

## **Digitally Transforming to Autonomous Operations and Smart Manufacturing 4.0**

At Yokogawa's 2021 virtual conference, industry-leading experts sat down to discuss an autonomous future that requires digital infrastructure that spans the entire operation and integrates data, smart devices at the edge, and robust hardware and software that deliver the necessary level of flexibility, adaptability, and resilience. Taking part in the discussion were Cor Beetsma, a control system veteran who has a great deal of experience with large-scale projects, Naveen Kashyap, an IT/Cloud application development expert, and Brad Ford, an executive with expertise in the human aspects of transformation as well as business strategy and process consulting.

### **Why should leaders act on Digital Transformation, Autonomous Operations, and Smart Manufacturing?**

Describing a key driver Ford states, "Significantly aging populations characterize some societies such as in Japan and Taiwan. If they fail to transform to autonomous operations, they will literally run out of people to operate their plants. In Australia, the high cost of the labor force has resulted in facility shutdowns. Therefore, there is a drive to bring costs down to sustain the business. In Russia, regionalization is a major issue. Plants are in remote areas while people want to be in cities. The key is to allow remote operation of plants while the expertise resides in the cities."

Ford added that "while machines get it right every time, humans make mistakes. But humans do have value to add. Where can that be best utilized? Within plants, automation systems offer the advantages of accuracy and faster response times. However, the leaders in autonomous operations and Smart Manufacturing are taking advantage of scalability by leveraging global human subject matter expertise to optimize across a broad range of their assets."

According to Kashyap, "major drivers are complex, distributed, dynamic value chains and the crew shift with considerable experience and savvy walking out the door on a daily basis. Autonomous operations and Smart Manufacturing deliver the power of data throughout the enterprise. Across the industry, there is focus on operational efficiency and operational excellence—and a new focus on sustainability."



Beetsma stated, "According to our survey, two-thirds of the companies are working on autonomous operations. There still exist the realities of the delivery, how to bring it about, how to make sure that the value of technology utilization is realized. We do this in a pragmatic sense and learn from each other."

### **Are Autonomous Operations and Smart Manufacturing Possible Today?**

Expert answers ranged from "feasible" to "yes, but..." to "not yet, but..."

Beetsma opined that autonomous operations are not feasible yet due to architecture issues and the fact that end-users are grappling with risks. But it is not a matter of technology. He went on to offer some tips for success.

"Start the project with a return on investment (ROI) viewpoint. Smart Manufacturing is a must, an enabler of everything else. It is imperative to establish, upfront, an architecture that incorporates ET, IT, and OT know-how. Start with a proof-of-concept, then scale up. Human intervention will subside only when the autonomy is proven. That will take time."

	Autonomy Level	Stage	Attribute	
Industrial autonomy 	5	Autonomous Operations	The facility is completely autonomous including process operations, supply chain, etc. <i>System of systems</i>	Remote Ops Unattended Ops
	4	Autonomous Orchestration	The facility operates autonomously, synchronized to optimize manufacturing and safety under most circumstances. <i>Autonomous systems</i>	
	3	Semi-Autonomous	A mixture of autonomous and automated assets with human orchestration. <i>Autonomous components</i>	
Industrial automation 	2	Automated	Humans are responsible for safe operations, assisted by traditional automation systems	
	1	Semi-Automated	Humans and automation systems share the workload, with humans responsible for safe operations.	
	0	Manual	Humans control the facility at all times.	

**The Autonomous Operations Maturity Model**

In Kashyap’s opinion, “Smart Manufacturing is possible today. Today’s data analytics algorithms and massive scalability are the key enablers. However, ‘zero-touch,’ completely autonomous operations are not here, yet. Many companies are not ready to tackle the risk aspect, but that will be just a matter of time.”

Ford feels that autonomous operations are possible, now, primarily for greenfield projects. For existing plants, on the other hand, technology and culture are the major issues. “Technology is primarily a matter of expense, not only for a new purchase but the cost of downtime while changing out an existing technology. Meanwhile, culture is a core limitation. Digital transformations must overcome years of ingrained processes and attitudes. Obstacles range from aging standard operating procedures to the influence of labor unions.”

“It is encouraging that some companies have already built cultures that are aligned to enable autonomous operations. Other operations have made significant progress, such as the offshore upstream industry centralizing their subject matter expertise and implementing autonomous remote operations.”

**What are key accelerators and inhibitors?**

According to Kashyap, “The main inhibitor is a company’s inability to visualize the ideal, end-to-end state of the value chain. Users are bogged down by existing systems and their limitations, such as providing far less data than they need.” Kashyap used the term “tech debt” to illustrate the composite results of all the technical decisions and tradeoffs, often based on cost, the organization has made and how it must overcome the limitations of the technology now in use.

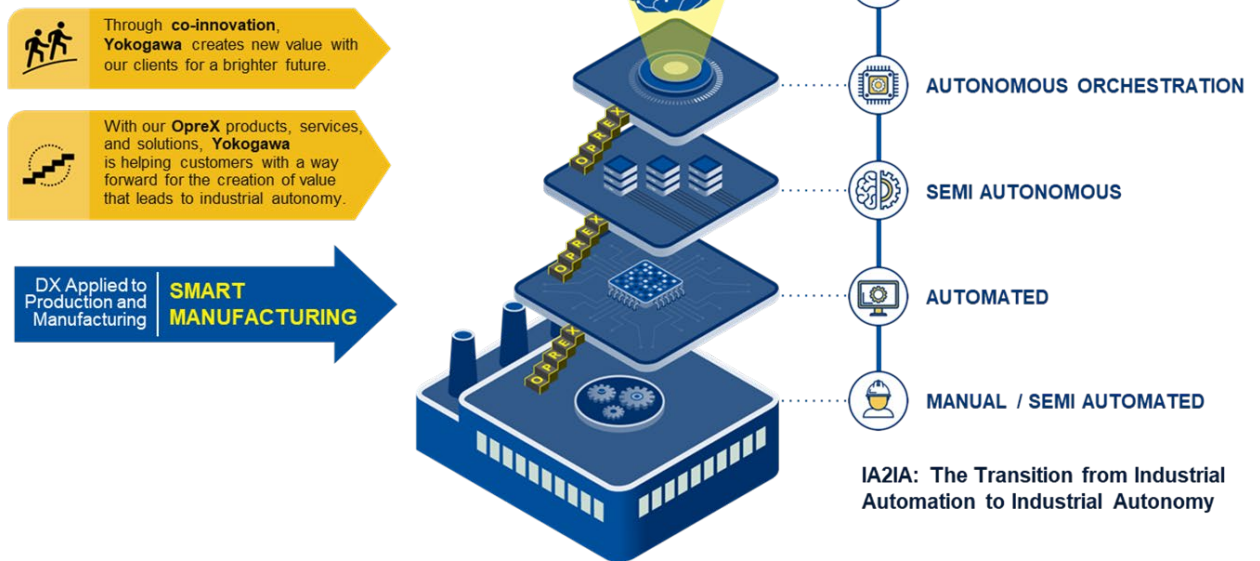
The organization can overcome the tech debt when people realize that technology is not the driver but an enabler of new business processes. A long-term *technical* vision, architecture, and roadmap support the long-term *business* vision and roadmap.

Kashyap continued that skill sets must also comprise a significant focus. The development, deployment, and upkeep of an autonomous operation will require new skills. Ford added that “companies pursuing

autonomous operations require communication, collaboration, and the ability to grasp and learn technical concepts. Those are just the skills that young computer gamers exhibit.”

Touching on his earlier comments about culture, Ford stated that the involvement of the front-line staff is essential to digital transformations leading to autonomous operations. Harnessing the vast knowledge at the front lines significantly increases the chances of success. That also means changing the “tribal” organization, in which the “tribal knowledge” is siloed, to a collaborative organization, which allows the entire enterprise to take full advantage of the knowledge.

## Industrial Automation to Industrial Autonomy (IA2IA)



**Digital transformation leads to industrial autonomy.**

### One Last Bit of Advice

When asked what is the one thing you would advise to customers who have decided to pursue autonomous operations, Kashyap urged users to avoid the concept of “tech perfect.” Instead, focus on redefining the overall customer experience and business process. Technology will follow.

Ford advised users to pick one facility. “It doesn’t have to be perfect but pick a facility that is, ideally, lower-risk but high in terms of operating cost. Move that facility at 100% full speed to achieve autonomous operation so you can prove to the rest of the organization that this can be done. That gets people who are on the fence to ‘yes, but’ rather than ‘no, but.’”

According to Beetsma, “you will need to reconsider the role of procurement. For instance, instead of ‘going it alone,’ engage a supplier such as KBC/Yokogawa as the lead autonomy architect. Think of it as a lifecycle integration challenge. Most clients are worried about how decisions made early in the project

affect the long trajectory. An experienced architect will be able to guide the process so that early decisions prove themselves rather than causing problems later on.”