NATIONAL CENTER FOR
THE MIDDLE MARKET

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The Resilient Supply Chain

Competing on the ability to come back from disaster

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The typical supply chain can fail for a variety of reasons. It can be ruptured by unavailable raw materials or unreliable equipment; by tainted ingredients or tarnished reputations; by government regulations or government overthrows; by price pressures, piracy, or pandemics.

Such threats can damage a company or kill it. Or, just possibly, they can make it stronger.

Paul Michelman marched out the grim statistics in a 2005 article in the Harvard Business Review's Supply Chain Strategy Newsletter. Every four to five years, a majority of companies will face a crisis. Of those companies that do, almost 75% will close or suffer a significant long-term impact. Of the 43% that never fully recover, just 29% will be in business two years later. A 10-day disruption translates into a survival rate south of 10%.

Supply chains are becoming more complex and interconnected just as economic, environmental, political, and technology-related shocks grow more frequent. For middle-market companies, the situation is especially dire. Many supply to larger businesses, which are streamlining their vendor lists to cut costs. Middle Market firms cannot risk letting glitches in their own supply chains make them weak links in their customer's supply chains.

Supply-chain vulnerabilities may also endanger a brand's standing with consumers. In February, Maker's Mark announced that it would water down its bourbon to cope with a shortage caused by poor demand forecasting. Hordes of irate whisky fans reacted just as you'd expect. (Maker's Mark gave a hoot and did not dilute.)

Fortunately, the field of ecology offers a way for business leaders to think about and start to manage their vulnerabilities. In some circumstances, living organisms can survive disease, injury, and changes to their environments. This is resilience: the upside of Darwinism. Similarly, beleaguered organizations can learn to bend--not break--and even to derive strength from their new shapes and suppleness. We call this enterprise resilience: the capacity of an organization to adapt, to survive, and to grow despite turbulent change.

To be clear, resilience and risk management are not the same things. Risk management is a structured process of risk identification, assessment, and mitigation. Resilient organizations practice risk management, but they are flexible enough to deal with unidentified risks as well. It's the difference between getting inoculated against known diseases and also having a hardy constitution and healthy lifestyle.

Resilient companies are prepared not just to weather disasters but also to adapt to dramatically altered environments. In a truly calamitous event--a tsunami, for example, or a terrorist attack—the resilient company can benefit by chugging along while competitors stall or stop. They are also prepared for slower-moving threats. For example, lax food inspections in the UK and Ireland resulted in horsemeat getting into the beef supply chain, which caused recalls and bad press for numerous food companies. But sales are up at the Sainsbury's supermarket chain, which ten years ago began DNA-testing products and buying only British beef. Thus, a threat for one company can be an opportunity for another.

SUSCEPTIBILITY AND STRENGTH

Previous authors (Christopher and Peck 2004) have described six best practices or characteristics of resilient supply chains: reengineering, collaboration, agility, flexibility, redundancy and a risk management culture. In earlier research, two of this article's authors--Keely Croxton and Joseph Fiksel--working with Timothy J. Pettit, framed the challenge more broadly: in terms of vulnerabilities and capabilities. The following charts are drawn from that earlier research.

Vulnerabilities are factors that make an enterprise susceptible to disruptions and can be found in both the supply and demand sides of operations (see Table 1). There are half-a dozen classes of vulnerabilities, including turbulence, which exists when a company operates in an environment characterized by frequent change. (For example, customer demand is unpredictable, currencies fluctuate, or geopolitical disruptions threaten operations.) Another vulnerability is sensitivity, which exists when the company requires carefully controlled conditions to ensure product and process integrity. (For example, restricted or fragile materials are used, or safety hazards are inescapable within manufacturing or delivery.)

Table 1

SUPPLY-CHAIN VULNERABILITIES		
VULNERABILITY	**DESCRIPTION**	**EXAMPLES**
Turbulence	Environment characterized by frequent changes in external factors beyond your control	Unpredictability in customer demand; Fluctuations in currencies and prices from the supplier and customer sides; Exposure to geopolitical disruptions from the supplier and customer sides; Exposure to natural disasters; Unforeseen technology failures; Pandemic
Deliberate Threats	Intentional attacks aimed at disrupting operations or causing human or financial harm	Terrorism and sabotage; Piracy and theft; Union activities; Special interest groups; Industrial espionage; Product liability
External Pressures	Influences not specifically targeting the firms that create business constraints or barriers	Competitive innovation; Government regulations; Price pressures; Corporate responsibility; Social/cultural issues; Environmental, Health and safety concerns
Resource Limits	Constraints on output based on availability of the factors of production	Raw material availability; Utilities availability; Human resources; Natural resources
Sensitivity	Importance of carefully controlled conditions for product and process integrity	Presence of restricted materials; Importance of supply purity; Stringency of manufacturing; Fragility of handling; Complexity of process operations; Reliability of equipment; Potential safety hazards; Visibility of disruption to stakeholders; Symbolic profile of brand; Customer requirements for quality
Connectivity	Degree of interdependence and reliance on outside entities	Scale and extent of supply network; Import channels; Export channels; Reliance upon specialty sources; Reliance upon information flow; Degree of outsourcing

Capabilities are attributes that enable an enterprise to anticipate and overcome disruptions. They can be either inherent or developed and exist throughout the organization, including in finance, operations, logistics, transportation, and human resources (see Table 2). Companies may possess any of 16 broad categories of capabilities, including sourcing flexibility, which is the ability to quickly change inputs or the manner of receiving inputs. (For example, the company uses common product platforms or has alternate suppliers.) Another capability is anticipation, which is the ability to discern potential future events or situations. (For example, the company practices demand forecasting, monitors deviations and near-misses, and gathers business intelligence.)

Table 2

SUPPLY-CHAIN CAPABILITIES		
CAPABILITY	**DESCRIPTION**	**EXAMPLES**
Flexibility in Sourcing	Ability to quickly change inputs or the mode of receiving inputs	Common product platforms; Supply contract flexibility; Supplier capacity; Supplier expediting; Alternate suppliers
Flexibility in Manufacturing	Ability to quickly and efficiently change the quantity and type of outputs	Product/service modularity; Multiple pathways and skills; Manufacturing postponement; Change-over speed; Batch size; Manufacturing expediting; Re-configurability; Scalability; Fast re-routing of requirements
Flexibility in Order Fulfillment	Ability to quickly change the method of delivering outputs	Multi-sourcing (peak versus base); Demand pooling; Inventory management; Alternate distribution modes; Multiple service centers; Transportation capacity; Transportation expediting
Capacity	Availability of assets to enable required production levels	Backup utilities; Raw materials; Reserve capacity; Labor capacity; Ecological capacity
Efficiency	Capability to produce outputs with minimum resource requirements	Labor productivity; Asset utilization; Quality management; Preventive maintenance; Process standardization; Resource productivity
Visibility	Knowledge of the status of operating assets and the environment	Information technology; Status of inventory; Status of equipment; Status of personnel; Information exchange with suppliers, customers, and carriers; Market visibility; External monitoring
Adaptability	Ability to modify the organization in response to challenges or opportunities	Seizing advantage from disruptions; Alternative technology development; Learning from experience; Strategic gaming and simulation; Environmental sustainability
Anticipation	Ability to discern potential future events or situations	Demand forecasting methods; Risk identification and prioritization; Monitoring/ Communicating deviations and "near misses"; Recognition of early warning signals; Business continuity planning; Emergency preparedness; Recognition of opportunities; Business intelligence gathering; Government lobbying; Awareness of global change

Table 2 (continued)

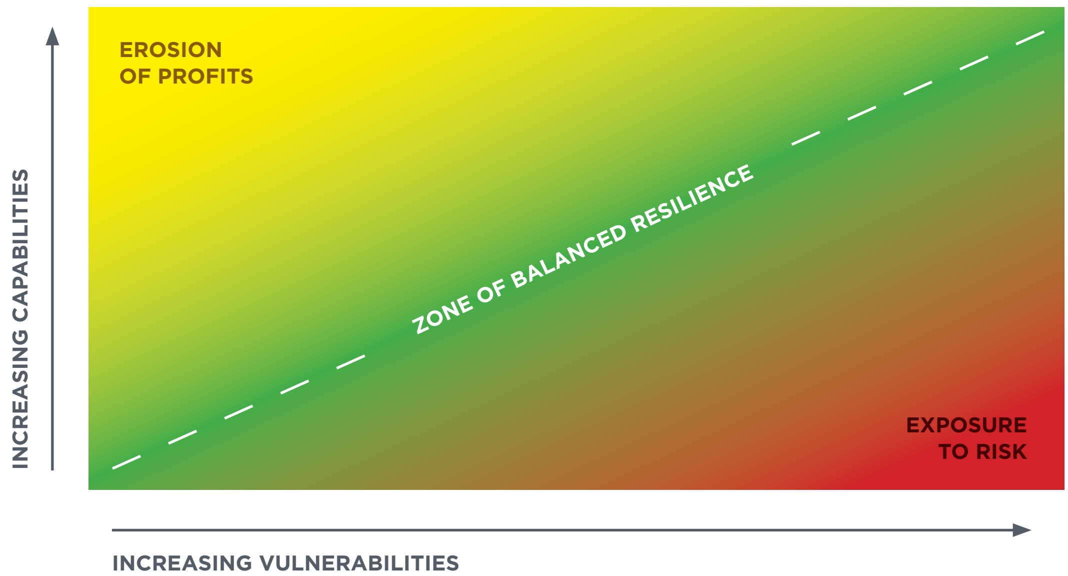
SUPPLY-CHAIN CAPABILITIES		
CAPABILITY	**DESCRIPTION**	**EXAMPLES**
Recovery	Ability to rapidly return to normal operational state	Equipment reparability; Resource mobilization; Communications strategy; Crisis management; Consequence mitigation
Dispersion	Broad distribution or decentralization of assets	Distributed suppliers; Distributed production; Dispersed distribution; Distributed decision-making; Location-specific empowerment; Geographic dispersion of markets
Collaboration	Ability to work effectively with other entities for mutual benefit	Collaborative forecasting; Supply chain communication; Collaborative decision-making; Supplier involvement in innovation; Customer involvement in innovation; Postponement of orders; Product life-cycle management; Supplier collaboration; Customer collaboration; Risk sharing with partners; Risk/reward sharing with customers
Organization	Human resource structures, policies, skills and culture	Creative problem solving culture; Accountability; Diversity of skills and experience; Substitute leadership capacity; Benchmarking/feedback – learning organization; Culture of caring for employees; Workforce flexibility
Market Position	Status of a company or its products in specific markets	Brand equity; Customer loyalty/retention; Market share; Product differentiation; Sustainability position
Security	Defense against deliberate intrusion or attack	Layered defenses; Access restriction; Employee involvement in security; Collaboration with governments; Cyber-security; Personnel security
Financial Strength	Capacity to absorb fluctuations in cash flow	Financial reserves and liquidity; Portfolio diversification; Insurance coverage; Price margin
Product Stewardship	Assurance of sustainable business practices throughout the product life cycle	Proactive product design; Resource conservation; Auditing and monitoring; Supplier management; Customer support

All classes of vulnerabilities and capabilities are laid out in the Supply Chain Resilience Assessment and Management (SCRAM) tool, which Pettit, Croxton, and Fiksel developed to help managers recognize strengths and weaknesses and prioritize areas for improvement. Dow Chemical Company has been using SCRAM to guide its own quest for resilience.

Resilience rises or falls in correlation with the increase or decrease of vulnerabilities and capabilities. That doesn't mean companies should Fort Knox-ify their operations in a fruitless effort to knock all of their vulnerabilities down to zero. Yes, a company with high exposure to risks and insufficient capabilities to address them is flirting with disaster. However, an organization may also invest in capabilities out of proportion to its risk exposure, tying up money, time, and effort that could have been better spent elsewhere. The result: waste, increased costs, and lower profits.

Companies should strive for balanced resilience: a sensible weighting of exposure to and protection against risk (see Figure 1). But how does firm size relate to vulnerabilities and capabilities? What distinctive opportunities do middle-market firms have to build resilience into their supply chains?

ZONE OF BALANCED RESILIENCE



Building on previous research and conducting in-depth studies at middle-market companies, turns out middle-market and large firms face similar vulnerabilities. However, middle-market firms have distinct advantages and disadvantages in developing capabilities to mitigate those vulnerabilities. The following is the research findings:

MIDDLE-MARKET MUSCLES

Middle-market firms possess several capabilities that bolster their survival skills.

Nimbleness: In middle-market companies, the entire senior management team generally works under one roof. This can be a problem if the roof blows off. More often, however, centralized authority is an advantage. It takes much less time to herd everyone into a conference room than to convene a teleconference across multiple time zones around the globe.

The fact that all critical decision makers fit into one conference room is another benefit. Middle-market companies have fewer layers of management, enabling smaller teams to act quickly. And fewer departments mean less competition for resources. Unexpected events can take a bite from available capital, human resources, shipping capacity—even the leadership bench. The more straightforward the allocation of resources, the quicker the company gets back to business.

That proved the case for one of the three middle-market companies that was studied, which will be called Firm A. The $130 million family-owned business provides uniforms and equipment to civilian-agency, emergency-service, and military markets. It is based in the Midwest and has a factory in Kentucky. In March 2012, an EF-3 tornado swept through the state, killing seven people and destroying houses and infrastructure. It missed Firm A's factory by less than a football field, but still knocked out electricity, gas and water.

In the immediate aftermath of the tornado, the senior managers of Firm A were able to quickly assemble to formulate their response. "The decision-making power, your major decisions are made right here," said the CEO. "We don't have to go to many people to take action… So we had to immediately mobilize a plan of action to find out where people were, how quickly we could get back up, who in government we could talk to about what their plan was. To the nimbleness point, we started meeting on a Sunday. The tornado was Friday night. We met first on Sunday once we were able to get into town and get a damage assessment."

That lack of bureaucracy helps in situations less dramatic than a tornado. A spike in customer demand or a competitor's disruptive innovation also requires rapid response. The fewer the layers, the lower the friction and the greater the speed. "Once you decide to do something or the owners decide to do something, they can do it… as long as you have the capital," said the purchasing manager at Firm B, a $125 million privately owned manufacturer and distributor of professional emergency, mortuary, and health-care products. "You don't go through the red tape you might have to go through in a larger organization with all the different layers."

Employee commitment: The middle-market firms studied in this research have long-tenured workforces. Such workers tend to be emotionally and professionally committed to their employers and to the organization. Also, in smaller companies it is easier for close relationships to develop among employees and between employees and managers, further strengthening the bond to the business. Companies cannot rely solely on the commitment of employees to recover from a disruption, but their loyalty certainly helps.

A four-day power outage struck the headquarters of Firm C, a $150 million cabling and connectivity company. Many employees were able to work from home; management's larger concern was continued operation of the data center, considered the "brain of the whole operation." Employees rose to the challenge. "At the end of the day, if something hits the fan, you are going to have all hands on deck," said Firm C's senior vice president of finance. "People grew up and built this company. If something happens, they get charged.

"During the power outage, the IT guys … I've never seen them happier," recalled the executive. "The room was getting too hot so they brought in this little air-conditioner, and they had to drain the water out of it. So somebody had to be here every hour because the bucket needed to be emptied. And they loved it. That is the culture here."

Cautious innovation: Middle-market firms tend to invest heavily in innovation. According to the National Center for the Middle Market, investment in innovation ranks second (after attracting new customers) as a driver of growth. But because middle-market firms are more vulnerable to financial risk than their large competitors, they typically don't stake out the bleeding edge. Instead, they try to be among the first entrants in a new market.

Firm C, for example, has a large product-development staff relative to the company's size and it puts a lot of effort into R&D. "We ensure that we have the products as a new PC comes out," said the COO. "We ensure that we have the visibility to what kind of connectivity would be required, and then we try to be an early entrant into that market. Not bleeding edge, because sometimes a technology will fall on its face. And for a company like ours, creating that capability can be rather expensive. So we want to see some lift in that market before we get into it."

The focus on innovation helps middle-market firms deal with increasing competitive pressures, product commoditization, and changing value propositions in the market. It also positions them to exploit the upside of risk. If events take down the status quo, the future belongs to whoever is already poised to move beyond it.

MIDDLE-MARKET ACHILLES HEELS

While middle-market firms possess important advantages, their scale and influence in the supply chain leave them vulnerable in key areas.

Lack of influence: Bantamweight boxers may be more nimble than their larger opponents, but likely won't pack as strong a punch. Similarly, middle-market firms may not buy in large enough volumes to be their vendors' top priorities. Downstream, they may not be critical enough that their customers will cut them slack in difficult circumstances. Their smaller scale can make it tough to negotiate deliverables or pricing or to mandate risk mitigation by other supply chain members. The CFO of Firm A described that company's position: "I would say that we lack pricing leverage, the ability to negotiate optimal cost of raw material input to the firm. In our specific case, some of that is driven by the uniqueness of our product. But some of it is driven perhaps by our size, too. A large company can just dictate what they are going to pay the suppliers. Someone like us has to do the dance."

In addition, middle-market firms must deal with both large and small companies, which constrains their ability to balance days of sales outstanding and days of payables outstanding. Firm A is caught between a large pool of small suppliers who require quick payment to survive and larger customers who may be slow to pay and with whom Firm A lacks clout to speed things up. The CFO laid out the math: "If a third of your supply base are these small mom and pops, and that group of your suppliers regresses to a mean of 15 days (for their days receivable), but your customers are generally paying you in 46 or 47 days, well it doesn't take a rocket scientist to figure out that you are upside down. And so where's the difference? The difference is in your line of credit."

Constrained access to capital: In private companies—family-owned firms in particular—ownership may trump all other interests. That includes interest in raising money to grow or protect the business. As Firm A's CFO explained: "A lot of middle-market companies, particularly third-, fourth-, fifth-generation family-owned and -operated, they are not really keen on diluting their stake in the enterprise. Whereas if you look at a larger company, the question is, 'Alright, do we flip bonds or do we do another equity offering? Which is cheaper?' So that's somewhat of a constraint to us."

Capital constraints have affected some international deals at Firm B, which sells through a network of dealers worldwide and has operations in 12 countries. "Since we can only borrow from banks basically, we can't go out and flip a paper or something like that," said the CFO. "And banks can't loan for international sales. When I am selling to an unrelated distributor in Greece or something, they won't take that as collateral. They won't lend any money on that. If I sell to our UK subsidiary, they won't lend any money because it's a related company. But if you are a P&G and you need money to finance your sales for P&G UK, you can just borrow money in the open market, get it here in the US, and lend it to all the other places."

Lack of scalability: Redundancy is a risk-management all-star, but limited access to capital makes it hard for middle-market firms to invest in backing up key operations. Consequently, these firms often operate close to capacity, shrinking any cushions that allow for increased production. That weakens their ability to deal with sudden fluctuations in demand, which can lead to frustrated new customers or irritated old ones (if the company chases after the hot prospect while existing accounts are left cooling their heels).

At Firm A, for example, the sudden, unexpected appearance of a huge order "was a blessing and a curse," said the COO. "Because basically, we had a certain amount of capacity. We ended up making that order and pushing everyone else's order back. And 'everybody else' are the customers that would probably be ordering more repetitively than this one order that we got."

TOWARD ENTERPRISE RESILIENCE

Lacking resources to invest in A-to-Z resilience initiatives, middle-market companies must prioritize their targets, focusing on risks with a higher than-expected probability of occurrence. But there are six steps middle-market firms should consider to shore up their operations and become, in turn, model links in their supply chains.

Build stronger relationships with select upstream and downstream supply-chain members. A company's most trusted and collaborative customer or vendor may carry more weight than the customer or vendor with whom it does the most business. Middle-market firms can gain leverage by sharing risks and rewards rather than through the volume of their sales or procurement. Stronger relationships can translate into more flexible contract terms, which help mitigate capital constraints and demand fluctuations.

Form strategic horizontal alliances. Cooperating with competitors is common in this networked world, from marketing tactics like airline code-sharing to Google developing apps for the iPhone. Forming alliances with competitors can also help overcome constraints in supply chains. For example, automotive giants Aston Martin, Jaguar Land Rover, and Toyota formed a community of "collective protection" against supply-chain risks. They plan to consolidate multiple risk-management processes into one, to create an online portal that provides comprehensive information about the supply chain to buyers and suppliers and to provide a financial "health check" on suppliers.

The benefits of joining such an alliance include access to physical and knowledge resources, risk-sharing, and improved efficiency. But cooperation with competitors poses risks as well. Company leaders should weigh tradeoffs before making this decision.

Form a cross-functional team of senior managers to develop a risk register: a repository of information about the probability and impact of risks as well as mitigation strategies. Middle-market managers often work in the same building and know each other's functions well. Not infrequently, middle-market supply chains are simple enough to draw on a single whiteboard. Applying shared knowledge to the identification and mitigation of risks can create significant advantages over larger companies, where many—often dispersed—people analyze more complex systems.

Focus on core competencies. Eager to grow, middle-market firms can lose focus on the things they do best. A new customer comes along that might need something the company might be able to provide, and it's off to the races. Lack of focus can lead to ill-advised diversions of scarce resources.

Innovate within your core competency. Innovation develops the agility muscle. It also captivates customers, who can't wait to see how you will make their lives or jobs better. Innovation, quality, and reliability are among the key contributors to brand loyalty. Since quality and reliability may suffer in a disruption, a reputation for innovation will help weld customers to your brand, thus increasing their willingness to wait for your recovery.

Capitalize on employee loyalty. In a resilient culture, employees are protective of the company's welfare and willing to stick with it, even in bad times. Their deep knowledge and institutional memory help identify problems and find solutions. In emergencies, they will put in extra hours and do whatever else is required. While you're anxiously scanning the horizons, loyal employees have your back.

With their increasing reliance on technology and global footprints, middle-market companies are vulnerable to shocks--both natural and man-made--in growing numbers. Ultimately, middle-market firms will only prosper to the extent that they can control and, ideally, exploit those shocks. Build your supply chain strong. Build it supple. Build it resilient.