Optimizing IIoT Time to Value
with IT-OT Alignment
in Manufacturing

There is a popular saying that if you want to go quickly, go alone, but if you want to go far, go together. These wise words are particularly applicable in manufacturing, where effective production requires the precise coordination of a variety of moving parts. But, historically speaking, this mantra has not extended across the full breadth of industrial operations. In particular, information technology (IT) and operational technology (OT) teams have traditionally worked largely independently of one another – though exceptions do exist.

Now, technological advances are disrupting the status quo. The rise of connected factories and digital transformation initiatives – specifically Industrial Internet of Things (IIoT) projects – is forcing manufacturers to rethink conventional, siloed operations. Thanks to IIoT, operational data is more accessible than ever, presenting a massive potential value in the form of opportunities for businesses to gain unprecedented clarity into operations to enhance decision-making, efficiency, and performance. Amplified by intense competition and the harsh realities of economic and regulatory demands, the allure of these benefits is driving IIoT spending to an estimated $189 billion in 2018[1] as manufacturers search for an edge.

But it's not as simple as just installing equipment sensors and upgrading software. Effectively deploying IIoT in an industrial environment is a very complex undertaking that requires a careful, strategic approach. And even then, there is intense pressure to demonstrate return on investment (ROI) in short order and continue scaling across operations to maintain a competitive edge[2]. Achieving maximum benefit in the least amount of time takes coordination and cooperation across multiple departments, and bringing IT and OT together is a critical step.
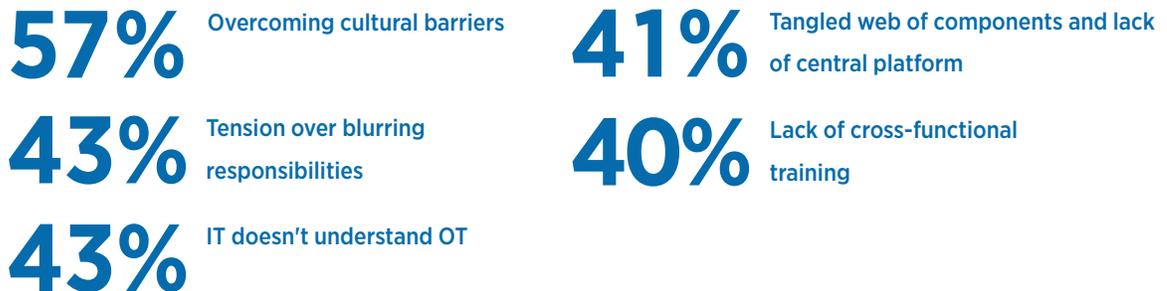
BSQUARE

The IT-OT Disconnect

There are a variety of technological obstacles to overcome to bring IT and OT together, and a quick online search will turn up volumes detailing those challenges as well as how to conquer them. However, the organizational aspect of IT-OT alignment receives far less attention, even though the structure of this working relationship is equally vital to IIoT success.

While there are both historical and current examples of successful cross-functional collaboration, aligning these two inherently different organizations is no easy task. The rift between IT and OT runs far deeper than separate executive leadership. In a recent survey, 57% of professionals with active IIoT projects cited "overcoming cultural barriers and organizational silos" as their biggest obstacle in achieving alignment[3]. Issues around who's responsible for what, unfamiliarity with how each other works, and lack of system organization were also popular responses.

Shared Challenges

Companies aligning IT-OT face the following obstacles[4]:

57% Overcoming cultural barriers

43% Tension over blurring responsibilities

43% IT doesn't understand OT

41% Tangled web of components and lack of central platform

40% Lack of cross-functional training

The IT-OT Dilemma

Differing missions, priorities, culture, philosophies, education, and background are just a few of the factors shaping the contrasting world views that drive a wedge between these two organizations. Furthermore, intangibles can vary greatly from one company to the next, so there's no uniform guidebook for this relationship. That said, obvious differences in hardware, software, and operating environments provide further context for this departmental divide.

In addition to expected technological differences between companies, the perception of IT's role and responsibilities can differ across a manufacturing organization. Typical duties include supporting business and administrative functions and providing network access and connectivity. Their focus on a digital environment makes things like data processing speed, system reliability, and security primary concerns. As such, IT has had to embrace rapid innovation and change to keep pace with developing technology.

Focusing on production environments and interactions in the physical world often ties OT activities directly to the bottom line of the company. Reliability and longevity of business-critical assets are primary concerns, especially since output goals are often on the line. Equipment can cost hundreds of thousands of dollars and, in some cases, operate virtually nonstop, in harsh conditions, spread over great distances for decades at a time. Additionally, automation and control systems tend to operate in isolation and correspond to a single specific machine and/or manufacturer. Maintaining long-term stability over a widely dispersed asset population running on a combination of unique or custom systems has made OT more resistant to change, and late technology adopters.

Nonetheless, collaboration is not unprecedented. A host of manufacturers have initiated intermittent projects that blurred the IT-OT lines throughout the years. Initiatives generally centered around adapting elements of IT for more industrial

> Successful OT-IT teams collaborate to build cross-functional trust, respect, and synergy.
>
> # 70%
>
> of Best-in-Class companies are implementing IT-OT convergence; a rate 25% greater than all others[5].

IT-OT Overview

IT consists of technology, systems, and applications to manage business data and support front-office processes.
- Generally reports to the CIO
- Applications managed can include ERP, MES, EPM, MWFM

OT consist of technology, systems, and applications to manage production assets and support smooth operations.
- Generally reports to the COO
- Applications managed can include PLC, PCD, SCADA, SIS

> *For industrial and asset-intensive companies (such as manufacturing, energy, oil and gas, and transportation), OT forms the operating platform of the organization[6].*
>
> **- Gartner**

environments – such as Ethernet networking and programmable logic controllers (PLCs) – and addressing security issues. These pioneering efforts provide a hint of what cooperation can achieve, paving the way for subsequent joint ventures that are becoming progressively commonplace as technological advancement has accelerated.

The permeation of "smart" equipment has also led some manufacturers to build technology support units within the OT organization to carry out IT functions. This approach is effective on the department level in terms of facilitating technology upgrades and can help bridge the culture divide by introducing some of the IT point of view into OT. However, it is inefficient on a company-wide level as it requires redundant personnel and resources, making large-scale implementations cumbersome.

The common thread of IT-OT interactions to this point is that each was born out of necessity. But now, to effectively seize the new opportunities advancing technologies present, manufacturers must take the next step. Adopting a proactive approach to IT-OT alignment makes it possible to unlock the full potential of IIoT – helping industrial businesses stay ahead of the curve, avoid technology-enabled disruption, and gain a competitive advantage.

The IT-OT Convergence

Though it's been around in some form for years, the proliferation of machine connectivity has shifted into overdrive – steadily infusing OT with elements of IT. These increasingly digital assets set the stage for IIoT to provide access to previously unavailable data. But deploying new technology is only part of the equation.

True digital transformation begins once an IIoT initiative has achieved strategic importance company-wide. It's at this point that companies recognize the need to look beyond old ways of running a business and rethink conventional corporate structures. This realization enables deeper exploration into new avenues for taking advantage of data coming from operational equipment in concert with other data sources and business systems to fully assess what's possible.

For instance, instead of focusing solely on monitoring and watching individual machines, the OT team can look at opportunities to partner with IT – along with other stakeholders – to collect and analyze data from all connected operational equipment. Such cross-functional efforts are a major step in giving companies a more holistic perspective to help identify inefficiencies and achieve objectives that can maximize ROI, like reducing downtime-producing failures, optimizing performance, and promoting longevity.

In 2021, worldwide IoT spending is projected to reach

$1.1

trillion[7].

The ARC Advisory Group's IT and OT convergence maturity model describes the relationship between people, process, technology, and measurement at various degrees of convergence. At the highest level, organizations have strong teamwork internally and with partners, engage in continuous improvement processes, use technology as a competitive advantage, and have clear metrics for success.

ARC developed a maturity model illustrating operational characteristics of industrial organizations at various levels of IT-OT alignment. Companies experiencing the most IIoT success generally exhibit the following:

People
A strong sense of teamwork exists across the organization and people feel empowered

Process
Continuous improvement of work processes for IT-OT

Technology
Leading edge technology deployed as competitive advantage

Measure
Collaborative metrics aggregated both internal and external

The ARC Advisory Group's IT and OT convergence maturity model (Level 5)[8]

Working extensively with industrial companies provides exposure to manufacturing environments across the spectrum of IT-OT maturity. It's not uncommon to find a variety of teams toiling away on disjointed, small-scale technology initiatives. Although these may fit into the overall IIoT category, they may not be recognized as IIoT projects. With minimal communication across departments, it can take work to even identify how many of these siloed skunkworks efforts are even in progress.

A company's level of IT-OT alignment, as well as overall IIoT strategy, is generally readily apparent very early on. And it can run the gamut from initial exploratory phase to issuing an RFP tied to strategic business metrics. However, while the latter will typically see value on a shorter timeline, manufacturers at any stage of IT-OT maturity can achieve ROI with the right strategy, support, personnel, and partners.

"Managing complex enterprise-wide transformation is a full-time executive-level job[9].

- McKinsey

In general, IT-OT disconnects and the lack of a dedicated leadership structure go hand-in-hand. Even so, companies still recognize how valuable data is becoming. So, left to their own devices, various business units and operations teams end up tackling a surprising number of individual IIoT projects, usually focused on solving specific, small problems.

For example, IT may be prototyping a system of sensors and software to help track and manage computer and networking equipment inventory, or a system to push software updates to mobile devices. At the same time, OT may be focused on a system that generates alerts for a piece of mission-critical factory equipment to notify plant managers if something happens that will negatively impact production.

More often than not, these siloed skunkworks efforts end up on the scrap heap due to lack of scalability or objectives that don't align with organizational priorities. And those that do survive can limp along for years in relative obscurity without generating tangible ROI. Neither is a particularly desirable result. That said, manufacturers don't have to blindly accept this fate, but avoiding it takes work. First, trying to identify these little unsanctioned projects can turn into a lengthy scavenger hunt. Then comes the exercise of figuring out a way to legitimize them, procuring the necessary funding, and securing the support they need to become a strategic part of the business.

When analyzing the performance of different manufacturer's IIoT initiative, the companies that typically succeed on the most efficient timelines are the ones that establish a cross-functional team that represents all stakeholders at the outset. This oversight organization could take many forms – such as a steering committee, center of excellence, digital transformation unit, or digital innovation center.

Leadership and coordination are vital to successful organizational changes. Among Best-in-Class companies navigating IIoT and IT-OT alignment initiatives[10]:

53% employ a chief digital officer; a rate 27% greater than all others

43% establish a formal organization; a rate 12% greater than all others

Likewise, its makeup and aim can vary, though at a high level the purpose is typically to unify IT-OT activities to streamline IIoT adoption as well as review any current projects underway to determine if any points of synergy exist.

No matter how this takes shape, executive awareness and support is critical. Companies generally designate a capable c-level candidate to head these organizations – popular titles include chief digital officer, chief IIoT officer, and chief information officer. In addition to guiding IT-OT alignment, this leader must foster discussions around how the business views technology in general – and IIoT specifically – strategy and motivations for adoption, and outline objectives to target.

While the paths to aligning IT and OT may look very similar in a vacuum, manufacturers with more mature IT-OT convergence initiatives before implementing an IIoT solution experience accelerated time to value. That said, companies taking a learn-by-doing approach to aligning IT and OT while beginning to explore IIoT opportunities can absolutely still achieve their ROI objectives, it may just take longer to get there. So, investing time and resources to solve the challenges of uniting the efforts of IT and OT teams, as well as broader IIoT and digital transformation initiatives, pays even greater dividends the earlier it occurs.
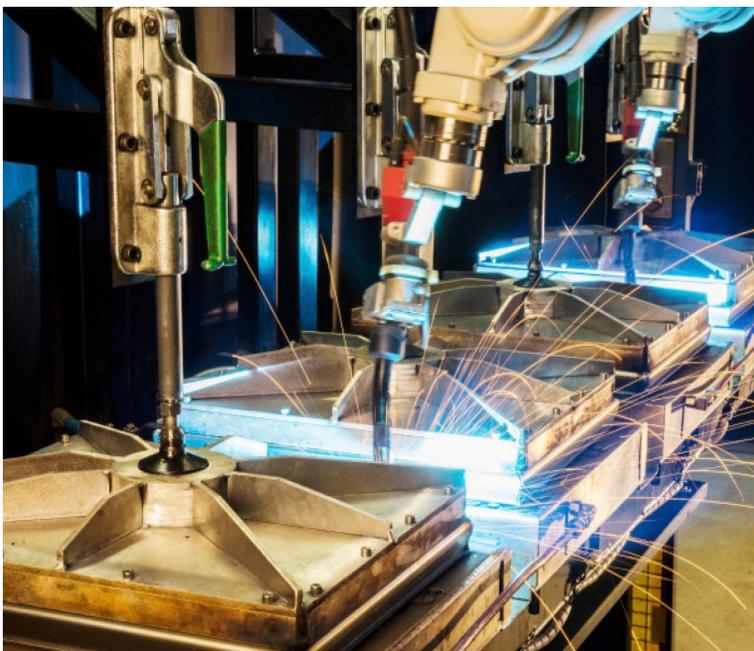
In addition, well-planned organizational structure and strong leadership also help balance limited resources with seemingly unlimited benefit potential. Which is important because as soon as managers realize what IIoT can do for their department, everyone will want their own initiative to solve their own problems. Attempting all these projects at once isn't realistic, and a mature IT-OT organization will be able to build a roadmap to attack these needs in a strategic and fiscally responsible manner. So how do companies get to this point?

How to Succeed with IT-OT Convergence

Here are the steps manufacturers are taking to maximize IIoT ROI through IT-OT alignment:

Secure management buy-in. One of the most important elements in successfully bringing IT and OT together, and the success of any broad-scale IIoT initiative by extension, is buy-in and support from upper management. IIoT must be considered a strategic initiative from the top down in order to ensure collaboration across functional and territorial boundaries. Management must make it clear that the effort is good for the company and as such, requires agreement among the various stakeholders to work together on execution.

Create an organization responsible for IIoT. Of the numerous companies, across a spectrum of industries, investing in IIoT solutions, a typical hallmark of the most successful is the presence of well-defined overlay organizations. Viewing IIoT initiatives – and IT-OT alignment by extension – as ongoing is a key factor, as constant monitoring, maintenance, and innovation are necessary to ensure a deployment evolves to continuously meet the internal and external demands facing manufacturers. Steering committees with cross-functional representatives or dedicated centers of excellence-type organizations are best suited to take on the task of understanding the challenges likely to arise, looking for operational efficiencies between groups, and evaluating standards and technology options in concert with any systems and solutions already in place. Some companies have even created entirely new management positions, such as chief digital officer. Regardless of the details, it's important to treat the initiative as its own entity and not simply an offshoot of an existing cost center.

Establish clear strategic goals. Once management support and team leadership are in place, clearly defining the strategic goals driving the initiative is an essential step. This is a good time to brainstorm all possible opportunities, thinking outside the four walls of the business to consider how the IIoT initiative might integrate with others in the supply chain. Starting from raw material acquisition to post-sale customer relationships, examine supply chain implications, partners, or any other element that intersects any point along the chain.

Develop a data management plan. Planning for data management needs up front is a must. One of the benefits of IIoT is that it provides the ability to set policies, partitions, and different views of data. Companies can establish data sharing controls to dictate which information becomes public, without compromising the privacy of sensitive material.

Enlist stakeholder participation. As these elements come together, bringing in stakeholders from across the company will become necessary. Representatives from departments such as legal, marketing, and support and repair organizations can help guide privacy policies and enhance insight into the company's new strategies and potential business models.

A Common Aim

Companies integrating IT and OT are focused on[11]:

58% Reducing operational costs

57% Optimizing business processes

49% Improving intra-company communications

47% Improving interoperability and standards management

45% Improving security policies

A digital transformation or IIoT initiative has the power to produce an entirely new business asset – the company's data. This added resource may be the most valuable tool a company can use to build a competitive advantage. At the same time, it can create an equally substantial competitive disadvantage if misused. A critical caveat since, despite the wealth of companies achieving success with IIoT, there is a lack of widely used best practices available to guide policy creation around data privacy as well as data sharing across OT and other business-facing departments. Fortunately, this standards gap will undoubtedly disappear before long, as more IT and OT organizations converge and roll out successful IIoT deployments. In the meantime, the guardians of the company's security and privacy practices must remain intimately involved with IIoT planning until such guidelines emerge and become more accessible.

Build strong partnerships to overcome weaknesses. A company must recognize the areas where it has extensive knowledge. Likewise, it must be honest about areas outside its core competencies. Bring in partners that can work closely with the internal IIoT team and subject matter experts (SMEs) to determine how and where to apply the appropriate technology. Purpose is a key element of success with these projects, so do not attempt to deploy technology just for technology's sake. Always set clearly defined business goals to pursue, with metrics established to measure success.

> *We starting to see a wide range of IoT use cases across virtually all industries. But, the big challenge now is demonstrating return on investment. Executives need to validate the contribution that IoT can make in order to justify large-scale rollouts[12].*
>
> **- Chet Geschickter, Gartner Research Director**

Optimizing ROI by Aligning IT-OT

Machine health is one of the top challenges driving IIoT deployments, according to manufacturing respondents to Bsquare's recent IIoT Maturity Survey. The most cited applications include predictive analytics to help flag potential failure conditions before they cause costly unplanned downtime and condition-based maintenance to service machines only when needed to lower the cost of equipment upkeep and increase longevity.

Fulfilling these objectives for a single department or asset population is a good start, but scaling an implementation across an entire manufacturing operation without a joint effort from IT and OT teams is a tall order. Such cross-functional cooperation also helps unify the company vision and direction. Meanwhile, as connected equipment comes online, it provides access to unprecedented, real-time operational insights to enhance decision making.

By joining forces, IT and OT teams are able to eliminate redundancies to reduce costs and streamline operations. In fact, IDC predicts that 35% of large global manufacturers with smart manufacturing initiatives will integrate these two organizations to achieve advantages in efficiency and response time by 2019[13]. This union also enables IIoT capabilities that can help optimize production and logistics, which is another top application cited by survey respondents.

For example, an IIoT system can learn the steps and functions required to shut down a production line and reconfigure it for a new production task. Rather than requiring human operators to change machine settings, the system can automatically modify the configurations of all equipment in the line that are necessary for the new task. This rapid reconfiguration can significantly improve output volume and efficiency, allowing for more economical use of factory space and operator time. And as the system ingests more internal and external input, such as parts and repair applications, the IT-OT team can continue to evaluate other areas of the business where the resulting insight can enhance operations – from improved maintenance and repair processes to better product quality.

By optimizing IIoT initiatives and facilitating application scalability, IT-OT alliance enhances manufacturing operations:

- Analyzing real-time equipment data in conjunction with other contextual information to identify changes in a machine's operating condition that may signal an equipment failure or a maintenance need.

- Running simulations on digital models of equipment and systems – and examining the results in context with historical maintenance and repair information – to predict outcomes such as possible breakdowns.

- Using data-driven analytics to pore through massive amounts of information to rapidly recognize patterns or changes that would take days or weeks for human analysts or data scientist to evaluate.

- Incorporating input from the company's SMEs, to enable system rules creation to define what conditions should generate alerts for further examination.

- Applying machine learning to repeated responses and actions, to build intelligence and perform complex automated actions under certain circumstances.

Ongoing IT-OT Collaboration

In many situations, once a pilot program has proven successful, IIoT projects encounter obstacles when expanding beyond the initial narrow project scope. This underscores the importance of embracing IT-OT alignment as an ongoing initiative. Prototyping a system for a small number of asset with a limited scope

and environment is pretty straightforward. However, as more equipment comes online, each addition generates massive amounts of data that requires analysis to achieve optimal results. This information overload can easily push an ill-equipped deployment to the breaking point.

For the greatest business benefit, IT-OT teams must work together to scale an IIoT system to hundreds of thousands, if not millions, of endpoints. Planning is essential to attaining this level of scalability, and the corresponding security, as retrofitting is not an option – manufacturers must account for growth from the start. Partnering with IIoT platform solutions is an efficient way to secure the agility, flexibility, and functionality required to scale, along with the tools and support to ensure reliable long-term use.

As adoption grows,

75%

of IoT adopters will turn to outside firms for help developing, implementing, and/ or managing these initiatives[14].

In fact, these systems can take advantage of the data existing factory systems already collect and bring it together with other real-time machine data and contextual data sources to provide true scalability and support for multiple beneficial use cases.

Additionally, IIoT providers can supply the added value of industry expertise in data acquisition, management, and analysis. On top of the innate advantages this expertise delivers, bringing IIoT specialists on board has the supplemental benefit of freeing company resources to focus on its core competencies. Finally, the union of IIoT experts with internal IT-OT teams and cross-functional stakeholders enables continuous improvement of manufacturing processes and the system, resulting in ever-increasing levels of accuracy, automation, and overall business value.

The Finish Line

It's easy to place disproportionate focus on digital challenges – like technology, hardware, software, or sensors – when bringing IT and OT together. After all, these form the core of each organization's mission statements. But there are operational and human elements that are equally crucial to effective IT-OT collaboration, as well as efficiently optimizing ROI through IIoT initiatives.

Manufacturers that embrace the proper management and organizational building blocks, goal-setting and planning, skills awareness, and technical solutions can transform factory operations in fairly short order. Whether it's accelerating the ability to quickly reconfigure a production line or establishing touch points with end-user customers, IIoT is an affordable technology that should show measurable results within a year. However, the success of one or two initial projects is not the finish line.

For factories, the Internet of Things offers a potential economic impact of

$3.7

trillion a year in 2025[15].

Ongoing IT-OT collaboration is key to success with IIoT as part of a digital transformation or Industry 4.0 initiative. With organizational and leadership unity, IIoT technology has nearly limitless opportunity to improve business outcomes and expand the potential for new revenue streams far into the future.

About Bsquare

For over two decades, Bsquare has helped its customers extract business value from a broad array of assets by making them intelligent, connecting them, and using data collected from them to improve business outcomes. Bsquare software solutions have been deployed by a wide variety of enterprises to create business-focused Internet of Things (IoT) systems that can more effectively monitor assets, analyze data, predict events, automate processes and, in general, optimize business outcomes. Bsquare couples innovative software with advanced professional services that can help organizations of all types make IoT a business reality.

Endnotes

1   IDC, "IDC Forecasts Worldwide Spending on the Internet of Things to Reach $772 Billion in 2018," December 2017.
2   Gartner, "Gartner Survey Shows That 43 Percent of Organizations Are Using or Plan to Implement the Internet of Things in 2016," March 2016.
3   Brian Buntz, "Survey: Why IT/OT integration is so tough," IoT Institute & the Industrial Internet Consortium, July 26, 2017.
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