,784,640 units, even though utilization would be much lower than that in Year One. This is conservative; the retailer may well be able to negotiate capacity reservation with the 3PL that does not require so much unused space in that first year. Nevertheless, for our calculations, we assume that the full capacity is reserved up front.

The cost per order incurred varies as the retailer's growth rate varies, assuming that it installed capacity sufficient to cope with the high-growth scenario. (See Figure 4.) In the leftmost graph, actual annual growth was indeed the 30% that was expected, leading to cost per order of \$10.72 and \$9.31 for the traditional and dynamic networks respectively. The other two graphs show the costs if the actual growth rate was moderate (20%) and low (10%)

FIGURE 4

Cost per order with variable demand growth



Source: Vivek Rajeevan

respectively. In those cases, the costs per order with a traditional network rise to \$11.04 and \$11.40 respectively, because utilization decreases. Cost per order under the dynamic model, however, stays unchanged at \$9.31 because of the pay-per-use nature of the dynamic warehousing system.

Of course, the retailer may choose to invest assuming a low-growth scenario, and not risk low utilization. In that case, the opposite problem will arise: If actual growth is high, then the retailer runs out of capacity, and risks either losing demand or having to pay other costs to meet the unexpectedly high demand.

This ability to deal with uncertainty is one of the key benefits of dynamic warehousing. Uncertainty and variability arise in many forms, as we will discuss shortly. It's important to note that dynamic warehousing does not present an either-or decision with respect to traditional warehousing. A retailer may use a blended approach: operating some warehouses, which it owns or contracts with 3PLs, and deploying dynamic warehousing as a filler when needed. Such a system can offer most of the advantages listed above while also lowering the risk exposure; however, it would require some amount of capital expense. For many e-commerce players, a mix of approaches may provide optimal levels of costs and service.

> Dynamic warehousing is "dynamic" in the sense that the retailer can change the configuration frequently: based on demand conditions, **warehouse space could be deployed at different locations, for different volumes**, in a dynamic fashion.

Other pros and cons of dynamic warehousing

Dynamic warehousing also makes it possible to hedge against other types of variability beyond just variations in volume. For instance, it can help address the following:

- **Regional variability.** Demand could grow much faster in some regions than in others. Dynamic warehousing provides the ability to increase warehousing capacity in regions with high or fast-growing demand, and decrease warehousing capacity in regions where demand is declining.
- **Cost variability.** Operating costs can change in different ways across different regions. For instance, tax policies in one state could make costs particularly attractive there, with wage and rent inflation making other regions unattractive. A dynamic warehousing network can quickly adapt to such changes.
- **Supplier variability.** As the e-commerce retailer grows, it may add new suppliers in other parts of the country or the world. Or, the supplier itself may add new facilities, or transportation disruptions may cause the flow of imports to arrive through a different port. Again, dynamic warehousing can quickly adapt to these changing conditions.

It should be mentioned that dynamic warehousing is not without its own risks. The single biggest risk is that the retailer is exposed to market rates for warehousing space. Putting it in consumer terms: Much like Uber's surge pricing, market conditions may cause warehousing rates to spike suddenly. A retailer that has its own network of owned/operated warehouses will typically be in a better position to manage its costs.

Another potential risk factor stems from the fact that orders are being fulfilled by a network of unrelated warehouses contracted only through an electronic marketplace. As in any such outsourcing situation, operating conditions at some warehouses may not be optimal, leading to errors in order fulfillment, for example, or misalignment with the retailer's values and objectives. This risk can be mitigated by appropriate contract structures and monitoring, both on the marketplace platform and via third parties.

Dynamic warehousing is an idea whose time has come. Not only does it offer a cost efficient way for smaller e-commerce retailers to offer high service levels in a flexible fashion, but it is also likely to become a standard way of contracting for warehousing services.

Acknowledgements

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Set objectives for optimization tools

To get the most out of supply chain optimization, think beyond cost savings.

Complex supply chains have made it harder for organizations to effectively track their supply chain performance and make determinations about how best to streamline their operations. To address this problem, vendors have developed a variety of supply chain optimization tools that consider multiple factors to determine the best configurations of resources.

Two such systems, network planning and optimization tools and distribution requirements planning (DRP) software, offer the potential to increase supply chain efficiency while reducing costs. Network planning and optimization tools aid in the alignment of strategies across the supply chain—from procurement to shipping. These systems enable organizations to determine the effects of potential market changes and better implement appropriate responses to those changes. DRP software packages focus on the distribution and transportation aspect of the supply chain. They aim to help organizations determine the ideal locations and quantities of goods that will best meet demand.

By Becky Partida, Senior Research Specialist – Supply Chain Management, APQC

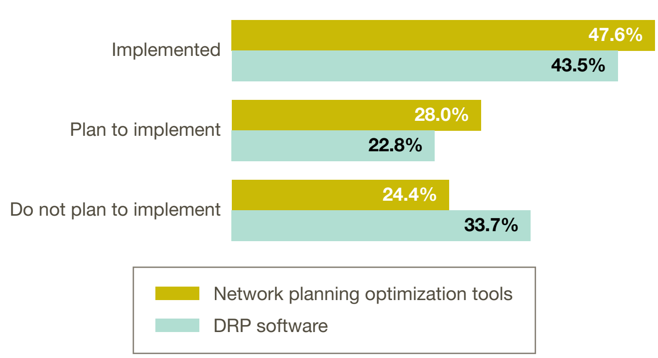
According to APQC's Open Standards Benchmarking data in logistics, each of these systems has been implemented to a modest degree among organizations. As shown in Figure 1, less than half of responding organizations have implemented network planning and optimization tools, but about a quarter of those organizations plan to implement these systems at some point in the future. Organizations responded similarly when asked whether they had adopted DRP software.

Overall, the organizations that have implemented these tools consider them to be effective in helping them reach their goals. According to APQC's data, 93% of organizations that have implemented network planning and optimization tools consider the tools to be extremely or somewhat effective. A similar percentage of responding organizations consider their DRP software to be extremely or somewhat effective in helping them reach their goals.

APQC took a closer look at whether these

FIGURE 1

Implementation of optimization tools

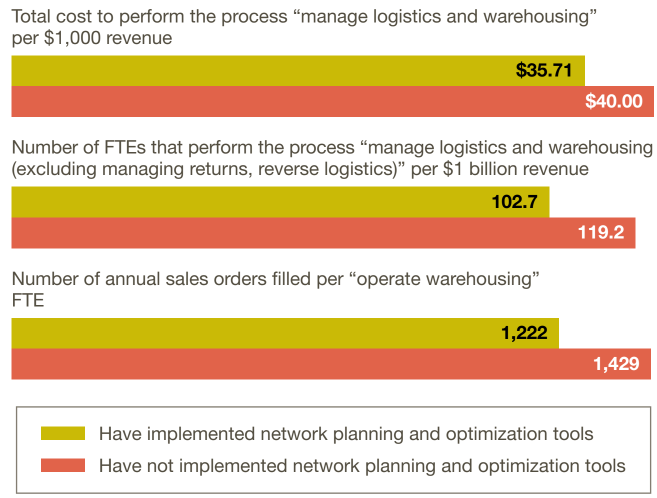


Source: APQC

optimization tools are resulting in the benefits that organizations may expect. In particular, APQC looked at the logistics performance of such organizations. By looking at the efficiency of organizations that use these tools, as well as the amount these organizations spend on logistics, APQC has found evidence that there is a disconnect between organizations' perception of how well their optimization tools are improving their performance and the actual performance they achieve.

FIGURE 2

Logistics performance and use of network planning and optimization tools



Source: APQC

Tools to plan and optimize networks

APQC's data indicates that organizations that have adopted network planning and optimization tools have a cost advantage over those that have not adopted these tools. However, this does not necessarily translate to a performance advantage. As shown in Figure 2, organizations using network planning and optimization tools spend $4.29 less at the median to manage their logistics and warehousing per $1,000 in revenue. For an organization with $1 billion in annual revenue, this indicates a potential savings of $4.3 million associated with using this type of optimization tool.

These organizations also need fewer full-time equivalent employees (FTEs) to manage their logistics and warehousing than do organizations without network planning and optimization tools. At the median, they need nearly 17 fewer FTEs per $1 billion in revenue for these activities than their counterparts that are not using network planning and optimization tools (Figure 2).

However, these advantages do not necessarily translate into superior efficiency. APQC's data in Figure 2 also shows that organizations using network planning and optimization tools fill fewer sales orders per warehousing FTE than organizations that have not adopted these tools. In fact, at the median they process 200 fewer sales orders per FTE than their counterparts. These results hint that organizations implementing tools to optimize their supply chains have focused on reducing the overall costs and resources needed for their supply chain operations. However, it appears that these reduction efforts have affected the ability of supply chain employees to perform as well as they need to for the organizations to maintain service levels.

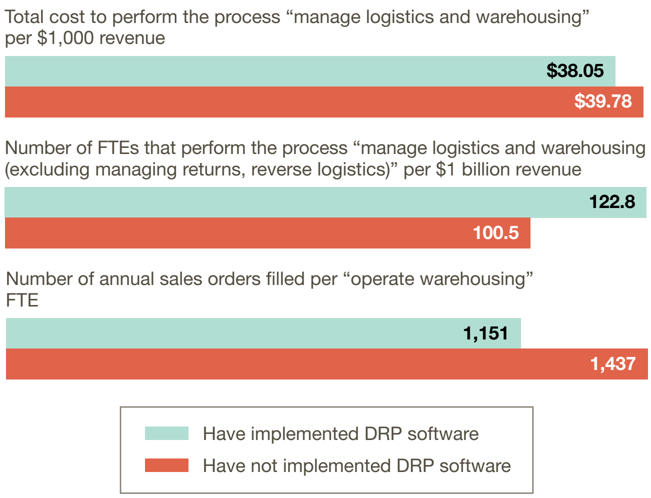
Software to aid distribution planning

When looking at the logistics performance of organizations that have implemented DRP software, APQC found results that are similar to that of organizations using network planning and optimization tools. Organizations using DRP software have an advantage with regard to cost, but they lag in efficiency because they need more resources for their logistics processes and are able to fill fewer sales orders with those resources.

As shown in Figure 3, organizations that have implemented DRP software do have a slight cost advantage over organizations that have not. At the median, they spend $1.73 less per $1,000 in revenue on their logistics and warehousing efforts than their counterparts. For an organization with $1 billion in annual revenue, that

FIGURE 3

Logistics performance and use of DRP software



Source: APQC

means a potential savings of over $1.7 million for its logistics operations.

However, the advantage organizations using DRP software have over others does not appear to carry over to the efficiency of their logistics efforts. As Figure 3 also shows, these organizations need more FTEs for managing logistics and warehousing. At the median, they need over 22 more FTEs per $1 billion in revenue than their counterparts that have not implemented DRP software. These results seem to contradict the notion that implementing DRP software will make an organization's warehousing and transportation efforts more efficient and thus reduce the number of staff needed to complete tasks.

There is also a contradiction when one compares the number of annual sales orders organizations are able to fill. At the median, organizations that have implemented DRP software fill 286 fewer sales orders per warehousing FTE than their counterparts that have not implemented DRP software. Coupled with the data on the number of FTEs needed for logistics, these results present a startling notion about organizations using DRP software: Although they have achieved lower costs for their logistics processes, they have not seen the across-the-board performance improvement one would expect to see from software that would optimize inventory amounts and locations.

Tools should support improvement efforts

APQC's data indicate that there is a disconnect between the perceived effectiveness of both network planning and optimization tools and DRP software and the actual results that organizations are achieving. Although organizations using these tools spend less on their logistics efforts than organizations that do not, they have room to increase the efficiency of their logistics efforts. It is possible that organizations using these optimization tools are looking only at their cost advantage and considering their optimization efforts successful without digging into the actual service levels they are able to provide to their customers.

The organizations in APQC's data that have adopted network planning and optimization tools or DRP software may have been short sighted in their implementation efforts. A common mistake organizations make when adopting new software is to think the technology will address all the issues with minimal effort from the organization. In reality, the software should be viewed as one part of a larger improvement effort. APQC recommends that organizations implementing these tools set objectives that the tools should help meet. After implementing the tool, organizations can monitor performance related to the objectives to ensure that expectations are indeed being met.

As with any improvement effort, the software does not replace the need to assess processes and make adjustments when necessary. In fact, assessing logistics processes should be one of the first steps an organization takes when optimizing its supply chain. Adjustments to processes can then be made to ensure that the optimization tool operates as effectively as possible.

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Currency: The next commodity risk management disruptor

Falling commodity prices have made businesses look good and given business leaders a false peace, but looming currency wars may prove to be the disruptor that ignites a new round of commodity volatility.

BY JOHN PIATEK

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In recent years, commodity volatility has quietly slipped out of the minds of business leaders. In fact, over the past five years most commodities—though not all—have fallen substantially. Though most media attention is given to crude oil, which is half of its value from five years ago, other commodities have also fallen at a breakneck pace including corn (-44%), copper (-38%) and wheat (-30%).

Those declining prices have made many businesses look good and led economists to debate whether we are at the end of a commodity super cycle that will propel prices even lower. For example, as China tries for a "soft landing" of decelerated economic growth, commodity prices could fall further as demand slows. If so, those lower prices may give business leaders a false peace. The decline in commodity prices is already adding political pressure to do something on commodity exporters such as Australia and Saudi Arabia, and sparking political unrest in countries around the world such as Russia and Venezuela. It leads one to wonder if currency wars aren't looming in the future, and if so, what comes next?

In fact, there is evidence that the currency wars have already started. Compounding the issue, the last two years have crushed the markets' belief in the predictability and stability of currency values. Consider the following:

- **"Francogeddon."** In January 2015, Switzerland abandoned its peg to the euro and threw financial markets into chaos, with the value of the Swiss franc spiking to more than 20% above the prior valuation relative to the U.S. dollar.
- **"Brexit."** Mainstream media missed the anti-EU sentiment building in the United Kingdom, causing many to be outright startled when U.K. voters supported the Brexit effort to leave the European Union in June 2016. The economic impact was immediate and by mid-October 2016 the pound had fallen 18% against the U.S. dollar.
- **Struggles of "Abenomics."** After some success, Shinzō Abe's economic policies of fiscal stimulus and monetary easing for Japan are struggling to contain the value of the yen, which has risen 14% since the beginning of 2016.

• **Chinese moves.** In August 2015, China changed the structure of how exchanged rates are fixed, enabling more market input on its valuation. This sent the currency on a steady downward slope. The yuan is now down -8% in dollar terms as compared to January 2015.

What this means is that businesses today are operating in a world where both commodity and currency values are changing rapidly and in unpredictable ways.

A new reality

As countries and businesses adapt to this new reality, currency volatility is likely to trigger commodity price volatility. This will have a tremendous impact on companies that source their goods globally. That is because the structure of commodity production is not set up to withstand these swings in currency prices. Domestic production cannot be started quickly enough to replace supply disrupted by the increased costs of imports. Increased costs often have to be absorbed by the consumer.

The current unstable economic outlook should compel leaders to take action now before it's too late. Yet, given what we have experienced in commodity prices over the past few years, many organizations overlook how important commodity volatility is to their overall enterprise risk. For that reason, any uptick in commodity volatility would catch many off guard.

This should be a C-suite priority. While many organizations are not ready to manage commodities in a comprehensive, end-to-end manner, there are actions a company can take now in preparation for higher prices.

Priority actions

1 **Define and publish a commodity risk management strategy (CRM) throughout the business.** Many organizations have different perspectives on what the risk strategy should be. Should the company try to outperform the market? Can market intelligence be used to gain an advantage? Would it be better to pay a premium for stability? How far in advance should the company plan in these uncertain times?

2 **Agree how commodity risk management will be measured.** What are the objectives of the CRM program? How will performance be measured against these objectives? What metrics are needed to track this?

3 **Arm the business with a full arsenal of CRM weapons.** Effective CRM is not simply derivatives and other financial hedging strategies. Leaders should consider a full spectrum of solutions, including partnering with suppliers to manage risk, integrating CRM into pricing actions and, where possible, changing the long and short physical stock holding positions.

4 **Execute CRM as a standard business-as-usual process, not as an exception driven by market disruption.** Strong CRM systems have a tiered governance structure to balance executive involvement, decision-making and escalation protocols for extreme market disruption. The process is well structured and not reactive, and is transparent to stakeholders with roles and responsibilities defined. The process is supported by a set of standard tools that reside in a central repository.

5 **Upgrade internal tracking of currency and commodity markets and develop a single voice on the market data.** The different functions of the business (marketing, supply management, supply chain, finance) need the same feed of information to make decisions. While opinions will vary on the future, the business should be fully informed and aligned on the past and present.

The time is right to focus on CRM: Businesses should mobilize now to upgrade their corporate governance around commodity risk management and commodity buying strategies. This may be the end of the calm before the next commodity storm begins.

A SPECIAL SUPPLEMENT TO:
SUPPLYCHAIN MANAGEMENT REVIEW

Survey respondents indicate a desire to apply more IT solutions and keep up on capital expenditures as they confront complex issues like bigger facilities, labor issues, high SKU counts and the growing reality of omni-channel.

2016 Warehouse/DC Operations Survey:

Ready to Confront Complexity

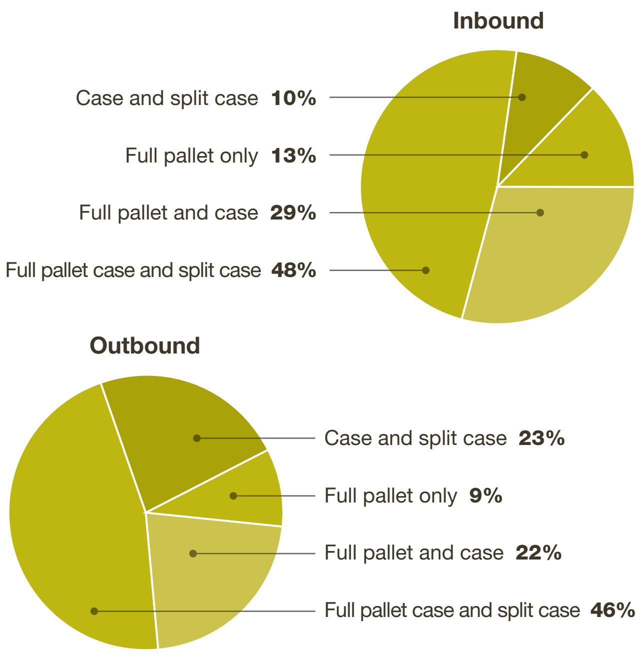
As it has the last few years, our "Annual Warehouse and Distribution Center (DC) Operations Survey" points to growing order fulfillment complexity, larger labor forces, and other challenges associated with e-commerce. However, the 2016 survey reflects an industry that's not only well aware of these challenges, but one that's poised and ready to do something about them.

By Roberto Michel, Contributing Editor

From tweaking operational processes, to tapping labor as a means of flexing capacity, to incrementally applying more technology, the survey clearly indicates that respondents are in the midst of addressing omni-channel challenges. For example, capital expenditure (CapEx) levels have kept pace with CapEx growth seen in recent surveys, and workforce numbers held steady or grew among some respondents.

According to Donald J. Derewecki, a senior consultant with St. Onge Company, and Norm Saenz, Jr., a managing director with St. Onge Company, a supply chain engineering consulting company and *SCMR*'s partner for this annual research, a majority of the data points to an industry engaged in con-

Nature of DC's inbound/outbound operation



Source: Peerless Research Group (PRG)

fronting omni-channel complexities.

"As operations requirements become more complex, companies in general seem to be coping," says Derewecki. "E-commerce has been affecting nearly everything. Even companies that don't directly participate in e-commerce now experience Amazon-type expectations from customers about rapid ordering and fulfillment. So the bar is set pretty high on requirements, and in response, the majority of respondents seem to be focused on improving their processes and the information systems support for those processes."

While the survey indicates only modest increases in information technology (IT) use or plans, there were increases across certain IT and materials handling automation solutions, while reliance on paper-based processes continued its slow decline.

"I feel the trends are continuing, and that companies are doing a little bit more to meet the demands of e-commerce and omni-channel growth," says Saenz. "It was encouraging to see in the survey that more companies, in addition to their focus on process improvement, are looking to apply more technology and spend a little bit more."

Some of the highlights that show continued complexity on the one hand, and common responses on the other, include:

- After a big increase in square footage last year, the numbers remained pretty steady, with the median square footage of 240,410 narrowly under last year's median of 246,341.
- This was the first year we asked about servicing omni-channel, drawing a 16% response. Another 35% service e-commerce, down 5% from 2015, but when factoring in the omni-channel response, and further dwindling in those who service only one channel (now just 11%), the survey indicates steady growth in e-commerce involvement.
- The average number of employees for a DC held fairly steady at 278 (compared to 287 in 2015) while 21% of operations now have 500 or more employees. This year saw a 4% increase in operations that have 500 to 999 employees.
- When it comes to projected CapEx for the coming year, the average increase was slight, less than 2% growth, but the median climbed by 47.6%.
- In terms of improvement actions, "improving warehouse processes" remains the most common approach, but "improving warehouse IT" climbed from 34% to 41%.

As it has over the years, our annual survey of decision makers for warehouse/DC operations spans multiple areas, including operational trends, use of technology, improvement methods, and company initiatives and experiences in areas such as key operational issues and value-added services performed.

Most participating companies came from manufacturing (39%), followed by distributors (32%), third-party logistics providers (12%) and retailers (6%). Leading verticals included food & grocery, automotive & aerospace, general merchandize, paper products & office supplies, and apparel.

Complexity the norm

After a few years of the survey showing trends including bigger facilities, more workers, less handling of full pallets, more stock keeping units (SKUs), and lately, more inventory turns, most of these factors that make managing DCs challenging remained fairly steady or grew slightly.

In fact, the 2016 survey certainly suggests that complexity is here to stay.

This year, only 9% of respondents handle full pallets on the outbound side, the same as 2015's findings. On the inbound side, full pallet only stood at 13%, a 2% rise from last year. However, those saying that they deal with a mix of full pallet, case, and split case on the inbound grew 4% to 48%.

Overall, 58% of inbound flow involved split cases, and 69% of outbound involved split cases. "This is consistent with last year's breakout, and reflects both the trend for more frequent and smaller receipts, and the effect of e-commerce," says Derewecki.

Wholesale (67%) and retail (60%) are the most common channels serviced, with e-commerce serviced by 35% of respondents. While that is lower than last year's 40% e-commerce response, 16% say they service omni-channel. While there's likely some overlap between e-commerce and omni-channel responses, just over half of 2016 respondents indicate they service e-commerce and/or omni-channel needs.

The survey also reflects the inventory challenges of omni-channel and e-commerce support. While the average number of SKUs was down slightly to 13,774, that represents a less than 2% decline from 2015 and remains significantly higher than 2013's average of 12,916. Average inventory turns, which bumped up to 9.1 last year, climbed slightly to 9.2 for 2016.

At first glance, this slight rise in turns seems positive, but both Saenz and Derewecki believe that there's room for improvement with turns, because 2016's response was spotty in certain ranges for number of turns respondents could choose from. For example, only 7% reported turns of between 12 to 18 this year, a drop of 8% from last year. Some ranges did see higher turns, including the highest range of 24 turns or greater, which may indicate more crossdocking, notes Saenz. In a separate question, 35% of respondents said that they use crossdocking, up 2% from last year.

Overall, the turns data, while not headed entirely in the wrong direction, indicates that some companies are perhaps struggling to rationalize SKUs and right-size inventory levels. "Omni-channel SKU proliferation is killing some people," says Saenz. "Figuring out which SKUs to keep in the mix, and how much to carry, is challenging. To a large extent, it's a people problem, getting people in merchandizing, marketing, and procurement to figure out what to carry."

Buildings and labor

With the steady march of e-commerce, it's not surprising that DCs continue to be large facilities humming with sizeable labor forces.

Total square footage in the network averaged 539,000, down from 570,700. The median dropped as well, but not very much, from 246,341 square feet in 2015 to 240,410. The mega-sized DC network response dropped a bit as well, but the response in the next two ranges grew a point or two.

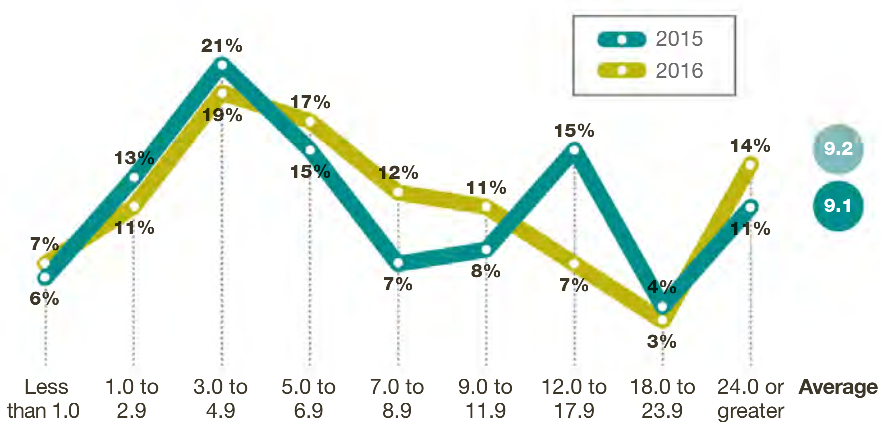
When it comes to the most common square footage for a single DC, when the network is four buildings or more, the average is 264,445, down a bit from 270,680 square feet in 2015. However, for networks of three buildings or less, the average for the common facility reached 178,090 this year, up from 158,955 in 2015.

In terms of building clear heights, the trend toward higher modern facilities held steady. In fact, the average was up very slightly to 31.1 feet, with 19% of respondents this year having buildings with clear height of 40 feet or higher—even with 2015 and 9% more than in 2014.

The results on size of the DC network continue to reflect scale and complexity. Those saying they have more than three buildings grew slightly to 38%; of these, 28% now have six or more buildings, up from 25% last year. However, the percentage with three buildings declined slightly. According to Saenz and Derewecki, these mixed results likely reflect diverse pressures on industry—to be closer to customers, but to also rationalize DC networks and consolidate into more modern, efficient facilities.

When asked about DC expansion plans, 27% said that they plan to expand square footage, down slightly from 30% last year. There was also a slight downward trend on respondents planning to expand the number and height of buildings, as well as employees. However, expanding employee count remains a common choice (33%) and down just 1% from 2015.

Scope of distribution center operations: annual inventory turns



Source: Peerless Research Group (PRG)

The number of employees in DC operations remained relatively stable, dropping slightly from an average of 287 people last year to 278 this year. However, the 2016 average remains well above the 236 average seen in 2013, and there was some growth in the highest workforce ranges. Specifically, in 2016,

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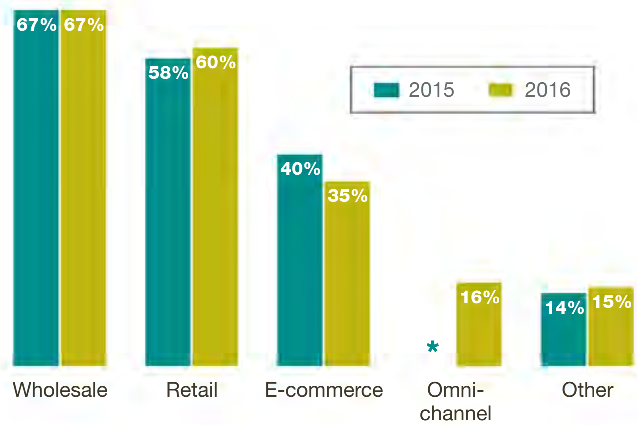
21% of respondents reported employee counts of 500 people or more, up from 16% in 2015.

Not only are building and workforce trends staying robust, but so are CapEx plans. The average current CapEx reached $1.37 million, up from $1.21 million last year. Median CapEx declined from $266.13 million last year to $242.95 million this year.

When it comes to CapEx plans for the next year, the average projection is $1.39 million, up very slightly from the previous year's projected average of $1.35 million, while the median for projections comes to $358.8 million, well above the previous year's projected median of $314.8 million.

That bump up in median CapEx plans indicates that the more typical operation, not just the big companies, are willing to spend more on DCs. "The fact that the median projected CapEx is up by 47.6% indicates that more of the smaller companies are getting into the game with investments" says Derewecki.

Market channels serviced by company



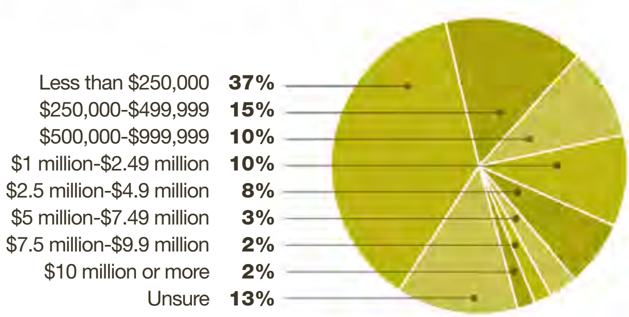
* Not previously asked

Source: Peerless Research Group (PRG)

Technology and methods

Investment in software and automated material handling equipment remained relatively stable, while reliance on manual methods continues to ebb. Use of paper-based picking, for example, fell below a 60% response, while use of "parts-to-person" systems like mini-load shuttles and vertical lift modules, first asked about last year, grew from a 5% response to 10%.

Estimated capital expenditures for warehousing equipment and technology in 2016



Source: Peerless Research Group (PRG)

Picking technologies, which saw a slight increase, included light-assisted systems, voice assisted with scan verification, and robotic picking, which grew from just 2% last year to 3% this year. However, not all the automation questions showed growth. Use of "automated picking" is down to just 3% this year, from 7% last year, and as high as 11% in 2013.

Derewecki and Saenz observe that some of the drop in automated picking may be related to older, fully automated systems that have not proven flexible enough for today's e-commerce-driven order profiles. In some cases, the legacy automation may be getting replaced by more semi-automated methods or technologies like parts-to-person systems better able to cope with new order mixes.

"Sometimes, fully automated systems can be less flexible and more of a constraint than an enabler," says Saenz.

A bright spot for software and IT is found in the survey question about "actions taken" to lower operating costs. Here, "improving warehouse IT" grew from a 34% response last year to 41% this year.

WMS trends continue to bode well for WMS offerings from enterprise resource planning (ERP) vendors, many of which have acquired WMS vendors or steadily enhanced their offerings. In fact, WMS from ERP vendors grew from a 34% response last year to 39% this year, while the response for best-of-breed solutions declined. Respondents also bumped up their use of slotting functionality by 2%.

To some extent, note Derewecki and Saenz, WMS from an ERP vendor may be gaining ground because it typically entails less integration work, but also at play is the fact that some ERP vendors have improved their WMS packages, making their offerings more suitable to a broader range of companies.

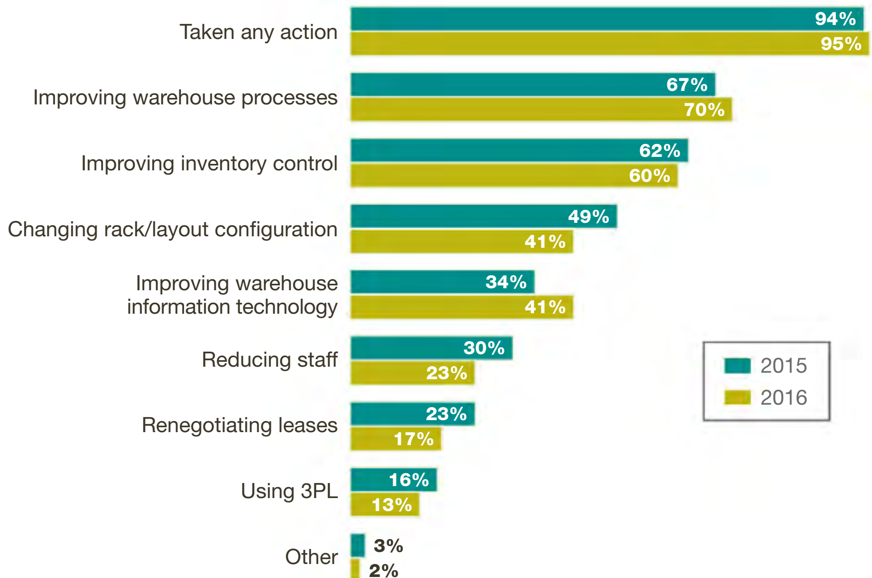
"Generally, the ERP vendors have done a good job of improving their WMS offerings, in most cases, by jolting capabilities via acquisitions," says Saenz.

One technology that has not seen growth is Cloud-based WMS. This year's survey response saw on-demand/Cloud WMS hold steady at just 3%. "Breaches of IT systems being in

Technology That Counts

apex Supply Chain Technologies

Actions taken to lower DC operating costs



Source: Peerless Research Group (PRG)

the news doesn't help this technology," notes Derewecki, "but it may be that Cloud WMS simply has a long 'gestation' period because of the long lifespans of WMS."

This was the first year we asked about "put wall" systems, which drew a 3% response. When combined with slight growth on "light-assisted" picking, light-assisted solutions seem to be seeing some growth. "Put wall systems are becoming very attractive to retailers who are increasing their e-commerce business, so we would expect to see further growth for this technology," says Saenz.

In another first this year, respondents were asked if they have SKU weights and dimensions in their item masters, drawing a 68% "yes" response. Keeping up with this data is challenging, however, notes Derewecki, since not only are SKUs frequently being added, but suppliers may reconfigure the size or weight of existing SKUs.

The vast majority continue to use some type of productivity metric (82% use metrics, down just 2% from 2015). Common metrics used include units/pieces per hour (40%), orders per hour (30%), cases per hour (29%) and lines per hour 23%. Use of "percent of an engineered standard "dropped slightly, from 19% last year to 17% this year.

Respondents continue to take a range of actions to lower operating costs, with 95% taking an action of some kind. Common actions include improving warehouse processes (70%) and improving inventory control (60%). Changing of racking and layouts dropped by 8% in 2016, while improving warehouse IT grew 7%.

The greater willingness to apply IT points to companies realizing that they need better information to back up the process and layout tweaks they've made the last few years, says Saenz. "Now more companies are looking at their systems to enhance the effort made around process improvements," he adds.

Major issues

The survey tracks major issues for DC operators, and while the findings remained fairly consistent with last year, one change is that "inability to attract and retain qualified hourly workers" rose from 39% last year to 41% this year.

The leading challenge was "insufficient space," holding steady at a 43% response. The third most frequently cited challenge was outdated storage, picking or material handling equipment (which held steady at 34%), followed by inadequate information systems support, cited by 31%, up from 32% last year.

The percentage of respondents who experienced a catastrophic event was just 6% for 2016, down from 17% last year. Some of this might be luck, observes Derewecki, since right after the survey closed, Hurricane Matthew hit the Carolinas.

The vast majority of DCs (89%) continue to offer value-added services to customers, up slightly from 87% last year. While some types of value-added services saw a slight decline, such as grouping/sorting products prior to shipment, and deferred customization, others held steady, and there was a 3% increase in respondents saying that they perform serial number control.

Overall, the survey shows companies are keeping up on investment on DC infrastructure, and incrementally applying more software, IT solutions, and slightly more automation to keep up with the pressures of e-commerce and omni-channel.

At the same time, note Derewecki and Saenz, it's not as if the survey data shows the floodgates have opened on technology or automation spending. Companies are still trying to manage costs via process tweaks, and are willing to use labor as an inexpensive way to flex capacity.

However, with growing complexity from e-commerce, and some signs that labor rates are beginning to rise in the U.S. market, just relying on process tweaks and labor has its limits.

As Derewecki concludes, "already, many companies have found they need to invest in sophisticated automation to get orders out the door on time. I think that the pressure to apply more automation and have better information system support will intensify in the future as the Baby Boomer generation moves out of the workforce, and DCs have fewer people to draw from."

Roberto Michel is a contributing editor to SCMR

A SPECIAL SUPPLEMENT TO:
SUPPLYCHAIN MANAGEMENT REVIEW

TOP 20 Automatic Data Capture SUPPLIERS

Suppliers and users of scanners, printers and rugged mobile devices find themselves at the intersection of technological advances, increasing consumer demands and rising labor costs. The top players are finding ways to meet each challenge with minimal risk as the market landscape continues to shift.

BY **JOSH BOND**, CONTRIBUTING EDITOR

Editor's note: VDC Research Group no longer reports RFID market information. The analysis and graphs in this article reflect only the markets for rugged mobile device and bar code scanners and printers.

Last year, the global market for automatic data capture solutions (ADC) used in factories, warehouses and logistics applications reached $6.242 billion in sales, according to Massachusetts-based VDC Research Group. Global figures, each ADC market segment and 14 of the Top 20 suppliers reported gains over last year, when dramatic fluctuations in currency exchange rates adversely impacted many of the reported revenues.

Still, the market in 2014 enjoyed a banner year that analysts did not expect to be replicated in 2015, according to Richa Gupta, senior analyst for AutoID and data capture at VDC Research. Following double-digit growth in the previous year, the combined revenues of the Top 20 still grew by another 2.6% in 2015.

The ADC market includes handheld and stationary bar code scanning and imaging devices, bar code printers and ruggedized mobile computing solutions for factories and warehouses. VDC's figures do not include consumables associated with automatic data collection, such as bar code labels.

The 2015 global sales figures represent an increase of 4.6% from 2014's

Top 20 ADC suppliers

2015 RANK	2014 RANK	COMPANY	TOTAL 2015 REVENUES (in millions)	TOTAL 2014 REVENUES (in millions)	North American Headquarters	Web site	Bar code printers	Handheld scanners	Stationary scanners	RFID	Mobile computers
1	1	Zebra (Motorola Solutions , Psion)	2,150	2,081	Schaumburg, Ill.	zebra.com	X	X	X	X	X
2	2	Honeywell (LXE, Intermec, Datamax-O'Neil)	1,189	1,098	Morristown, N.J.	honeywellaidc.com		X	X		X
3	3	Datalogic	524	484	Eugene, Ore.	datalogic.com		X	X	X	X
4	4	SATO	192	192	Charlotte, N.C.	satoamerica.com	X			X	
5	5	Toshiba TEC	165	153	Irvine, Calif.	toshibatec-ris.com	X			X	
6	6	Denso Wave	123	121	Southfield, Mich.	denso-adc.com		X			
7	8	Cognex	99	89	Natick, Mass.	cognex.com		X	X		X
8	7	Casio Computer Co. Ltd	88	90	Dover, N.J.	casio4business.com		X			X
9	9	SICK AG	87	86	Minneapolis, Minn.	sick.com		X	X	X	
10	12	Fujian Newland	74	68	Fremont, Calif.	newlandna.com				X	X
11	11	Avery Dennison	69	68	Glendale, Calif.	averydennison.com	X			X	
12	13	TSC Printers	62	56	Pomona, Calif.	tscprinters.com	X			X	
13	14	Bluebird Soft	59	51	Palisades Park, N.J.	mypidion.com	X				X
14		Shandong New Beiyang	54	40	Shandong, China	newbeiyang.com	X		X		
15	15	NCR	50	50	Duluth, Ga.	ncr.com	X	X	X	X	
16	16	Unitech	49	45	Los Angeles, Calif.	us.ute.com		X		X	X
17	17	Opto Electronics Co. Ltd. (Opticon)	42	43	Renton, Wash.	opticon.com		X			X
18	20	cab Produkttechnik GmbH	40	34	Tyngsboro, Mass.	cab.de/en	X				
19	18	M3 Mobile	35	38	Iselin, N.J.	m3mobile.net		X	X	X	X
20	19	CipherLab	27	36	Plano, Texas	us.cipherlab.com		X	X		X

Source: VDC Research

AutoID market analysis

Estimated global shipments of AIDC hardware (in millions of dollars)

	2014	2015	% Change 2014-2015	2016	% Change 2015-2016	2020	CAGR 2015-2020
Rugged mobile devices*	$2,760	$2,856	3.49%	$2,870	0.48%	$3,112	1.7%
Barcode scanners and printers	$3,209	$3,386	5.53%	$3,510	3.66%	$4,287	4.8%
TOTAL	**$5,968**	**$6,242**	**4.59%**	**$6,380**	**2.20%**	**$7,399**	**3.5%**

*Includes forklift-mounted, handheld/mobile devices, and wearables
Source: VDC Research

comparable estimate of $5.9 billion, which had grown 3.8% from 2013. VDC data projects the market will post a compound annual growth rate (CAGR) of 3.5% through the next five years before reaching $7.4 billion in 2020. This includes a 4.8% CAGR for bar code scanners and printers, and a 1.7% CAGR for rugged mobile devices.

"Growth was on the slower side, but 2015 was still a strong year from an AIDC perspective," Gupta says. "A lot of that was driven by larger vendors, and there continues to be intense competition from Asian manufacturers, particularly in China and Taiwan. Given that AIDC market drivers are tied to broader supply chain and data capture trends, we don't expect any significant slowdown."

Notable performances

Zebra again ranks No. 1 by a comfortable margin after its 2014 acquisition of Motorola Solutions' enterprise business. Second-place Honeywell reported 8.3% growth following its acquisition of Datamax-O'Neil in early 2015.

"Now Honeywell is working to ensure all its brands on the printing or scanning side are communicating with a similar vision in terms of what products are used for, following Honeywell's policy that a single message be communicated by products under each portfolio," Gupta says. "They launched new Honeywell printer models, which was a shift in how they previously approached the market when leveraging the Intermec and Datamax brands. They're now trying to unify under the Honeywell brand."

In terms of printers, Gupta says Datamax continues to be a relatively strong competitor to Zebra, which is dominant in the space. Datamax owns significant market share in the Americas and India, she says, while the Japanese market is dominated by 4th-place Sato and 5th-place Toshiba TEC. In mainland China, 12th-place TSC and Top 20 newcomer Shandong (No. 14) are prominent players. One of the only noteworthy acquisitions in the scanning and printing space, Gupta says, was Taiwanese TSC's acquisition of Printronix, whose bar code printer revenues have ranked it just outside the Top 20 in recent years.

Cognex's 11.2% growth to $99 million was enough for it to leapfrog Casio Computer to claim 7th place, and Fujian's 8.8% growth gained it two spots to finish No. 10. Shandong (35%), cab Produkttechnik GmbH (17.6%) and Bluebird Soft (15.7%) posted the highest rates of growth in 2015, and CipherLab (-25%), M3Mobile (-7.9%), Opto Electronics (-2.3%) and Casio Computer (-2.2%) reported lower revenues. SATO and NCR held level at $192 million and $50 million respectively.

Navigating operating systems

David Krebs, vice president of VDC's enterprise mobility and connected devices, says the big story in the rugged handheld market is consolidation. Although there have not been any big deals among the Top 20, Krebs cites Honeywell's acquisition of Intelligrated and its attempt to acquire JDA Software as evidence of the trend.

"The other big theme is about operating systems and to what extent Android is wedging itself into the market," Krebs says. "We estimated Android share to have reached just more than 20% in the first half of the year, and Zebra is the clear beneficiary of this based on the investments they've made. While most vendors have Android solutions and products in their portfolios, Zebra has taken a leadership position there, which was important given the lack of direction from Microsoft."

Microsoft was rumored to release a new mobile operating system for several years before the announcement of its Windows 10 IoT (Internet of Things) mobile enterprise product. "It will be interesting to see how they are received," Krebs says, "since the platform has a lot of question marks. Android does, too, but Windows is probably about two years behind Android as a platform for rugged mobile applications."

Specifically in the warehouse materials handling environment, Krebs says there is still pent-up demand for a Windows-based mobile solution. The technology adoption dynamic inside the warehouse is very different than outside applications like retail or field service, logistics and delivery.

"The warehouse tends not to do wholesale upgrades, and instead prefers to hold onto its install base as long as possible," he says. "We've seen terminal emulation continue to have an almost impenetrable hold and, because it is the dominant approach, Windows CE has been resilient. That said, Android is still an emerging opportunity as opposed to something that has reached critical mass. There haven't been any Android-based, warehouse-specific solutions or vehicle-mounted solutions, so there are still gaps in the portfolio."

VDC recently conducted a survey among warehouse decision makers, Krebs says, including a telling question: "If you had the choice, would you rather upgrade rugged mobile devices more frequently or continue to use what you have?" A slight majority, 52%, wanted to replace more often.

"I don't know if there is necessarily a good justification for that, since there tends to be only incremental device improvement; the difference between a device's capabilities now and three years from now is not huge," Krebs says. "However, warehousing is changing with technology, automation, robotics, the impact of e-commerce and item-level fulfillment, and the way products move through the supply chain. That is all suggestive of a demand for modernization, including migration from green screen, character-based systems to perhaps more touch-sensitive, intuitive, graphic mobile interfaces. This might portend a growing trend toward managing those devices in the warehouse in a similar way to what we see outside it."

In terms of top drivers for mobile solution upgrades, the No. 1 factor is that the existing OS has reached the end of its life, Krebs says, and No. 2 is a desire to upgrade to a more modern interface. When evaluating solutions the primary concerns are security, business continuity, and the ability to customize applications. Android is particularly suited to easy customization, Krebs says, whereas the next-gen Windows mobile platform is being managed more as a consumer-style interface that is less customizable.

According to the VDC research, the central business pressures driving investment are familiar concerns. No. 1 is the consumer's demand for faster delivery, No. 2 is the existing system's ability to keep up with those orders, and lastly the high cost of labor.

Hardware trends

Sales continue to reflect a shift toward 2D scanning and imaging capabilities as the popularity of laser handheld scanners continues to decline.

"Vendors are really pushing the value proposition of imaging and helping customers migrate away from laser because of the additional capabilities imaging offers," Gupta says. "In terms of mobile scanning, we've noticed the emergence of companion scanners to support the functionality of consumer-grade products that are winding their way into the enterprise environment. This is becoming a bigger discussion point."

With a smaller form factor, connected typically by Bluetooth, companion devices like sleds and sleeves that attach a scanning engine to smart phones or tablets are in use as alternatives to industrial-grade rugged mobile computers. Consumer products don't always have warranties or robust durability, Gupta says, but certain applications have several opportunities.

In the warehouse, Krebs also notes the continued penetration of imaging technology, particularly with regard to vision capture for dimensional applications. Perhaps more importantly, given that labor costs are among the largest expenses, Krebs says the analytics associated with labor are seeing greater attention.

"Training and onboarding of part-time and seasonal staff is a much more critical issue," he says. "Customers are asking for solutions that are more intuitive and can reduce training time."

Because warehouse applications also tend to be harsh environments for mobile devices, Krebs says there has not been as much adoption of consumer-grade solutions.

"We recommend—and see the majority of customers using—fully rugged devices," he says. "We're seeing consumer devices becoming more robust, with drop-proof or waterproof features, but they still are not 'rugged' by any stretch of the imagination."

In the industrial rugged mobile handheld market, there is a clear downward trend in average sale price, which Krebs says has affected the overall market's desire for "semi-rugged" devices,

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B. Legitimate paid and/or requested distribution (by mail or outside the mail)		
1. Outside County paid/requested mail subscriptions stated on PS Form 3541	11,433	11,418
2. In-County paid/requested mail subscriptions stated on PS Form 3541	None	None
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4. Requested copies distributed by other mail classes through the USPS	None	None
C. Total paid and/or requested circulation (sum of 15B (1), (2), (3) and (4))	11,601	11,565
D. Nonrequested distribution (by mail and outside the mail)		
1. Outside County nonrequested copies stated on PS Form 3541	483	486
2. In-County nonrequested copies stated on PS Form 3541	None	None
3. Nonrequested copies distributed through the USPS by other classes of mail	None	None
4. Nonrequested copies distributed outside the mail	725	2,214
E. Total nonrequested distribution (sum of 15D (1), (2), (3) and (4))	1,208	2,700
F. Total distribution (sum of 15C and 15E)	12,809	14,265
G. Copies not distributed	119	164
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I. Percent paid and/or requested circulation (15C divided by 15F times 100)	90.60%	81.10%

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C. Total copy distribution (line 15F) + requested/paid electronics copies (line 16A)	16,292	17,821
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Michelle McKeon (signed), Senior Audience Marketing Manager, 10/1/16

particularly in applications like healthcare and retail. These solutions have also contributed to the lower average sale price.

"It has been a tough year so far for rugged mobile," Krebs says. "There was a large rollout with the United States Postal Service last year, which makes it difficult to compare year over year. But there is still is bit of a wait-and-see attitude, which will start to break up since we now know what operating system we're getting from Microsoft."

Going forward, wearable technology continues to be an important form factor and growing segment. Voice-directed solutions are also continuing to grow.

"We're seeing some really interesting, although very much nascent, augmented reality (AR) technologies," Krebs says. "Based on the demos I've seen, there's a cool factor there, but I wonder if it's really solving a problem that exists or just doing something cool. We have seen some larger logistics organizations, at least in labs, continuing to play with all sorts of ways to support workers and make them safer and more efficient."

Collecting the data

Because this industry includes both public and private companies, this is the eighth year in a row that VDC Research Group compiled the data. They are covering this technology every day and are therefore very close to the market.

To make this list, companies must sell in North America, though the chart includes worldwide revenues. The list does not include resellers, systems integrators or other companies that do not manufacture ADC hardware. Because our readers are focused on supply chain solutions, we do not include companies whose primary focus is the retail checkout counter or non-industrial settings, like hospitals, libraries or resorts. Nor do we include companies that only manufacture consumables like bar code labels and RFID tags.