



PROTOLABS
Manufacturing. Accelerated.

GUIDE

DIGITALIZING YOUR SUPPLY CHAIN FOR AGILITY

How to reboot your supply chain with digital manufacturing
to react faster to market demand



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Times are changing. Designers and engineers are developing products within highly shortened timeframes and the result is the need for parts, in hand, faster than ever before. Speed to market is king and companies that get there first have an inherent advantage.

But adding to this urgency is a market and economy that remains volatile amidst a backdrop of various political, social, or health crises. Demand shifts—both up and down—and so does the need for an agile supply chain that can adapt alongside companies.

This is what digital manufacturing is all about—technology-driven, agile, on-demand. And implementing it into your supply chain stream creates cost and time efficiencies along the way.

To request our comprehensive Procurement Guide or Quality Handbook, please reach out to your current account representative, or email customerservice@protolabs.com.



FACILITY STATS

TOTAL MANUFACTURING SQUARE FOOTAGE:
478,150

TOTAL OFFICE SQUARE FOOTAGE:
237,550

TOTAL SQUARE FOOTAGE:
715,800

UNITED STATES PERSONNEL COUNTS:
1,747 total personnel
857 employees in manufacturing
890 in the office

LOOKING FOR A SUPPLIER?

HEADQUARTERS LOCATION:

5540 Pioneer Creek Drive
Maple Plain, MN 55359
Hennepin County, US

WEBSITE:

protolabs.com

PHONE:

877-479-3680

FAX:

763-479-2679

EMAIL:

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KEY EMAIL ADDRESSES

QUALITY DEPARTMENT:

quality@protolabs.com

ACCOUNTS RECEIVABLE AND CREDIT:

credit@protolabs.com

REMITTANCE:

paymentadvice@protolabs.com

INVOICING:

invoicing@protolabs.com

Is It Time to Reboot Your Supply Chain?

The global business and commerce fallout from the coronavirus continues. As recent news stories have reported, supply chains for companies large and small are being dramatically disrupted—from [toys and Teslas](#) to [stranded lobsters and missing wedding dresses](#). The damaging economic and market impact is a stunning reminder of China’s worldwide reach.

Of course, if you’re a buyer or procurement manager, this issue gets added to the already existing supply chain disruptions you navigate every day: trade wars, on-again off-again tariffs, increased government regulations, freight issues, poor or unacceptable part or product quality, and more.



The speed of digital manufacturing can help mitigate risk especially when you factor in the total cost of ownership all along the supply chain. For example, if your product is sitting on a container ship for three months, that’s all a part of your total cost.

PHOTO: Los Angeles Times

“Hoping for the best while preparing for the worst may not seem like a rigorous business approach to the [coronavirus] crisis. But given our lack of knowledge, it is the most prudent strategy for managing risk.”

– Yossi Sheffi

There’s also the ongoing challenge of unforeseen downtime. A [recent study](#) by Information Technology Intelligence Consulting reported that a single hour of downtime can equate to \$100,000 in losses in a manufacturing environment. Further, the study said that this number is likely higher, potentially exceeding \$300,000.

Given all of these issues, this may be a good time to look at a supply chain risk contingency plan, or, better yet, consider a major overhaul and reboot.

Supply Chain Emergency/Contingency Planning

As Yossi Sheffi, director of MIT’s Center for Transportation and Logistics, and the author of two books on supply chain risk management, recently wrote in a [Wall Street Journal article on this topic](#), “Hoping for the best while preparing for the worst may not seem like a rigorous business approach to the [coronavirus] crisis. But given our lack of knowledge, it is the most prudent strategy for managing risk.” Sheffi urges companies to act quickly to minimize short- and long-term impact on their operations. Among a long list of items, he recommends:

- Setting up a central emergency management center
- Planning for operating to maximize cash flow rather than profits in the short term
- Reviewing your company’s product portfolio and customer base in order to set priorities
- Reviewing your suppliers to figure out who makes critical parts and are there alternate sources

Beyond this short-term, contingency mode that Sheffi outlines, if you are considering a supply chain reboot, here are some brief points on how digital manufacturing suppliers can tame supply chain disruption with rapid manufacturing, regional sourcing, on-demand production, and customization.

Reliable, Fast Lead Times Aid Supply Chains

As Sheffi recommends, acting quickly can help minimize disruptions. Accordingly, turning to a digital manufacturer that can pair manufacturing scale with reliable, fast lead times enables companies to quickly adapt to market demands and unforeseen forces in your supply chain. Indeed, under a fully digitized process, accurate price quotes can be provided in hours, if not instantly, and the manufacturing can be completed often in a matter of days, sometimes even the same day. This speed can make a difference especially when you factor in the total cost of ownership all along the supply chain, from concept to distribution. For example, if your product is sitting on a container ship for three months, well, that's all a part of your total cost.

Regional Suppliers Mitigate Risk

Using regional suppliers can be an effective way for companies to not be as blocked by global disruptions. And especially if those regional suppliers also use regional suppliers. What do I mean? At Protolabs, for example, we have global manufacturing facilities—we operate in 12 locations in eight countries—yet we work with regional sources as well.

Indeed many companies have been discovering the benefits of [onshoring options](#), taking advantage of contract manufacturers that use digital technologies on our own shores and insulating their companies from the macro-economic unpredictability I've mentioned.

At Protolabs, we're seeing an increasing number of our customers turning to localized and on-demand manufacturing alternatives to off-shoring. Manufacturing locally, or closer to the point of consumption, has been made more economically feasible with the proliferation of digital manufacturing.

On-Demand Production Can Tame Demand Volatility

On-demand manufacturing can help your company [tame demand volatility](#), gain greater control of inventory cost, and deliver the right products at the right time at the right total cost. Manufacturing on demand helps companies navigate market volatility so that they're not tied to massive production forecasts. When demand spikes, you can get parts quickly. On-demand sourcing can also lower overall inventory costs and warehousing expenses because you're no longer focusing on mass producing products with high minimum order quantities (MOQs). Instead, you're opting for on-demand production in low volumes, thereby creating a supply chain that is truly driven by customer demand, not by (and dependent on) a supplier's lead time.



Market demands these days are more customized, requiring a low-volume and high-mix ratio of products, rather than mass producing components or products. This is especially the case for consumer products, such as this part Protolabs manufactured for Boosted USA, which manufactures electric skateboards and scooters.

Mass Customization Supports Supply Chains

Finally, yet another way to tame supply chain disruption is to deploy a [mass customization approach](#). Today's market demands are more customized. This low-volume and high-mix ratio of products is not the supply chain of the past where mass production was the normal way of doing business. Indeed, customization is changing how manufacturing needs to react and on-demand manufacturing has the digital capacity and rapid capability to meet those mass customization needs.

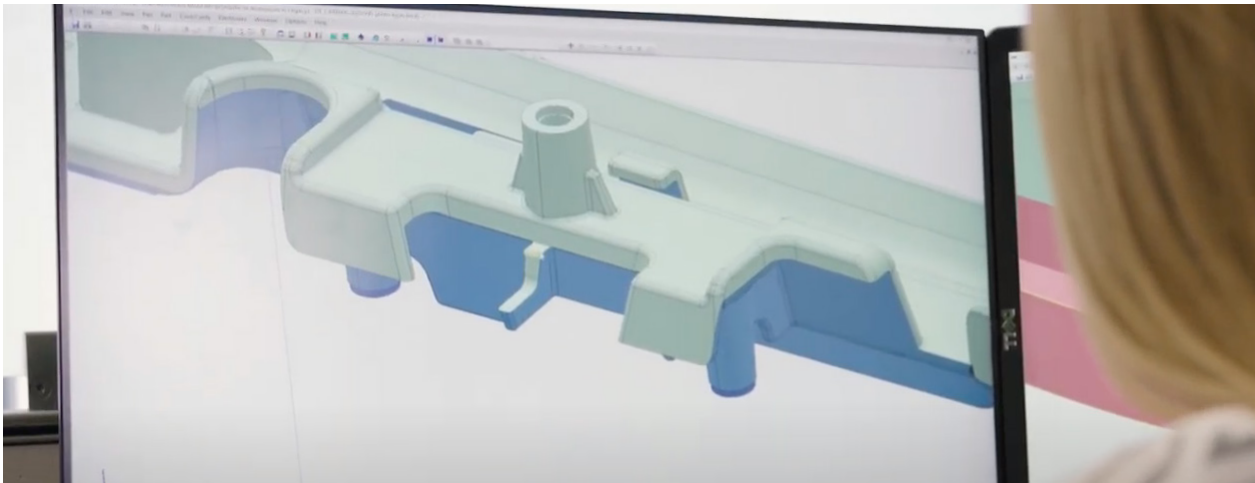
In summary, what's happening in China and now elsewhere as the virus spreads stands as yet another example of the global uncertainty that we as buyers and procurement managers face every day. And, beyond the business and market considerations, what's happening is of concern to all of us as caring world citizens.

Industry 4.0 Makes Supply Chains More Agile

Throughout history, major events have spurred change. Author Malcolm Gladwell refers to these events as “[tipping points](#),” or the point where an idea, trend, or social behavior hits a threshold and catches fire for widespread adoption. Inflection points spur change due to industry disruption, like the transition from on-premises software to the cloud. Industrial revolutions are the result of technology changes to spur the next phase of industry and manufacturing, which started with the first revolution, where steam and water power was adopted alongside mechanization, changing the face of manufacturing forever.

And now, we’re in the fourth revolution. Commonly referred to as Industry 4.0, this revolution emphasizes that the way we manufacture today will be forever impacted and changed because of the evolution of technology and the digitization of manufacturing.

In our world today, the global COVID-19 pandemic serves as a disruptive point in our world that has shaken cultural, societal, and business norms. It’s shown us the [true impact of supply chain disruption](#) and the importance of contingency planning. Before anything else, it has shown us that the acceleration of the fourth industrial revolution is more needed than ever as the industry is ready for another metamorphosis into what will drive the next manufacturing generation forward.



Having an optimized part design before any actual production begins is crucial, which is why digital manufacturers like Protolabs provide automated design analysis, along with price quotes, within hours of every part that is uploaded.

The Role of Digital Manufacturing

Over the past several decades, technology has transformed how we do business—and the industrial world has been slow to catch up. However, in recent years, it’s become more apparent that manufacturers are adopting technologies—including artificial intelligence, internet of things (IoT), and predictive analytics—to drive success in their businesses and supply chains.

What we’ve learned from traditional manufacturing over the past century is that external threats, such as market demand, and internal challenges, like workforce retention, significantly impacts gross margin and thus, profitability. Digital manufacturing focuses on leveraging technology to minimize the impact of external and internal factors while creating a manufacturing process that helps deliver that profitability.

As one of the leading digital manufacturers in the world, we have a digital thread that connects the manufacturing process from the moment that a CAD file is [uploaded into the system](#) for quoting. Because of the gains offered with tight technology integration on the plant floor, we can deliver parts in as fast as one day—no matter what market factors may be present.



Rigid supply chain plans may look good on paper, but often fail to execute in practice as market conditions are ever-changing and require adaptability in order to succeed.

PHOTO: Supplychaindigital.com

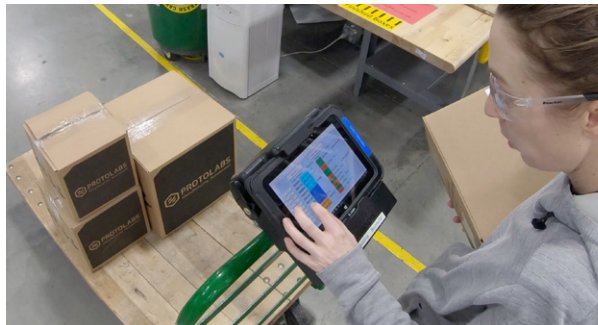
Digital manufacturing will continue to accelerate as the world and technology evolves. The current global pandemic, for instance, highlights weaknesses within today’s global supply chain that can be mitigated with a digital manufacturing partner that can respond quickly without compromising quality or reliability along the way.

What Digital Manufacturing Means for Supply Chain Flexibility

In the past 12 months, U.S. companies have come up against some of the toughest supply chain challenges—from trade wars to natural disasters and now a global pandemic. Macro conditions have never created as much complexity for companies as they have now. The issues have revealed one important component about today’s supply chains: They cannot survive without flexibility.

The acceleration of Industry 4.0 emphasizes how digital manufacturing will become a thread for manufacturers in today’s world. Just like previous industrial revolutions, Industry 4.0 will cause short-term pains for manufacturers in order to drive long-term benefits for the industry and companies around the world.

How does this support supply chain flexibility? Taking what the industry has learned over the past several months—from the desire to [move production back to the U.S.](#) to a [renewed focus on contingency planning](#)—leaders understand that rigid supply chain plans may look good on paper, but fail to execute in practice as market conditions are ever-changing and require adaptability in order to succeed.



Supply chain challenges abound: Trade wars, natural disasters, and now a global pandemic. Quick response from digital manufacturing suppliers, aided by total automation from production to delivery, can help meet those challenges and build more flexibility into your supply chain.

Will Digital Manufacturing Result in Onshoring Production?

More than three decades ago, China underwent an [industrial revolution](#) that positioned it as the top exporter for manufacturing goods due to incomparable infrastructure and supply chain management comparative to other manufacturing powerhouses.

Since then, tariff wars and global issues like the COVID-19 pandemic, combined with advances in digital manufacturing, have made onshoring production more appealing for many companies, particularly for injection molding. Using [on-demand injection molding](#) for low-volume production can eliminate risk from supply chains by offering quality parts in as fast as one day—giving companies a second source to support line-down emergencies, demand volatility, or even product customization.

With the growing impact of macroeconomic conditions on manufacturing and supply chains, as well as the ability to onshore production while maintaining costs and quality while improving reliability, Industry 4.0 is poised to transform manufacturing. Industry 4.0 will help create a more sustainable and innovation model with U.S.-based digital manufacturers that understand how to support the desire for more flexible supply chain models that can quickly react and respond to disruption.

Medical Manufacturing Speed, Agility Crucial During Pandemic

The COVID-19 pandemic has created unprecedented challenges across the world. To meet those challenges, from a medical device manufacturing perspective, our company and many others are helping a highly-regulated industry facing supply chain disruption to quickly respond to worldwide shortages for essential medical supplies like face masks and ventilators.

This industry has proven to be fast and agile before in times of crisis. Case in point: the last time an unprecedented event turned medical devices and supplies on its head. In 2017, Puerto Rico was slammed with [Hurricane Maria](#)—a Category 5 hurricane that was the worst the region had seen in 90 years. In addition to tragic deaths and damage to the island’s infrastructure and homes, the hurricane wiped out manufacturing facilities for many critical medical supplies including pharmaceutical drugs, implantable devices, IV saline bags, and at least 50 medical devices. Entire supply chains came to a standstill, quickly creating shortages and impacting healthcare systems around the world.



Digital manufacturers with quick-turn capacity and the ability to turn around parts in a day are able to respond to market demands in a time of crisis.

Hurricanes and pandemics may be different in many ways, but they share one commonality—the ability to tip supply chains upside down on a moment’s notice. And as a result, regulators, medical device companies, healthcare professionals, and manufacturing firms once again find themselves adapting to a supply chain that is on critical life support in desperate need of help.

China’s Supply Chain Disrupted

China was the first to feel the reverberating effects of COVID-19, shutting down factories across the country and uncovering the tip of the iceberg in terms of supply chain impact from the virus. It resulted in the [fastest contraction on record](#) for factory activity in China and the country’s Purchasing Managers’ Index (PMI) fell to a record low as well. For medical companies China’s outbreak was the first wave of impact from what would be many from the novel coronavirus. But, as the industry learned from Hurricane Maria, secondary manufacturing locations serve as imperative, not only while seeking FDA submissions, but throughout the production lifecycle to mitigate risk for products. Many medical device companies, for instance, made this secondary support a priority for future product development by identifying secondary manufacturing sources for line-down emergencies, or even when they were in need of a bridge-tooling resource.

Global issues like a pandemic mean that we must act swiftly; and that means there isn’t time to build new factories or even attempt product development in the traditional way that we’re used to. This is especially challenging when it comes to medical devices, as this space is highly regulated and focused on implementing quality measures for optimal results.

FDA, Companies Respond to Supply Chain Challenges

For regulatory bodies like the FDA, a pandemic requires them to become more agile and evaluate risk differently—giving emergency use authorizations to products so they can be brought to market in days, not months. This has been one of the most notable things we’ve witnessed throughout the pandemic: As numerous companies and individuals have stepped up to help with the medical supply shortage, the FDA has been a notable partner in arming our healthcare professionals with the supplies they need to fight COVID-19.



Protolabs and other manufacturers are helping medical device companies facing unprecedented supply chain disruption right now. Recently, we worked with Italian 3D printing company Issinova to supply 3D-printed kits that turn snorkel masks into non-invasive ventilator masks for healthcare workers globally.

We’ve witnessed cross-industry partnerships between [Tesla and Medtronic](#) to pool their resources to do what they can. Doctors have found other ways to help patients, like Dr. Stephen Richardson and his team at the University of Minnesota, who developed a [low-cost ventilator](#) in a matter of days to respond to the ventilator shortage in the U.S. Companies like [Dyson](#), [Giorgio Armani](#), and countless others have transformed their business to fit the shortages driven by the pandemic.

In yet another example involving Medtronic, the medical device company is now making the [design files for its PB560 ventilator system](#) available to the public with the hope that engineers and others will use this intellectual property to inspire their own potentially lifesaving innovations.

There’s an additional element that contributes to rebooting the supply chain during a time of need. A reboot requires agile companies and regulators, but also critical manufacturing partners like Protolabs that can respond to the call and produce necessary parts for equipment just as quickly as they can be developed. Supply chain and market agility rely on manufacturers like us that can respond rapidly, helping to take items from concept to prototype to production in just a matter of days. While traditional injection molding tooling, for instance, can take at least 12 weeks, we use a digital manufacturing process that can take products from concept to prototype to production in just a matter of days, accelerating that process from CAD submission to mold build to part production to shipment.

While we work to flatten the curve of the pandemic around the globe, these swift actions by industry leaders help equip our healthcare workers with the right tools to fill the growing chasm of medical supply shortages. From unlikely partnerships to innovative minds to swift actions from regulators and industry leaders, we can fill the gaps of medical supply shortages and rally around the mission that matters the most—protecting public health.

Mass Customization Supports Supply Chains

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In summary, what’s happening in China and now elsewhere as the virus spreads stands as yet another example of the global uncertainty that we as buyers and procurement managers face every day. And, beyond the business and market considerations, what’s happening is of concern to all of us as caring world citizens.

Onshoring Options Offer More Efficient Supply Chain Management

Supply chain managers are continuing to discover the benefits of onshoring options, taking advantage of contract manufacturers that use digital technologies and smart, on-demand manufacturing on our own shores.

Just about every industry has had its fair share of macro-economic unpredictability over the years, be it natural disasters, health epidemics—and now a global pandemic, or political unrests, we live in times of global uncertainty. Managing global supply chains has arguably never been more challenging. It's for that reason we're seeing an increasing number of our customers turning to localized and on-demand manufacturing alternatives to off-shoring. Manufacturing locally, or closer to the point of consumption, has been made more economically feasible with the proliferation of digital manufacturing.

These automated, digital factories of the future—yes, just like the ones we have here at Protolabs—are helping OEMs and others to create strongly connected supply chains that are nimble, resilient, and more responsive to risks and opportunities.

Leveraging On-Demand Production

Simply stated, on-demand manufacturing helps companies **effectively manage demand volatility** and gain greater control of inventory cost.

Let's tackle that volatility issue first. This concept of manufacturing on demand helps companies navigate market volatility so that they're not tied to massive production forecasts. When demand spikes, they can get parts quickly, avoiding the risk of lost sales opportunities because of stock outages or long lead times from off-shore vendors (see "Avoiding Logistical Logjams" below).

Next is the inventory issue. On-demand sourcing can also lower overall inventory cost and warehousing expenses for companies because they're no longer focusing on mass producing products with high minimum order quantities (MOQs). Instead, they're opting for on-demand production in low volumes. This approach enables companies to create a supply chain that is truly driven by customer demand, not by (and dependent on) a supplier's lead time.



On-demand production that takes advantage of rapid injection molding can create a more efficient, seamless supply chain.



You want capacity? Protolabs has more than 1,000 pieces of automated manufacturing equipment at several U.S. facilities, including this one in Minnesota, which run at 80% capacity to avoid production delays. Accordingly, as a supply chain manager, you'll always be first in line at Protolabs.

Avoiding Logistical Logjams

Going off shore can increase the [logistical complexity and cost](#) of your supply chain. Your company may find it is not as adaptable to adjust to production volumes when transit time from an international factory floor to your warehouse may be measured in weeks or even months because of container ship lead time. Onshoring in these cases can solve the long litany of logistical logjams.

Mitigating On Again, Off Again Tariffs

Yet another reason OEMs are opting for onshoring instead of offshoring, are the on-again, off-again tariffs that have been front and center in the news. Indeed, this issue has only worsened, as the tariffs that were originally only on critical raw materials, may now include finished products, [including cellphones, laptop computers, toys, and shoes made in China.](#)

Deploying Mass Customization

As we previously reported in "[What Keeps a Buyer Up at Night](#)," today's market demands are much more customized. This is moving manufacturing to become more reactive. This low-volume and high-mix ratio of products is not the supply chain of the past where mass production was the norm. Some manufacturers still focus their capabilities to mass produce products with high MOQs and long lead times. Customization is changing how manufacturing needs to react and on-demand manufacturing has the digital capacity and rapid turnaround capability to help meet those mass customization needs. In other words, one-size-fits-all mass production has given way to [mass customization and product personalization](#). Digital manufacturing plays a key role in this game-changing transition.

Checking the Boxes on Your Approved Vendor List

11 Reasons Why Protolabs Should be on Your AVL

To make it as painless as possible to add Protolabs to your company's approved vendor list—and streamline part ordering as a result—we pulled together some of the most important areas that procurement and supply chain teams often look for when sourcing a manufacturing supplier. Here are 11 reasons why Protolabs is a good fit.

Competitive Pricing

Competitive and accurate pricing is available with your quote in a matter of hours. Production pricing is also available for injection molding, CNC machining, and additive manufacturing. Plus! Our applications engineers are always available to discuss key cost trade-offs for designs.

Quoting And Manufacturing Speed

We provide interactive quotes with free design analysis within a few hours and have expedite options across all four of our manufacturing service lines, so we can ship parts in as fast as one day.

Capacity

More than 1,000 pieces of manufacturing equipment that run at 80% capacity to avoid production delays. You're always at the front of the line and is a reliable option if you run into a supply chain emergency or line-down situation.

Quality Assurance

Unlike quality measures of traditional manufacturing systems—usually conducted at the end of the production chain—our quality system is embedded throughout the entire process. Traceability and transparency of projects are found every step along the way.

Injection Molding. Process development reports and basic inspection reports are included with each order, and enhanced inspection reports, like FAIs, are available upon request. In addition, our on-demand manufacturing option allows for ISO 13485-certified injection molding for plastic medical device components.

CNC Machining. All machined parts are inspected for cosmetic conformance to workmanship standards and dimensional conformance on at least three dimensions (typically X, Y, and Z), and with production parts for machining, we also provide conventional inspection reporting like FAIs, Certificate of Compliance (CoC) documentation, and additional certifications like ISO 9001 and AS9100.

3D Printing. To ensure high-quality parts, we offer powder analysis, material traceability, process validation, and inspection reporting on printed parts, and our metal 3D printing process is ISO 9001 and AS9100D-certified. With metal 3D printing, you're also able to choose from several secondary processes like post-process machining, tapping, reaming, and heat treatments that produce end-use production parts.

Sheet Metal Fabrication. Sheet metal fabrication happens in our New Hampshire facility and is ISO 9001:2015 certified. Inspections provide design verification for sheet metal parts, and in addition to our standard internal inspection process for all manufactured parts, additional inspection services are available upon request. This includes FAI, CoC, and material and finish certifications. We also offer welding, hardware insertion, plating, silk screening, and powder coating to provide complete sheet metal components—and total traceability—all under one roof.

View all of our facility certifications [here](#).

✓ Production Scheduling

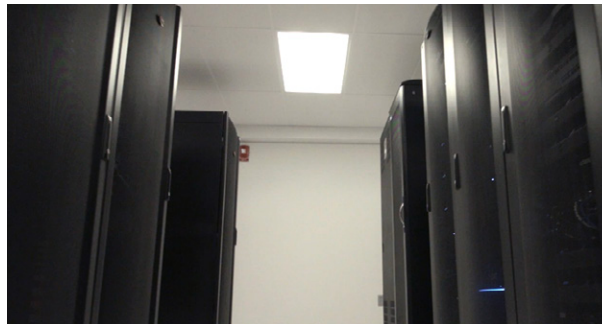
Automated algorithms have been programmed to help prioritize and streamline ordering and scheduling processes to accelerate the manufacturing process. This is a key element in the digital equation that allows us to ship parts in as fast as 24 hours.



With digital manufacturing, scheduling is automated too, which helps prioritize and streamline the process to accelerate manufacturing.

✓ Equipment

We're technology agnostic with many different equipment providers, so we're not reliant on one OEM. And when we add new machines to our manufacturing floors, they are typically customized for speed and accuracy like our existing equipment.



Security is paramount, with all data protected and backed up.

✓ Security

All proprietary 3D CAD files, intellectual property, or customer information is protected. And server redundancies are in place so data is protected and backed up. We are also **ITAR compliant**, and since we are a global company, we must ensure that employees outside of the U.S. don't have access to any parts or part information for ITAR classified projects. This means keeping separate databases for different countries, having procedures in place to ensure that any parts or information we share publicly or between locations aren't ITAR controlled, and not allowing employees from other locations access to the manufacturing floor or other secured areas. We also prohibit photo, video, and audio recording from visitors in our offices and manufacturing facilities.

✓ Safety

Multiple measures are in place to ensure safe work environment on the production floor including sound dampening, robotic block handlers, and safety harness systems. At our CNC machining facility, for example, we installed a Gorbel Tether Track fall protection system, which is an engineered track-and-trolley system over each milling machine. The system uses a self-retracting life line and a personal fall arrest harness to protect our employees as they work on top of a mill which immediately locks and stops like a seatbelt if it senses a fall.

We've also put in place many different safety precautions to protect both our employees and customers against COVID-19. Currently, facility tours with customers have been paused but you can virtually tour our **CNC machining facility**, **molding facility** (sampling), and **additive manufacturing facility** online.



Ensuring a safe work environment on the production floor includes a long list of measures: safety harness systems, sound dampening, robotic block handlers, and fall-protection systems, plus a range of precautions now in place to protect employees and customers against COVID-19

✓ Material Inventory

You can choose from more than 100 different thermoplastic and elastomer **materials for molding** and more than 30 plastic and metal **materials for CNC machining**. With 3D printing, we have **20+ plastic resins and metal powders** for both prototyping and production-grade, end-use parts. And we also have a handful of sheet metal options including **galvanized and galvanized steel**. We also accept **customer-supplied materials** and provide **custom color matching** for molded parts. Basically, we have a variety of materials that can meet nearly any project requirement.



At Protolabs, we keep a wide range of materials in stock (top photo) for all of our manufacturing services, and we also accept customer-supplied materials. Additionally, we provide custom-color matching (above) for molded parts.



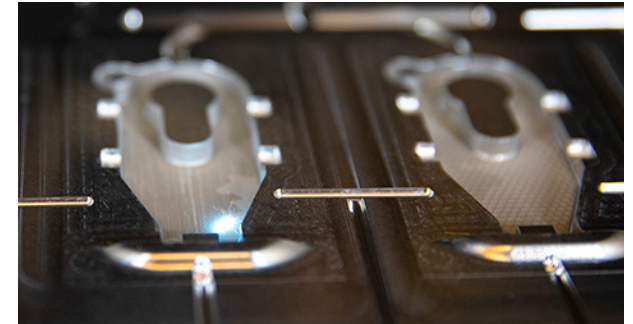
We have extensive digital manufacturing experience, from knowledgeable design analysts and engineers to highly skilled

✓ Extensive Manufacturing Experience

We have experienced engineering, quality, and procurement teams and highly skilled machine and press operators overseeing pre-production, production, and post-production activities. With additive manufacturing, for example, we've seen over 1 million 3D-printed part geometries over the past 20 years. And if you have any manufacturing or procurement questions, you can talk with an in-house applications engineer at any time.

✓ Single Supplier

We manufacture all parts in-house for consistency, speed, and reliability. But we also serve as your single contact for things like quality control and finishing options in-house—or with a trusted third-party vendor—to ensure you are getting end-use parts as fast as possible.



As a digital manufacturer, Protolabs can serve as a single-source supplier, from design to delivery.

10 Ways Digital Manufacturing Can Improve Your Supply Chain

A handful of forward-thinking manufacturers have evolved significantly over the past decade into digital supply chains that are far more agile, efficient, reliable, and versatile than their traditional predecessors. This is great news for like-minded companies and procurement teams wanting to partner with manufacturers that place importance on technology.

So how do you find the right digital manufacturing company? From cost and quality to equipment and capacity, here are 10 areas to assess in a supplier.

1

Cost

Start with one of the most obvious points of critique that a procurement team is tasked with: the reduction of overall manufacturing costs. Lowering your piece-part price in injection molding without sacrificing part quality, for example, is certainly important, but what is the most efficient way to do that? Increase volume and invest in steel tooling to shrink piece-part price, right? Perhaps, but then you're strapped with a significant and risky financial investment in tooling that could make or break your project if there's an unexpected market reaction and major design iterations need to happen to your product.

There are other options. Find a supplier that has different manufacturing levels to step in to; if you're prototyping molded parts, use prototype tooling, and if you need low- to mid-volume part quantities in the tens of thousands, then use low-volume or bridge tooling. Mold costs with aluminum-based tools are often dramatically more affordable (think \$10,000 vs. \$100,000 for a steel tool) and the integrity of piece-part price remains intact when total cost of ownership is considered. And guess what? No minimum order quantities with low-volume tooling and resulting storage fees for excessive inventory.

We have implemented these [tiered levels](#) at Protolabs that are tailored to the company's needs. Then when you need more than 100,000 or 200,000 parts, and your engineering team has fully vetted its design (and the market has verified it), you can make a smarter, less financially risky move to a capital investment in production tooling. If you're still not convinced, look beyond pricing for further savings in softer costs like quoting, design, and development time along with the time (read: money) saved by cutting aluminum tools instead of steel.



Aluminum tooling provides a faster and more affordable entry point into low- to mid-volume production compared to steel tooling.

2

Turnaround Time

Accelerated, reliable production speed is another critical characteristic that provides companies with agility at all product phases—from development to launch to growth to sunseting. Sure, your 3D printer is fast. Your team may even have a few sitting on their desktops. But [commercial-grade 3D printing](#) equipment (that offers precision, repeatability, and low-volume production) is nearly as fast with digital manufacturers regularly shipping parts in as fast as 1 day. This isn't really a huge surprise though as commercial 3D printing has taken significant steps as a major manufacturing player over the past five years. What is more welcoming is the concept that "rapid manufacturing" is no longer limited to and associated with just 3D printing. Traditional manufacturing methods like machining, sheet metal fabrication, and molding have all been digitized to consistently deliver low-volume production components in the same timeframe of days, not months. Find a manufacturer that embraces a technology-agnostic approach to digital manufacturing so you have a true "on-demand" manufacturing source across many different manufacturing methods.

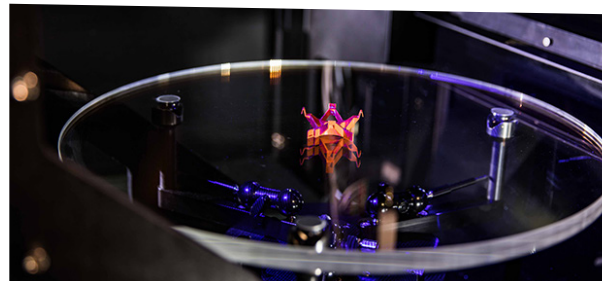
3

Quality System

In few areas of manufacturing is the concept of digitalization more important than a supplier’s quality system. Automated software and hardware breeds speed and consistency. Sorry humans, the machines have us beat here. This [concept of the “digital thread,”](#) which stretches from CAD model to design analysis to production to shipping, is becoming essential to suppliers and should be a requirement of procurement teams looking for legit digital manufacturing companies to work with. Here are a few digitalized areas to look for:

- **Automated Design Analysis.** Manufacturability feedback within hours (vs. days or weeks) not only enables engineering teams to iterate designs before any actual manufacturing begins, it’s fast. This saves the company development time and production costs by avoiding design reworks.
- **Traceability.** Digital traceability by way of rigid document, record, and revision control is crucial as the thread moves toward the production floor. Digital manufacturers use the CAD model and the part’s online configuration as the record of customer requirements and are able to reference this data at any point in the manufacturing process. The software ensures revision control of customer data and tracks the digital history of key manufacturability communication.
- **Inspection.** Make sure the supplier’s scope of its monitoring and measurement system includes receiving inspection, machine-based inspections such as automated part probing and tool checks, in-process inspection, and final inspection. Does the supplier have digital inspections or first article inspection (FAI) quality reporting, or processes that satisfy FAI requirements? A robust quality system should.
- **Visibility.** A supplier that outsources its customers’ orders (ahem, brokers), inherently loses visibly and quality monitoring without an in-house quality system at work to monitor parts at every stage.

Digital inspections start by analyzing the final part with a laser-based 3D scanner. The digital scan is then used to generate a report that includes verification of critical dimensions and color map to directly compare the final part to the original CAD model.



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Certifications

Certifications are really a subset of our aforementioned quality system point, but nonetheless deserve their own mention. So, how qualified is your supplier? If you work with a service broker, are its manufacturers qualified? Do you work with a supplier that is ISO certified? Certification is important because it provides independent validation and assures companies that suppliers are meeting verifiable standards. The requirements represent a solid foundation of planning, control, and improvement. In many industries, companies will only do business with certified suppliers because there’s inherent confidence that suppliers are working to accepted standards and procedures. We’re ISO 9001:2015 certified and its metal 3D printing and machining processes are [AS9100 certified](#), particularly enticing to industries like aerospace.

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Material Selection and Monitoring

You might have an amazing supplier that manufactures quality parts fast and cost-efficiently, but if it has a limited selection of materials or its own material supply chain issues, all of the attributes that make it amazing in the first place—speed, quality, cost—can be impacted. Find a manufacturer that has a wide selection of in-house plastic, metal, elastomer, silicone rubber materials and one that accepts customer-supplied resins, but also a supplier that has good visibility to its materials. This is an important subtlety.

A good example here is the [service bureau vs. service broker](#) argument. Brokers outsource the actual manufacturing of their customers' parts, so in theory, more manufacturing options including material selection. However! (And there always seems to be a "However!") The broker's line of site to material control can be obstructed when compared to a bureau since the bureau's materials are at its fingertips. A broker is also at the material monitoring mercy of the manufacturer it outsourced its customers' parts to. As a result, inconsistencies can emerge.



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Equipment

A manufacturer's equipment list is important—Haas, Toshiba, Cincinnati, Arburg, Concept Laser, Viper, Projet—but touting an impressive inventory of machinery isn't necessarily where the conversation should end. What is the manufacturer's overall purchase and implementation strategy? An equipment-agnostic approach is a customer-focused approach; it simply involves using the machines that are best suited for the production of parts, preventing the manufacturer from being anchored into a particular equipment brand. Within each particular manufacturing process, however, equipment redundancy can help drive consistency.

A quick example. We have invested in more than [500 Haas CNC machines, 400 presses, and a handful of Arburg silicone rubber presses](#), which are all configured specifically for Protolabs. It also houses more than 150 3D printers whose maker varies by manufacturing process from Concept Laser to 3D Systems to HP. Equipment agnostic by manufacturing service; equipment redundant by manufacturing process. Standardization of equipment across processes ensures in-process quality and production repeatability. You know you're going to get the same part quality during each every run.

Each of our 500 Haas CNC machines are specifically configured for our digital manufacturing processes.

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Capacity

Like many of the points on the list, capacity is dependent on other areas like equipment and technology, and capacity issues can inherently impact turnaround time. Has your part order ever been de-prioritized due to another company's larger order? That shouldn't happen if capacity is stable. A reliable supplier will typically run at 70-80 percent of its capacity so it has flexibility in its production schedule to avoid shipping disruptions. Ask your supplier what its on-time delivery rate is; it should have that data and it should be in the upper 90 percentile.

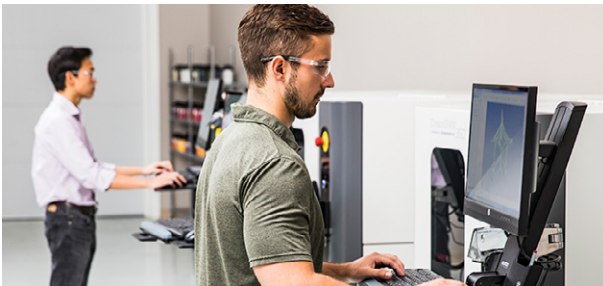
Another benefit of large capacity is that idea we mentioned earlier of on-demand manufacturing. If you're working with multiple suppliers at any given product phase and one of those suppliers runs into capacity issues, it's good to have another supplier with open capacity; one that's willing to produce parts on demand so your company's procurement schedule remains linear and absent of production hiccups.

8

Technology

Manufacturing as an industry has been notoriously slow to adopt digitalized processes but for some manufacturers, technology-minded operations are the only way forward. Find a supplier that embraces technology—not one that hides from it—because it’s highly beneficial to your company at every point of supplier interaction.

How? A manufacturer that’s data-driven can collect, analyze, and leverage its data to create efficiencies. Automation and connectivity (the digital thread) between software and hardware manufacturing systems produce efficiencies in cost and time, which ultimately get transferred to procurement teams that are ordering parts. Quicker turn times, cost-effective bottom lines, happy companies.



Digital manufacturers embrace technology, which is beneficial to your company at every point of supplier interaction.



Look for a digital manufacturer with experience. An experienced manufacturing supplier is an intangible benefit worth factoring into an overall supplier audit.

9

Experience

An experienced manufacturer is an intangible benefit worth factoring into an overall supplier audit. Years of business is important since the manufacturer has most likely produced millions of parts and analyzed tens of thousands of part geometries, and as a result, can recognize the most efficient ways to manufacture those parts. If you peel away a few layers, experience means also having engineering expertise and a procurement team within the manufacturing company to answer questions that machines can’t. This helps validate processes in pre-production, during manufacturing, and post-production, inspection, and shipping.

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Ease of Business

This is another intangible and underrated supplier attribute. Is your experience with your supplier smooth—how is the quoting engine? Do you have full transparency into costs? Is it easy to order parts? Do the parts arrive on time? Are there in-house points of contact that are responsive with any questions that arise? Just a few questions to ask on your way to finding the ideal supplier.



Ultimately, as a supply chain manager, you’re busy, so look for a manufacturing supplier that’s easy to work with.