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Special report - Disasters show flaws in just-in-time production

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By Nick Carey, Noel Randewich and Kevin Krolicki, Japan/DETROIT/SAN FRANCISCO (Reuters) – Just over a week after the massive earthquake hit the sprawling Texas Instruments chip plant here, a gardener is reworking the Japanese garden in an inner courtyard of the office tower attached to the plant.

The garden is a symbol of tranquility and the gardener runs his rake in swooping patterns in the fine gravel that resemble ripples in a pond.

Although no one is manning the gate or the front desk in the office building, the rest of the plant just outside Tsuchiura -- which locals dub "Tekisasu," or Texas -- appears anything but tranquil.

Dozens of workers in jump suits and hard hats inspect the outside of the plant complex. A conference room on the ground floor of the plant's office tower is packed with white-collar workers even though it's a Sunday. TI says the plant will not resume full production until mid-July.

There is no visible damage to the plant. But if it is structurally sound, the Japan just outside its gates is not. There are cracks in the asphalt on the roads and the concrete walls of older buildings. Gas stations are shut and ration purchases when they do open. Train schedules have been cut sharply. A homemade sign on a hotel window says "Japan: Don't Let This Quake Defeat You."

Soon after the devastating earthquake and tsunami that struck northeastern Japan on March 11, major manufacturers around the world sprang into action. From a conference room at General Motors Co's technical centre in the Detroit suburb of Warren to the Memphis headquarters of package delivery giant FedEx Corp, teams of employees scrambled to assess the impact on staff, factories and goods.

"Within an hour and 15 minutes we'd established a crisis room after the earthquake," Andy Palmer, senior vice president of Japanese automaker Nissan, said in a

telephone interview from his office in Tokyo last week. "From there we were able to see everything unfolding, the priority being on the status and welfare of the employees."

In a globalized economy where manufacturers have moved ever more towards lean inventories and "just-in-time" production -- keeping ultra-low quantities of parts on hand to avoid holding expensive stocks of parts -- a speedy response was vital because a disruption to the global supply chain would spread quickly, shuttering plants employing legions of workers around the world.

Numerous manufacturers and suppliers have already warned of possible supply disruptions that are seen potentially affecting everything from consumer products such as Apple Inc's iPad to Boeing's long-awaited Dreamliner.

The most immediate threat to manufacturers stems from the fact that the weakest link in the global supply chain is what Japan is best known for: high-end, highly technical parts like semiconductors, which also weigh very little.

"The earliest impact will be felt with high-cost, low-weight products," said John Hoffecker, managing director of restructuring advisory firm AlixPartners LP. "They come out of Japan by plane so manufacturers don't have much of a buffer for those products."

Interviewed by Reuters on March 17 Hoffecker said the real impact of supply disruptions for those parts would become evident "in about a week." GM said the parts it gets from Japan are more the high-end electrical type. Chips made by ON Semiconductor, which has shut down facilities in Aizu and Gunma due to infrastructure troubles, are used by automakers in everything from air conditioning to power steering, lighting, braking systems, navigation and lighting.

It is not just a question of high-tech production, but also inventory. Even a split-second loss of power at a memory chip plant, where production takes weeks, can wipe out a large volume of goods.

TOUGH CHOICES

Even under normal conditions, bringing suppliers back online after a disruption can be a lengthy process for the most basic parts. It requires careful calibration and extensive testing. So the road to recovery could be a long one.

Speaking in Sao Paulo, Brazil on Friday, GM chief executive Daniel Akerson said it could take two weeks to assess the impact -- and the situation is still uncertain because of Japan's ongoing nuclear crisis.

Manufacturers with backup supply sources are already switching production to them. For those without alternatives, the race is on to find them, leaving many companies chasing the same ones.

Even if they do find alternative sources, getting them to produce the right part is a lengthy process involving design and factory testing.

"The production of any part can be moved over time, but in the short term it's a huge challenge," said Fred Hubacker, executive director at consultant and turnaround specialist Conway MacKenzie. "It takes more than weeks and less than years. It's certainly not something that can be done overnight. It's generally not cost effective to move to a new supplier."

In the meantime, manufacturers face tough choices as inventories dwindle. They may be forced to halt production on some models as parts run out, or channel shared parts to popular models to maintain output.

"If you are looking at risk management in a situation like this you would want to protect the vehicles you sell the most of," said Dan Cheng, leader of A.T. Kearney's automotive practice in the Americas.

GM has already idled a plant in Louisiana making pickup trucks with low sales volumes, plus suspended production at a plant in Spain and cancelled two shifts at a plant in Germany making cars for its loss-making Opel unit. "We are optimizing the usage of parts that are or might be in short supply as a result of the earthquake in Japan," said spokesman Klaus-Peter Martin.

"TRYING TO UNDERSTAND THE SITUATION"

Details of the extent of the damage in Japan have been slow to emerge, not least because communications with badly affected areas were impossible in the days after the 9.0 magnitude earthquake. While many companies have provided updates on which plants are out of action, Austin, Texas-based Freescale Semiconductor provided a rare glimpse of how its employees coped after the disaster.

The coastal city of Sendai was hit by a 10-metre (33 feet) tsunami following the quake, causing catastrophic damage. Freescale has a facility there making accelerometers, pressure sensors and other chips for cars that shut down after the tsunami.

Spokesman Rob Hatley said fast-thinking Freescale employees elsewhere in Japan leased trucks after the quake to get emergency supplies like dry food, water, clothes and batteries to their colleagues in Sendai who are shifting production to other facilities and moving inventory to customers.

"We run a global supply chain, so the same resources, skillsets, problem solving and ingenuity that we put in our fab every day, we continue to apply in our current environment," Hatley said.

Within days of the disaster, major local manufacturers said their plants had been affected. Companies from automaker Toyota Motor Co -- which makes 38 percent of its vehicles in Japan -- to consumer electronic giant Sony Corp reported stoppages and in several cases manufacturers said they did not know when production would resume.

Big suppliers like Shin-Etsu Chemical, the world's leading maker of silicon wafers, and chip maker Texas Instruments have also reported that quake damage has hurt production. Japan produces 57 percent of the world's wafers and around 20 percent of its semiconductors.

Texas Instruments declined to say which customers are affected by the closure of its Miho plant, the one with the Japanese garden. But a list of TI customers obtained by Reuters includes Apple, Nokia, the world's largest cellphone maker by volume, and auto safety gear maker Autoliv Inc. On its web site, Autoliv says it provides parts to all the major automakers and that GM is its largest customer, accounting for 14 percent of its sales in 2010. It was not possible to determine which of them are served by the Miho plant.

The plant also makes Digital Light Processing chips, a key component in many video projectors. Texas Instruments is the main manufacturer of DLP chips, making their steady supply crucial to projector manufacturers like Optoma Technology Inc and Vivitek Corp. Vivitek is working closely with TI to monitor the availability of the crucial chips and guarantee their supply, a Vivitek spokeswoman said.

NSK Ltd, Japan's largest manufacturer of ball bearings, said none of its plants were damaged, but it did not know when it would be able to resume full production "due to uncertainty over power supply."

A list of NSK's automotive customers obtained by Reuters reads like a who's who of global automakers, including majors such Ford Motor Co, Fiat and Volkswagen -- though again it was not clear which customers receive parts from NSK's Japanese plants.

Chris Swartwout, vice president in charge of human resources and supply chain and logistics for NSK in North America, said he could not discuss which of the company's customers were affected. "We are really in a phase where we are trying to understand the situation with our suppliers," he said. "The situation is still being assessed."

"INFORMATION IS PARAMOUNT"

The crisis room at GM's technical centre in Warren, Michigan, is one of four the company has worldwide -- one each for North America, South America, Opel/Vauxhall and GM International.

GM's Chief Global Manufacturing Officer, Diana Tremblay, said the room is staffed constantly -- with around 25 people when she last visited on Thursday -- and contains lists of all plants around the world, all vehicle models and key parts like

powertrains. There are regular conference calls and email updates as information comes in about GM's broader supply base. Tremblay says GM leaves decisions on plant shutdowns until the last possible minute.

She said the decision last Thursday to idle its Shreveport, Louisiana, plant, which makes low-selling Chevrolet Colorado and GMC Canyon pickup trucks, was necessary because the workers are "4/10s" that is, they are working four 10-hour shifts Monday to Thursday and needed to be told before the weekend.

Tremblay said GM could not say how long the plant would be closed, nor which others could be affected. "There are no games being played here, we just don't know," she said. "And I can assure you it's not from a lack of effort."

FedEx, which flies low-weight, high-tech parts out of Japan, also immediately set up a global planning team after the earthquake and began helping customers assess the situation after finding that all of its employees escaped the disaster unscathed. "We were very fortunate," said Doug Cook, vice president of international planning and engineering at FedEx unit FedEx Express.

Apart from shutting the nearest facility to the damaged Fukushima nuclear plant, he said the company is running normal service in and out of Japan and is screening all outgoing packages for radiation.

Cook said FedEx account executives in Japan are working "day in, day out" with customers to see if they need alternative locations for deliveries and pickups and to provide assessments of the situation on the ground.

"Information is paramount," he said. "It enables people to understand what's going on."

Norman Black, a spokesman at rival UPS said the company stands ready to help customers move items to other factories overseas if they determine they have to move production.

Obtaining information is a problem right now because the supply base below the top suppliers is opaque.

"When it comes to the supply base companies tend to focus on the level below them," A.T. Kearney's Cheng said. "It's simply time consuming and cost prohibitive to go deeper than that across your supply base."

Barry Tarnef, a senior risk specialist at property insurer Chubb Corp, said the murky nature of the supply base may mask the fact that somewhere down the chain a company may "control the lion's share of the market."

"If something happens to that one company it could shut down an entire industry," he said.

DEJA VU

Experts have been recommending for years that manufacturers diversify their supply base. After all, recent history is full of examples of widespread supply chain disruptions and their consequences for manufacturers reliant on too few sources -- from the attacks on September 11, 2001 to Hurricane Katrina in 2005 and the cloud of volcanic ash from Iceland that shut down Europe's skies last year.

In the wake of such events, some companies have implemented strategies to diversify their suppliers and production. But according to Gad Allon, an associate professor of managerial economics and decision science at the Kellogg School of Management at Northwestern University, they are the exception rather than the rule. "A minority of companies have a good understanding of operational risk," he said. "The majority do not."

Toyota has been gradually implementing a strategy so that all of its models can be produced in more than one plant around the world. But that does not include the Prius, which is only made in Japan, leaving Toyota stuck. Multiple suppliers can also reduce the risk of disruptions.

"Should you have just a single strategic supplier, should you hedge your bets and have some redundancy?" said James DeLoach, managing director and risk management expert at consulting firm Protiviti. "These are tough calls. But once you've made your call, you've got to play the hand you dealt yourself. That's why companies are faced with these issues right now."

TrueCar.com's Jesse Toprak said that prior to the earthquake Prius models in California were selling on average \$300 (184 pounds) below the dealer invoice price. Within four days, the price was \$1,000 above the invoice price. Toprak said the price will continue to rise because the high-mileage Prius is popular among environmentally conscious consumers.

But in the longer term if the price gets too high, customers interested in a Prius to save money on fuel will balk at the cost. "At some point, the math just won't make any sense for most people," Toprak said.

SAVE NOW, PAY LATER

Sunil Chopra, a professor of operations management and information systems at the Kellogg School of Management, says the lure of single suppliers is they make life easier for manufacturers and are cheaper to manage.

"If you're saving 5 pennies per unit then the \$100 million you could lose in a disruptive event doesn't show up in your results today," he said. "That's what drives

companies towards single-sourcing. But how many units at 5 pennies per unit do you have to produce to make up for that big loss?"

Chopra and others like D&B Supply Management Solutions' Mike Krechevsky expect events in Japan and their impact on the supply chain will force major manufacturers to think about the need for reserve plans.

"This is going to open up a lot of eyes," Krechevsky said. "Many organizations are going to step back and take a look at this and see if they have contingency plans for such a thing."

But Chopra says companies talked about diversification after previous disasters and past experience shows that when the dust settles manufacturers will select the cheaper option to boost their bottom line.

"We'll see a surge now in companies talking about diversification," he said. "But as this fades into memory decision makers will not take disruptive events into account to the extent that they should."

"In six months they'll discount the risk all over again."

"THE RIGHT THING TO DO"

If there is any debate on whether the Japan quake will force a rethink on suppliers, there is apparently none about just-in-time production. No one interviewed for this article expected any change.

GM's Tremblay has been with the company since just before her 18th birthday in 1977. Back then, inventories were much bigger, bringing "lots of extra cost and lots of extra confusion."

"Years ago you had a lot of stock lying around," she said. "The big change is that there's not all that inventory lying around anymore. It's far better not to have all that inventory."

"But the opposite is true when you have supply chain disruptions," she added. "That's the tradeoff."

"On balance, it's still the right thing to do."

(Additional reporting by Ben Klayman, Deepa Seetharaman and Bernie Woodall in Detroit; Helen Massy Beresford in Paris; Bill Rigby in Seattle; and Suzanne Cosgrove in Chicago; Editing by Jim Impoco and Claudia Parsons)