

TEN BUILD-BUY FACTORS FOR IOT PLATFORMS



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IoT Competence Transforming Competitive Landscape

The Internet of Things (IoT) is poised to disrupt the industrial status quo. We're at an early inflection point with IoT similar to when businesses began adopting the web. At that time, people knew they needed to "get on the Internet" but weren't exactly sure why or how it would impact their business. But they knew times were changing, and they did.

The competitive landscape was rewritten, innovative new businesses like Amazon loomed large, and traditional companies had to adapt or die. Welcome back to turbulent times.

IoT is coming into reach for more companies due to cheap sensors, embedded computers, wireless networks, and cloud server farms. Manufacturers are starting to see their competitors adopt IoT strategies and recognize the disruption could result in traditional industries polarizing into winners and losers. On the other hand, companies that master IoT have the opportunity to expand into new business arenas, much as Amazon started selling books with the intent of transforming the way consumers buy a wide variety of items.



"IoT is radical. I think it could result in a lot of consolidation. The first few companies that do it right could win and end up acquiring those that don't do it."

Engineering Manager, Plastics Processing Equipment

TYPICAL IOT USE CASES

- Remote monitoring / optimization (energy consumption, throughput, process)
- Predictive Maintenance
- Providing product performance feedback to Engineering
- Lead generation to drive new sales opportunities (replacement, upgrade, etc.)
- Product as a Service (PaaS)
- Monetizing data



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Build or Buy IoT Infrastructure?

To master the IoT, companies need to transform their businesses and put in place complex enterprise applications and infrastructure – both of which are significant efforts. The early IoT pioneers had to invent new business models and develop an immense amount of IT infrastructure concurrently. They stitched together lots of different pieces into patchworks of technology, often with limited or no success because the breadth and complexity of requirements is far greater than what all but a few companies have experienced.

Today, companies embracing IoT have a choice. They now have access to commercially available IoT "middleware" and application development environments that can deliver an integrated platform to collect and act on data. For most companies, IoT is an enabler and not a core competency, making it a good opportunity to outsource so they can focus on their business transformation as opposed to their technology. It's time to make a rational decision on build versus buy. Here are ten critical things to consider.



"We have 15 years of experience with IoT. Our system combines over 21 suppliers to get to the solution we have today. It's extremely complex to keep it running, get it stable, and to find what is wrong."

Business Process Manager, Compressor Company



Engineering Manager, Plastics Processing Equipment "Five years ago to set up IoT solutions and architecture you were setting up the server, web communication protocols, APIs, diagnostics, dashboards, and communications. That would have been out of our reach financially. Now, it's all available on the cloud so you don't have to develop it yourself."



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1 Understand the Value

The two most urgent tasks are getting some ideas in front of users fast to learn, and then evolving that to an IoT vision business strategy. It's time to ask how your company can benefit from IoT. This isn't all brand new. Companies have been doing parts this for a long time. Products have gotten smarter and more connected. Many manufacturers have leveraged SCADA to collect data from the shop floor, leading to significant gains in plant efficiency. Many have experimented with gathering data from their products or learned from early Machine to Machine (M2M) initiatives.

Companies have learned from both successes and false starts. For example, many have yet to fully leverage IoT data, let alone create new revenue streams. Plant initiatives helped at the plant level, but didn't provide a central view to allow further optimize optimization. Early results are promising and have created an appetite for more, resulting in industry initiatives like Industry 4.0 and the Digital Factory movement.

Companies are exploring the value, some out of hopes for new revenue and others out of fear for being left behind ("Amazoned"). So what are your goals?



Engineering Manager, Plastics Processing Equipment "It's getting harder to compete and differentiate, particularly over lower cost economies, as equipment becomes a commodity. We need to find new ways of doing business to drive more value over the entire equipment lifecycle and move from a sporadically reactive relationship with our costumers to become more of a continuously proactive and engaged partner than a supplier."

Connecting your products? Gathering sensor data? Getting closer to customers? Gaining visibility into product usage? Offering a new service? Embracing a new business model? IoT is accelerating as it gets more accessible. It's time to pick some ideas and work on a strategy to define your future.



2 Don't Underestimate the Cost and Complexity

With a strategy in place it's time to get started. But it's important to understand that IoT requires a lot of new infrastructure. It basically impacts everything and spans the range of electrical engineering and information technology disciplines, including:

- Electrical engineering
- Embedded software
- Networking

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- 3-tier cloud apps
- Big data analytics
- Business intelligence
- Enterprise application integration including ERP, CRM, SCM

It's hard enough to get products to communicate. Tech-Clarity's *Developing Software Intensive Products* research shows about one-half of manufacturers developing smarter products experience negative impacts on product quality, time to market, and operational efficiency.



"In my 35 years as a project manager, IoT is the most complex project I've ever done. It deals with embedded controls, mobile communication, global issues, firewalls, and more. There's not one topic that isn't covered in an end-to-end IoT solution, that's why it's so challenging and needs so many areas of expertise."

Business S Process Manager, Compressor Company



Negative Impacts of Developing Software-Intensive Products Developing Software-Intensive Products - Tech-Clarity



2 Don't Underestimate the Cost and Complexity

IoT requires even broader skillsets, including expertise most companies don't have. Once a product is in the field companies need to be concerned with communications, gateways, networks, networking equipment, new integrated services, and communications protocols. They also have to develop IT infrastructure with performance requirements far beyond the average IT project, including high availability computing, redundancy, failsafes, disaster recovery, queuing, security, encryption, certificates, data storage, and more. In most IoT systems, the "users" are devices that never sleep and have no tolerance for upgrades and maintenance windows.

This isn't your average IT project! These capabilities are especially hard for SMB given that Payscale.com shows that Java, Python, and .NET developers average about \$80k per year. It's this complexity, and the associated cost, that makes exploring IoT "middleware" services and cloud-based rapid application development environments valuable.



as companies keep looking for new features, new data, and new applications."

"Development cost is the biggest issue

Tom Duff, President, Hollis Controls



"I would never advise anyone to build an IoT platform themselves. We spent a fortune on building it, literally millions of euros. To rebuild everything again would we spend the same amount again, or perhaps double that."

Business Process Manager, Compressor Company



The first thing most people think about when they consider build versus buy decisions is cost. Clearly, that's an important factor. But time is probably just as important as money for IoT infrastructure, if not more so! Companies need to move quickly beyond technical feasibility studies and show they can effectively collect data and communicate with products. They can't afford the time to undertake a big IT project with custom coding and scripting tools.

Companies must spend their time exploring new business opportunities and relationships with customers. There will clearly be false starts and lessons learned. The key is to fail fast, gain experience, and then find repeatable value. Cloud solutions can help, *as Assessing the Cloud PLM Opportunity* explains, "cloud offerings are easier and faster to implement and scale up."

It's also important to be able to change fast. Flexible solutions can be reconfigured quickly to support an iterative approach. Ideally, people that can understand business tools like Excel should be able to understand and contribute directly to IoT solutions to rapidly develop and test proofs of concept.



Business Process Manager, Compressor Company

"To build something to replace what we have would have taken too much time. We developed our first solution over 15 years, but the proof of concept on our new platform only took a month and the implementation was only eight months. It's also important how fast we can iterate."



"It was a big shock how little of a technology project it was when we used IoT middleware. We were pleasantly surprised by that!"

Engineering Manager, Plastics Processing Equipment





"I hook up to a new platform in a few days. With our own protocol it took months."

Business Process Manager, Compressor Company



Tom Duff, President, Hollis Controls

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"We want to be able to keep the database up to date as they install new units every day and customer information changes. With the platform that's easy to do without the vendor or an IT person." As we mentioned earlier, smart and connected products aren't new. But with IoT we're asking more from them. We're relying more on the ability to connect with them, ideally in real-time, regardless of their location. This means connecting with equipment or networks in a wildly heterogeneous world.

A key success factor will be how quickly companies can hook up to devices, capture data from them, and make business sense of it. Companies have to be ready to connect with new all sorts of equipment, communication devices, and protocols. While standards are evolving, there are many to choose from and there may never be a standard because things are moving very quickly and there are simply too many forces at work. As things change, it's important to know how to talk to devices, but also how to capture and store data.

Of course it's also important to realize that most companies aren't operating in a "greenfield" environment. Getting the next product to connect isn't easy, but it's in your control. But IoT success often leads to the need to connect with devices that have been in the field for years. This may include retrofits for your own equipment as well as competitors' devices.

Be Ready to Integrate with Enterprise and Engineering Applications

As mentioned earlier, IoT impacts everything. New processes will likely span across a host of people, departments, and business systems. For example, equipment data may be needed in crossfunctional areas requiring integration with:

- CRM for leads, customer data
- ERP for billing
- Service Lifecycle Management (SLM) for service tickets or predictive maintenance
- PLM to close the loop to make product performance and experience visible to designers and automate change requests and more

In addition to enterprise systems, IoT processes and system might need to leverage data in engineering applications, such as:

- CAD / 3D modeling tools for real-time visualization of IoT data
- Engineering analysis tools (FEA, CFD, Model-Based Engineering) to improve engineering analyses by incorporating real-world data
- PDM to provide detailed product information or specifications to IoT applications



Business Process Manager, Compressor Company "Integration is where the power is. If you don't have integration you will never monetize IoT. We're integrated with ERP, with CRM for lead generation, and with engineering systems to do energy calculations."

IoT has significant potential to connect internal business processes with products and their customers in the field. Some of the more exciting areas of integration include correlating product performance data from the IoT with the "digital twin" to support 3D data visualization and augmented reality scenarios.

Of course there are a host of other systems that may require integration including messaging services, email, and more. The ability to quickly share information across systems will be extremely important in the connected, IoT world.



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Be Ready to Scale Transaction Volume

One of the key factors that hampered early, homegrown IoT infrastructures is scalability. Most manufacturers have simply never had the need to develop Internet-performance-ready solutions. It requires a new level of performance, uptime, and availability than typical internal systems demand. It also requires the ability to store and process big data, and analyze it to find trends, patterns, and correlations. The issue is orders of magnitude more challenging than most companies have dealt with.

IoT scalability is a moving target. Transaction volumes can growth due to:

- More new devices in the field
- Expanding IoT programs across the product portfolio
- Retrofitting legacy equipment with transmitters
- Collecting more sensor data from existing equipment
- Gathering sensor data more frequently
- Adding more sensors into products

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Scaling can be one of the most challenging and costly issues in IoT. Cloud-based solutions that bring the supercomputing power of thousands of servers working together are really the only realistic option for most companies to support growing volumes.



Engineering Manager, Plastics Processing Equipment "We had a proprietary controller on our devices. We can store data at certain intervals on SD, memory stick, or internal memory but when want to do high-end problem solving we can't record easily because it can be many data points per second. We filled up the SD card!"



Business Process Manager, Compressor Company

"Scaling was (and is) the biggest issue. Our initiative was too successful. We started with a few thousand machines, but then we made a major decision to scale up to every machine that leaves the factories. We went from adding tens of machines a week to a few thousand and now we're over 150 thousand. Our infrastructure wasn't designed to scale to that!"



Be Ready to Scale Functionally

IoT implementations also scale to support new capabilities that go beyond just capturing data. They act on it. Companies must be ready to provide detailed data visualization and dashboards to share information and make sense of it. They should be able to provide different levels of information granularity, such as rolling up customer equipment into groups, complex business unit structures, or geographies. They should also be able to put the data into action through thresholds, alerts, and triggers.

Companies often scale from gathering information to twoway communications. They may use this to push changes to the machine software or controls to correct issues or provide additional capabilities. They may take on the role of monitoring equipment with automated actions like safety shutdowns. Or, they may want to send information or messages to customers via their equipment, providing them with valuable, actionable information.



Business Process Manager, Compressor Company "Fifteen years ago we were happy to have our first connectivity via SMS to have a remote view of the data. Now we're monetizing the service to the customer through data, alerts, and optimization. We have a whole chain of products that we built on top of productivity. Our next steps are looking at operational efficiency, lead generation, and very customized products."

Be Ready to Scale Functionally

There is no shortage of ideas or opportunities. "We've already identified 20 to 30 value propositions. The hard to task is to narrow it down to decide what to do first," explains the Engineering Manager for the Plastics Processing Equipment. What will be the next set of requirements? Will you need a digital twin? The ability to view statistics overlaid on an existing product? View equipment in its current location leveraging laser scanning or reality capture data? Sharing information via augmented reality (AR)?

You may have to think ahead about the possible future scenarios/functionality you may want to support in the future and instrument your products accordingly to avoid having to retrofit products in the field. Ideally a sourced IoT infrastructure would already support these kinds of capabilities before you need them, providing application templates for functions you haven't needed but others have.



Tom Duff, President, Hollis Controls "At first we were just looking at whether or not the unit was running. Now that we're getting more information, management is realizing they can do more with the data. They're even talking about installing monitoring devices on other companies' equipment."



9 Be Ready to Scale Globally



Business Process Manager, Compressor Company "Globalization is a challenge. Once you're in IoT there is no such thing as local anymore. There is no such thing as day or night or language. Everything is global. We work in 24 time zones, 26 languages, and different units of measure."



Tom Duff President, Hollis Controls

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"Customers may need to see levels of data grouped together in a secure way. The customer wants to see his data and Field Service wants to see all of their customers' data plus broader groupings. These kinds of capabilities were already in the IoT platform, they had already thought through how to display it. A feature one client wants will be useful to others." Moving into an IoT-based business model requires recognizing that equipment may be located in many locations and under a wide variety of conditions. IoT thrusts manufacturers into supporting global operations, global customers, and / or mobile equipment.

Supporting a global IoT implementation leads to significant challenges. It means connecting via different communication protocols. It means addressing needs such as multi-currency and multi-lingual transactions. It also results in surprisingly complex issues managing time zones because companies often need to capture, normalize, and analyze time-series data from equipment across the globe.

Global implementations lead to other issues as well. For example, systems are always on somewhere eliminating the "batch window" or "maintenance period" most IT organization are used to and requiring hot changes. It also develops new levels of customer relationships and intimacy and leads to more complexity as customer sites need to be linked and coordinated. IoT comes with global complexity at a scale that most companies have never experienced.

9 Be Ready for the Unexpected

IoT is dynamic. Companies must be ready to change rapidly. As new opportunities arise, the IoT platform will need to support unexpected demands. For example, it might need to incorporate mergers and acquisitions, manage other companies' equipment, or manage information for a different company.

Another way IoT implementations scale is internally. IoT impacts every department and can help in unforeseen ways. One example is helping Sales and marketing demonstrate equipment communication and connectivity real-time to prospective customers. It's very hard to predict what you'll need, and competitors will certainly not be standing still.

The IoT implementation may also need to rapidly react to competitive threats. Companies will invent the future on their own, but also find ways to leverage early adopters' experiences and investments. Companies should be able to experiment cost effectively, often without investing in hardware, by using device data emulation tools. The needs might not be what you expect, requiring significant flexibility from the IoT Platform. A commercial IoT platform will likely incorporate capabilities already in place in other companies.



Tom Duff President, Hollis Controls "The IoT platform adds sex appeal to the product. Sales puts the units on a map of the world and shows that to their end customers using out of the box functionality in the platform. It's much better than showing the product at a tradeshow!"



Business Process Manager, Compressor Company

"I'm afraid we'll run into a new world where connectivity will be expected to be free of charge for every product and we will have a huge operating cost. The cost will come down, but have to find other ways to get the money back."



10 Be Ready to Evolve

The one thing we know for sure is that things will change. Companies across the globe are making significant investments at all levels from chipsets up. This will create a need to incorporate the leading edge of technology at the same time as dealing with legacy and obsolescence issues. Of course, many start with equipment in the field that might be considered "obsolete" from an IoT perspective, but are just one decision away from needing to be retrofit with sensors, processors, and/or communication devices.



"Another company similar to ours in another industry developed an IoT platform and it's now a dinosaur architecture for IoT."

Engineering Manager, Plastics Processing Equipment At this point in time, companies should simply expect that anything they build will need to change, perhaps drastically, or be replaced as the IoT industry matures. We will almost certainly see more sensors incorporated deeper and more broadly in the product set. We will find ways to gain more insight from longer and larger data sets, and advances to analytics tools and machine learning will provide more insight into current and predicted product behavior. This is a tremendous amount of innovation and investment. It's hard to stay on top of it, let along take advantage of it, on your own.



Business Process Manager, Compressor Company "In another phase we want to give the data to our product companies that build the machine to close the loop. Then, we can design a machine, see how it works in the field, and feed that back into the design."



Don't Go it Alone!

Few companies, if any, should develop IoT infrastructure on their own. The transition to an IoT-enabled business is a valuable, but challenging journey. It's important to recognize that it's a business transformation and partner with the right advisors and technology providers. Most companies' IoT initiatives will demand a wider selection of more advanced IT skills than they can afford. Even those with advanced skills will likely benefit by focusing internal efforts on use cases and changing relationship with customers and focus on core competencies and the big picture.

Finding a partner that can provide scalable, full-featured IoT infrastructure allows companies to focus their IoT investments. They should look for a partner that's looking further into the future than they can afford to and working with other companies to learn. The partner should also have specialists in each of the critical IT disciplines. Finally, recognize that this will be a dynamic journey with starts, stops, and surprises. They should also look for assurances that the partner will be able to keep up and continue to invest in the future as the industry matures.



Tom Duff, President, Hollis Controls "I don't see how you can possibly get what you need for the amount of money paid for the platform, you couldn't do that on your own. It's cheaper when you work with someone that's doing it on a bigger scale."



Engineering Manager, Plastics Processing Equipment

"There is no way a company of our size would have chosen to do this ourselves. We have enough trouble with the business transformation, the technical effort would have been outside of our reach; it would have been overwhelming. In only became viable when an integrated, cloud-based platform came within reach, was affordable, and deployable."





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About the Author

Jim Brown is the President of Tech-Clarity, an independent research and consulting firm that specializes in analyzing the business value of software technology and services. Jim has over 20 years of experience in software for the manufacturing industries. He has a broad background including roles in industry, management consulting, the software industry, and research.

Jim's experience spans enterprise applications including PLM, ERP, quality management, service lifecycle management, manufacturing, supply chain management, and more. Jim is passionate about improving product innovation, product development, and engineering performance through the use of software technology.

Jim is an experienced researcher, author, and public speaker and enjoys the opportunity to speak at conferences or anywhere he can engage with people with a passion to improve business performance through software technology.

