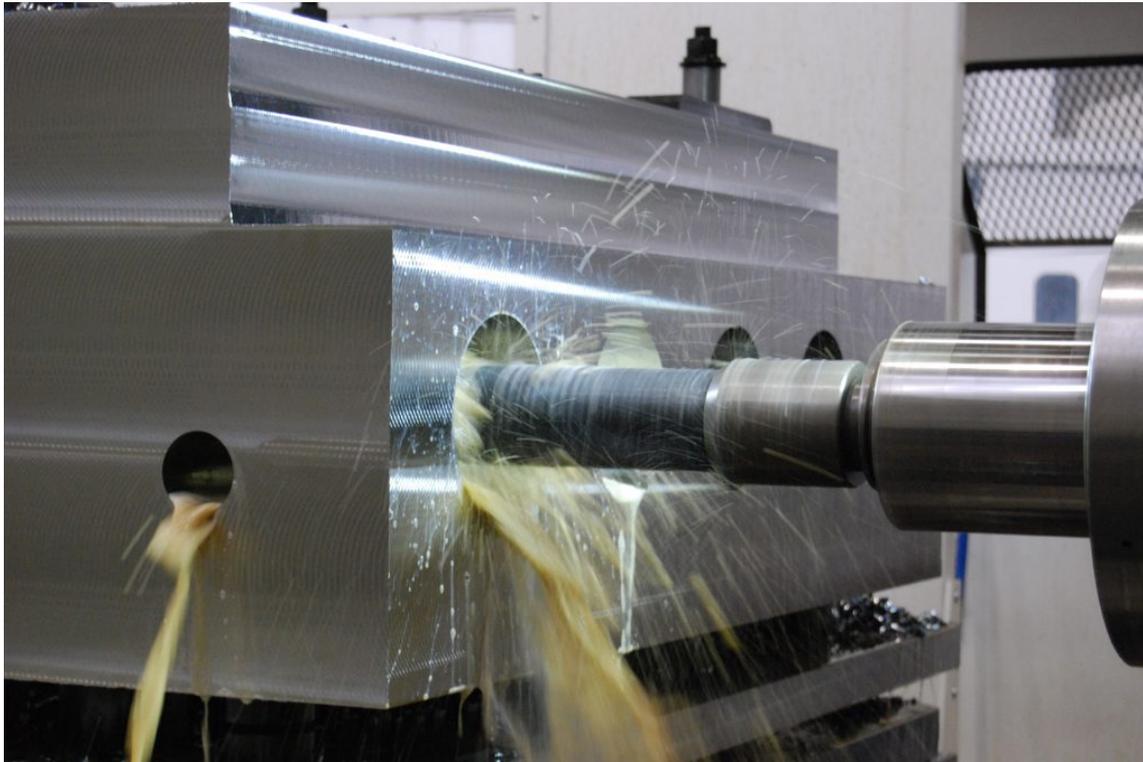


Oil Patch Transition: Manufacturing Adapts as Prices Recover

 advancedmanufacturing.org/oil-patch-manufacturing

May 2, 2018



A Fives Giddings & Lewis machine works on a fluid end.

The market is firming up while more difficult-to-machine materials are used

Manufacturing for the oil and gas markets is in a transition. The oil market has firmed up after prices plunged earlier this decade. That's helping suppliers of machines used to produce parts for oil and gas exploration and distribution, as well as the companies that make those parts.

At the same time, there are new challenges as difficult-to-machine materials are used more frequently.

"Beginning late 2016 and early 2017, oil prices recovered from their lows of January–February 2016," said Darshan Kalyani, oil and gas industry analyst for IBISWorld. Brent crude price slid to about \$33–\$34 a barrel, Kalyani said, while in this year's first quarter it recovered to about \$66 a barrel.



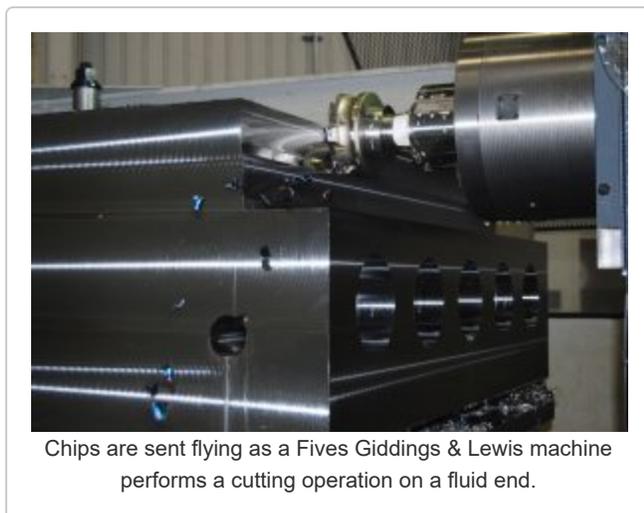
By Bill Koenig
Senior Editor

For 2018, IBISWorld estimates the average oil price will be about \$57 a barrel, while forecasting \$55–\$65 for 2019. “Crude oil is a commodity that moves beyond your normal supply/demand factors,” Kalyani said. “Geopolitics is the biggest external factor—especially because of the world’s reliance on crude oil from countries where political risk is high. Countries in the Middle East, Russia and Venezuela would be the prime examples. So political/economic/social changes in these countries have a heavy bearing on crude oil production and price dynamics.”

The Organization of Petroleum Exporting Countries (OPEC) has made production cuts to try to support oil prices. Such cuts “have definitely made an impact in controlling prices,” the IBISWorld analyst said. “More cuts are expected in 2018 and 2019. However, Saudi Arabia and Iran have been at loggerheads recently and the situation is very dynamic. Crude oil production in the US has been growing steadily and it would be hard to see increased gasoline prices domestically during 2018.”

Regardless of the specific numbers, oil price changes have been felt in the machine tool industry. “Machine tool manufacturing fell around 12.6% in 2016 without adjusting for inflation, reflecting the demand decrease from the oil and gas industry,” the analyst continued. “But the machine tool industry is expected to increase over the next five years.” Executives recall how the oil price swing affected business.

“In the heyday, 2011 through 2014, we were selling over 20 machines a month just in Texas,” said Carl Barthelson, currently the Northeast regional manager Doosan Machine Tools America (Pine Brook, NJ). “Then it all fell off the cliff,” he said. Smaller machine shops attempted to sell off machines they purchased in 2013 and 2014. “Certainly by February 2017, they were dusting things off and starting to put rigs up. We’re probably selling half of what we were in 2014. It’s not back yet but it’s certainly warmed up.”



Chips are sent flying as a Fives Giddings & Lewis machine performs a cutting operation on a fluid end.

Within the industry, executives have been taking all this in.

“Before this last downturn in oil prices, we were really focusing on the oil and gas market,” said Robb Hudson, CEO of machine tool builder Mitsui Seiki (USA) Inc. (Franklin Lakes, NJ). “We put everything in mothballs. We’re ready to take this out again. The exploration market for oil and natural gas seems to be picking back up. The drilling market is gaining a little bit of momentum.” The key, he said, is “if oil prices can stay in that happy medium where oil companies can justify pumping oil and exploring.”

Some companies used the period of low oil prices to prepare for a recovery. “We are engaged with a broad range of supplier product improvement programs,” said Edward Stockline, technical specialist with Promess Inc. (Brighton, MI), manufacturer of industrial monitoring and motion systems. “Capital investments for these programs tend to have an inverse relationship to production, i.e. corporations are more likely to invest in improved processes or equipment during periods of low production. Those who use this time wisely are better positioned to use new and/or improved tools to take full advantage of the next upturn in production.”

At Ingersoll Cutting Tool Co. (Rockford, IL), officials see changes that go beyond just oil prices. “Probably the biggest thing that we see is the demand for standard and special tooling is high, but the timeline in which we are allowed to deliver has been reduced,” the company said in a written statement by Pat Labunski, manager of proposal engineering; Don Yordy, manager of research and development; and Brad Johnson, product manager, milling products.

“Anything that can be done with standard off-the-shelf tooling on machining centers will be favored, so Ingersoll has tried to address by having more tools for the industry readily available,” according to the statement.

‘More Tools at More Places’

“Smaller buy volumes and quicker deliveries will yield orders. We also see smaller batch sizes being run at multiple manufacturing sites [simultaneously] as opposed to one company getting the entire contract,” the Ingersoll officials continued. “This puts more tools at more places, but also is a challenge because the machining process may be varied due to machine type.

“We saw that the price of oil and gas during 2012–2014 increased demand for fluid ends. The current demand that started in 2016 does not appear to be driven by fluctuating oil prices. What may be a driving factor is more efficient methods of producing shale oil.”

In any event, the Ingersoll officials said by the end of 2016 the company was “starting to see a rapid increase in demand for other types of cutting tools used in the subsequent roughing and finishing operations of the fluid ends. Throughout 2017, the demand for all types of cutting tools needed in the production of fluid ends grew rapidly. During 2017, we also saw an increase in demand for cutting tools used in the machining of other parts used in oil and gas, like mud pumps.”



For suppliers, the shift to harder materials is a major consideration. “There has been a transition from alloy steels to stainless steels and other materials that last longer,” said Peter Beyer, director of sales and applications for Fives Giddings & Lewis (Fond du Lac, WI). “The life of the pumps have been greatly increased by changing the materials that go into them. The materials have different machinability.”

Solving the Chip Problem

For example, Beyer said, there may be a 25–30% difference “in the machinability” of an alloy steel block compared with a stainless steel block. “The machinability means potentially more tool changes, different tool selections, and additional focus on chip management,” he said. “[That means] not getting long, stringy chips that cause problems in terms of automation of the manufacturing process. Long stringy chips can cause problems with tool changes.”

To run a machine tool “minimally attended,” Beyer said, “you have to solve the problem of breaking chips.”

There have been changes to machine tools to adjust to difficult-to-machine materials. “The machine needs more rigidity to handle special alloys,” said Johnson Lan, sales manager, Chevalier Machinery Inc. (Santa Fe Springs, CA).

What’s more, newer machine tools perform multiple functions, which “allows you to do all of the features...you don’t have to move parts from machine to machine,” Fives’ Beyer said. Examples include machines with integrated contouring heads, where complex bore geometry can be completed automatically on the same machine as roughing operations.

“More material removal capability via larger diameter drills and larger depths reduces the overall time to manufacture the part,” he said. “Productivity is the name of the game.”

“In the past, you would buy one machine to do the roughing and another to do the finishing,” he added. “Now you do the roughing and finishing on one machine.”

Doosan’s Barthelson agreed the trend is to have machines do multiple tasks. “The biggest factor is there are not enough machinists,” he said. “The mentality is we don’t have extra machinists, we have to be cutting all the time. I need to have more capability. I need more technology in every spindle I buy.”

Mitsui Seiki is licensed by General Electric Co. (Boston) to sell machines equipped with Blue Arc, a high-speed electro erosion technology. GE originally developed Blue Arc for internal use more than 15 years ago to cut materials such as titanium and nickel alloys.

Mitsui Seiki sees Blue Arc as one way to address increased use of difficult-to-machine materials in the oil and gas industry. “Doing rough cutting on these big Blue Arc machines removes large amounts of material very quickly,” Hudson said. It’s faster than conventional milling and can reduce manufacturing costs, he said.

Blue Arc melts part of a workpiece and flushes away the molten material. GE says it uses low force, enabling higher speeds. GE also says Blue Arc allows an operator to do unusual geometries. “We are fortunate we are licensed to manufacture that product,” Hudson said.



A Chevalier FBL-360B machine equipped with a FANUC robot.

Increased Fracking

The increased use of fracking also puts more demands on makers of machine tools. With traditional drilling, whether on land or off shore, oil and gas comes up with pressure. Much of the drilling equipment is used to manage the pressure. Fracking, by contrast, calls for forcing a slurry of water and sand into the ground to force oil and gas out.

“Since the move from traditional drilling to fracking, we have seen a wide range of parts that need to be machined from monolithic pieces [in some cases] of varying materials,” the Ingersoll officials said in their written statement.

“The transition to higher tensile strength materials have placed more demand on the tooling as reduced tool life is seen when compared to more traditional materials. Anything we can do to improve tool life and cycle time whether it be tool design, geometry, insert coatings etc., is always welcome by our customers,” they continued.

“There is also a challenge of trying to machine similar parts on not-so similar machines and perhaps using a different process. Here, we find that what works for efficient metal removal for one customer, may not be the best answer for another customer who has different machinery to work with. That is the reason why Ingersoll has developed more than one type of tool for machining similar features.”

Stockline of Promess said other changes represent more general changes in manufacturing. “Within the last decade, many industries have followed the auto manufacturers’ lead and replaced obsolete assembly systems based on hydraulic and air-over-oil press technologies with modern electromechanical and electronic technologies,” he said.

This trend is taking hold among oil and gas industry suppliers, said Stockline. “The technology gives manufacturers both unprecedented precision and 100% closed-loop force feedback, which can be monitored in real-time to allow fine adjustments to the process in real-time. [That] level of control reduces the risk of a bad assembly making it through manufacturing to almost nonexistent levels.”

One question facing oil and gas manufacturing is whether the industry will adopt Industry 4.0, involving “connected” machines that can be managed on smartphones and tablet computers. Some are enthusiastic about the idea.

“Industry 4.0 brings the machinery industry to another level of manufacture by using sensors and data to monitor every process of the production,” said Chevalier’s Lan. “With such an approach, operation can be more effective, efficient and with less error and discrepancy.” The company has its iMachine communications system. Lan said the system “does exactly what Industry 4.0 is pursuing. When every step of the production can be monitored, users will know exactly when to change parts or call service before it affects the end product.”

Mitsui Seiki, on the other hand, sounds a more cautious note. “We’re getting more involved in that,” Hudson said about Industry 4.0. The company uses a CNC platform from FANUC and it has links to Industry 4.0 software.

“The big danger is end users have potential to create a tremendous amount of data. Data can create a tremendous amount of noise.” He said it’s possible to end up “chasing irrelevant things instead of chasing four or five critical things.”



A Mitsui Seiki Blue Arc machine tool.

Some companies are looking to what their customers want. “Our customer base is still searching for what it means for them,” said Fives’ Beyer. “Increasing machine utilization is important. There’s really multiple levels of how complex and wonderful you need to be. Some [customers] are still just trying to figure it out. They’re struggling with the ability to find operators to run the machine and people to maintain the machines.”

There’s also the question of whether additive manufacturing has a role to play in oil and gas manufacturing.

Mitsui Seiki has a hybrid machine, which combines both cutting and 3D printing. “Ours is really aimed at repair operations, where the volume isn’t as high,” Hudson said. “I think there’s more potential for a platform like that.”

“Additive manufacturing is continuing to gain momentum in a variety of markets, although we have not seen it be used in production components that we have been involved in,” Ingersoll said in its statement. “Most [but not all] of the components we are machining are designed for high-pressure applications...which puts an added demand on certifications for use in general applications. All components made from additive processes would need to be initially tested for design, safety and life standards.”