SEIZING INDUSTRY 4.0 OPPORTUNITIES IN JAPAN

OPPORTUNITIES & BARRIERS TO IMPLEMENTATION OF INDUSTRY 4.0 IN JAPAN
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As the birthplace of several manufacturing techniques utilized all over the world, Japan is now positioning itself to introduce next generation smart manufacturing. Japan is a world leader in robotics and manufacturing, with a proud tradition of global technology leaders.

Japan is still lagging behind Germany and the US in terms of smart manufacturing implementation, but Japanese companies still have a firm belief that connected manufacturing will strengthen their competitiveness. This will create opportunities for companies who are willing to partner with Japanese companies and gain a foothold in the world’s third largest market.

What is Industry 4.0?

The next industrial revolution is taking shape around the globe. Also known as “Industrie 4.0” (Eng. Industry 4.0) in Germany and “Industrial Internet” in the United States, machines and production facilities are connected to the internet to enable them to communicate with each other. This modern application of existing technology, together with newly developed technology used to connect manufacturing equipment as well as to collect, observe and analyze new sorts of data, helps streamline the production and optimize the business.

Industry 4.0 was started in Germany and spread to the USA

Actors within the German manufacturing industry felt threatened by American Internet companies, such as Google and Apple, and they believed that if the manufacturing industry would not adapt to the new trends of increasingly sophisticated and connected devices in both manufacturing and society, the IT-companies would eventually enter and dominate the manufacturing industry, just as they dominate the consumer market for software. Through this pressing need, Industry 4.0 was born, creating a platform in order to support development of a more modern and connected German manufacturing industry. The term quickly gained popularity and has now been adopted in many countries to describe the concept of connected manufacturing.

In 2014, five American corporations founded the Industrial Internet Consortium (IIC) in order to help set standards for the Internet of Things (IoT) and how machines share and move data. The five founders, AT&T, IBM, Cisco, Intel and General Electric wanted to set these standards in order to help increase the market size for the IoT Industry and improve product development.

Japan is lagging behind in implementation of Industry 4.0 applications

According to a survey by McKinsey & Co, Japanese companies are highly optimistic about the potential for Industry 4.0, but Japanese companies are still lagging behind their American and German counterparts, both in terms of preparedness and implementation. Only 16% of respondents consider their companies to have made substantial progress regarding Industry 4.0 related initiatives.

Furthermore, in a study conducted by IDC, 16.5% of surveyed Japanese companies in 2014 expected to have established an IoT team by 2015, but the actual result was only 1.5%. This is also consistent with the trend in Industry 4.0 related R&D spend in the aforementioned
McKinsey study. It is interesting however to note that Japan has the highest percentage of respondents considering the R&D spend to be sufficient, even though their spend is lower than that of the German and US counterparts.

Chart 1: Progress of Industry 4.0 introduction at companies

Despite Japan lagging behind the US and Germany in terms of implementation, 82 percent of respondents are still as positive or more positive as they were last year regarding Industry 4.0 related initiatives. The vast majority also expect a significant boost to their company’s competitiveness as a result of implementations of Industry 4.0 methodologies.

As in many other countries, the bigger corporations are the main drivers behind the implementation of Industry 4.0 related initiatives. Japan has a large share of the world’s hidden champions, companies that are dominating the global market within their respective niches, but that are relatively unknown to the general public and in the wider marketplace.

Many of these hidden champions keep production capacity in the factories of the bigger companies in order to adhere to the tight integration policies that many Japanese companies employ for their supply chains. Many of these hidden champions are vary of adapting Industry 4.0 related technology out of fear of having their technology leaked to outsiders as well as to other companies that are part of the supply chain.

**Key takeaway:** Japan is still lagging behind Germany and the US, but Japanese companies still have a firm belief that connected manufacturing will make them more competitive, and that advances within this technology will help their stave off foreign competition. Expectations of future investments in order to catch up to Western markets can create opportunities for companies who are willing to enter the Japanese market and partner with Japanese integrators.

**Japan: A manufacturing powerhouse**

Japan has long been a powerhouse in the manufacturing industry. During the period of rapid economic growth during the 1950s to 1980s, Japanese companies contributed with several innovations within manufacturing processes. Notably, they developed revolutionary production improvement systems such as Kanban and TPS (Toyota Production System).

Kanban was revolutionary in its way of enabling smooth communication between the different stages of the production process. The Kanban-system in turn made the development of the TPS possible. This through communication between different divisions, you could maximize the flow of goods and at the same time minimize storage levels. Industry 4.0 ushers the communication of different parts of the production process into the modern age.

Because of rapid demographic changes in Japan, the government sees an urgent need to boost the manufacturing industry to make sure future generations can sustain a society with a higher percentage of senior citizens. The Ministry of Economy, Trade and Industry (METI) has highlighted the need for Japanese companies to embrace the digital revolution in manufacturing, especially in a way that can help usher SMEs into the new age of manufacturing. There is a strong focus on furthering collaboration and information exchange, and Japanese companies have so far had a strong interest in studying the recent developments in Germany and the United States.

Through intelligent manufacturing, production can be optimized by for example programming machines to solve a stop in the production themselves by utilizing data from previous stops and artificial intelligence algorithms. Consequently the need for manpower for tasks such as surveillance of manufacturing etc, will most likely be greatly reduced in the near future, helping cost savings or freeing up resources for other tasks requiring more human surveillance.
IoT Market in Japan is forecasted to grow rapidly until 2020

The Japanese IoT market is estimated to grow to 13.8 trillion yen (126 billion USD) by 2020, or 2.2 times its size in 2015 and IoT expenditure is expected to total 137 billion USD in 2020. Revenue growth is estimated to be 11% annually between 2013 and 2020 and expenditure is projected to grow 17% annually between 2014 and 2020.

Table 2 – IoT revenue growth in Japan, billion USD

Table 3 – IoT Expenditure growth in Japan, billion USD

Since a lot of production data can be transmitted through narrowband services, a string of companies not usually associated with network infrastructure, such as Kyocera, stole a lead on the bigger telecommunication providers by partnering with a foreign company. Narrowband services do generally not require a license in Japan, and this type of connectivity will be able to service the vast majority of sensors etc that will be employed in a connected manufacturing setting, though prices are significantly lower than any corresponding broadband service.

The entry from new players into this realm prompted the bigger telecom to launch similar services at a low price point. Narrowband IoT services (NB-IoT) is a viable option, but there is still a great deal of uncertainty which standard will eventually become the global benchmark. Many IoT systems in Japan are also built using public Wi-Fi networks, which do not carry communication fees but they demand a large number of access points to cover a wide area and can be prone to disconnections and other problems. The long term price development in this space will have significant impact on the proliferation of Industry 4.0. Cheaper communication costs can significantly reduce barriers to implementation.

Industry 4.0 as a way to reignite Japanese international competitiveness

By connecting production data with consumer behavior data, a factory can dynamically respond to changing market demand by automatically adjusting the quantity and assortment of products that are to be produced. This can help greatly optimize production even further and also help countries reduce their dependency on foreign based manufacturing facilities, promoting re-shoring of manufacturing capacity across a variety of industries.
Japan has many world famous technology companies, but cooperation between these companies has been very limited, resulting in a fragmented market with competing standards for solutions across a variety of industries. Furthermore, Japanese technologies have often been described as suffering a Galapagos syndrome with technologies developed strictly for the Japanese market, in lieu with existing global standards. Such standards, while reasonably effective in shutting out foreign competition from the Japanese market, have also hampered exports of these technologies, since they were not compatible or appealing in foreign markets.

One of the major organizations in Japan working to disseminate Industry 4.0 related technology in Japan, Industrial Value Chain Initiative (IVI), is helping to drive scenarios where companies naturally collaborate, in order for the companies to build general connection models (reference models), rather than one all-encompassing model. IVI has dubbed this approach "loose standard", meaning an adaptable model instead of a rigid system. A rigid new system would create many complexities in a connected manufacturing setting, mixing old and new technology.

The Industry 4.0 initiatives now being formed in Japan have collaboration at its very core and this focus not only on domestic collaboration between Japanese companies, but also on collaborating with Germany and the United States to form global standards for related technologies.

A collaboration agreement between Japan and Germany was concluded on April 28 2016 between the Japanese Ministry of Economy, Trade and Industry (METI) and the German Federal Ministry for Economic Affairs and Energy (BMWi) and a memorandum of understanding with key organizations in the United States was signed in September 2016. This includes the Japanese Internet Acceleration Consortium and the American Industrial Internet Consortium (IIC) and with OpenFog Consortium.

Areas of collaboration include international standardization, cybersecurity, of international regulations regarding IoT and support for SMEs. The intentions from the Japanese government when they entered into these agreements was that through cooperation with the leaders within Industrial Internet/Industry 4.0, Japan could get a big role in influencing future international standards. This in turn could help Japanese companies get an upper hand in manufacturing compared to other nations.

**Key takeaway:** The solid growth of connected manufacturing expenditure and the entry of new players into the communication infrastructure realm makes this space open to new agile entrants that can provide innovative solutions for communications at a cost that do not weigh too much on the companies willing to adopt this new technology. Japan is still the world’s third largest economy and with double digit growth for Industry 4.0 related technology, combined with new entrants in the space can favor foreign entrants to partner with Japanese companies.

**Introduction of IoT technology would significantly impact Japanese manufacturing industry**

There are a few common insights that Japanese companies see as key applications that are enabled through introduction of Industry 4.0 related initiatives. On an overview level, big data in the industrial environment is showing great promise when it comes to optimizing the production process, and giving the production managers key insights into huge amounts of data that was previously very difficult to collect, let alone process. This includes various areas such as general quality improvement, energy savings and uptime of the production line itself.

As for the production process, one key area highlighted in Japan is predictive maintenance. Needless to say, by being able to better predict when tools etc need to be recalibrated or replaced, countermeasures and early warning systems can now more easily be implemented as a result of increased data availability. Furthermore, costs for maintenance can be reduced as well.

Until 2020, some of the biggest expected impacts of IoT related technologies globally will be the abilities to tailor products and services to end users, as well as being able to anticipate when products are nearing obsolescence. Furthermore, greater insights into user information and usage patterns will lead to greater insights for sales representatives and improved ability to deliver service. Furthermore, companies expect significant impact on their business models until 2020, including:

- Shift to product as a service model
- Increased share of revenues from service business
- Increased sales directly to end customers
- Sales of product/service related data to third parties

While in the west, key success factors for IoT related opportunities are often attributed to the ability to
identify and pursue new business and revenue opportunities, Japanese companies cite organizational and skills related factors are the most critical success factors for successful implementation. This includes having dedicated departments handling IoT related matters, as well as having people with a mandate to act on identified opportunities. Decision making regarding Connected Manufacturing initiatives in Japan is also more commonly pushed to lower organizational levels than corresponding American and German organizations.

Furthermore, companies naturally deem it important to have sufficient technical capabilities to utilize data for process, product and service development as well as for R&D related purposes.

Japanese companies have up until now spent less overall on IoT initiatives than European and US companies, but are slightly better at using IoT business to improve their service businesses. Japanese companies are ahead of western companies when it comes to shifting to product-as-a-service models, as well as sales of data to third parties.

**Key takeaway:** Key success factors according to Japanese companies are different than those usually cited in the west. In Japan focus is on organizational issues, and decision making regarding connected manufacturing initiatives is to a greater extent pushed to lower levels of the organization in Japan.

**Three major organizations head the Industry 4.0 development in Japan**

In Japan, there are three main organizations that are involved with Industry 4.0 related activities:

- Robot Revolution Initiative (RRI)
- Industrial Valuechain Initiative (IVI)
- IoT Acceleration Consortium (IAC)

**Robot Revolution Initiative**

The Robot Revolution initiative was started in 2015 and works to help strengthen work utilizing advanced sensors and artificial intelligence, while making the most of the advantages of digital technology as well as network technology. The Robot Revolution Initiative is backed by more than 200 companies and 90 organizations, including Toyota, Nissan, Komatsu and Fanuc, as well as foreign companies such as General Electric, Dassault Systemes, Intel and IBM.

The initiative has three main focus areas, where the third of these is concerning IoT in the manufacturing environment. It looks to assemble those who are most aware of this problem, e.g. control equipment and networking companies, IT/software vendor companies, various manufacturing companies, business organizations, to carry out the following activities:

- Share the knowledge of who has already put IoT to practical use
- Deepen the understanding of the merits of IoT application

**Industrial Value Chain Initiative**

The Industrial Value Chain Initiative (IVI) is the organization most closely corresponding to the German Industry 4.0 organization, and is driving the international exchange, as well as the government initiatives surrounding international collaboration. IVI is a forum to design a new society by combining manufacturing and information technologies, and for all enterprises to take an initiative collaboratively.

IVI is looking to promote global and borderless collaboration by win-win value chain partnerships, not only with manufacturing industries, but also through service industries. IVI provides a forum for these discussions, and strives to provide useful results of global applicability.

IVI has three main goals:

- Increase transparency between manufacturing sites
- Secure Japan’s future manufacturing capabilities and increase digitization
- Further exports of Japanese goods and services

There are currently 19 working groups built on business scenarios, formed to promote areas of potential collaboration, as well as four working groups to create loose standards.

The long term aim is to promote production of products with high value add across all company sizes, and to create a common ecosystem that also includes software and service providers to complement the manufacturing companies, as well as to explore how human-centric manufacturing will change with IoT and to determine the focus of the efforts of Japanese companies.

**IoT Acceleration Consortium**

The IoT Acceleration Consortium wants to establish technologies that enable demonstration and development relating to creation and facilitation of new IoT related business models.
The consortium aims to support activities such as:

- Development, demonstration, and standardization for IoT-related technologies
- Creation of various IoT-related project and recommendations such as regulatory reform necessary to run those projects.

Activities undertaken by the consortium itself includes:

- Development and demonstration including standardization work regarding technology related to IoT, Big Data, AI and other related fields
- Initiation of projects concerning IoT, Big Data, AI, etc, as well as drafting regulatory reform proposals, in accordance with project needs
- Security issues regarding IoT, Big Data, AI etc
- Gathering and distributing information relating to IoT, Big Data, AI, and similarly
- Business promotion in order to support the purpose of the Consortium.

Opportunities and barriers in the Japanese markets

Several distinct opportunities and barriers exist in the markets

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Opportunities in the Japanese market

Market disruption: IoT can help change the existing market dynamics, through the introduction of new business models. By responding more flexibly to customer needs, companies can create new revenue streams and reduce time to market.

Increased data accessibility: By unearthing the vast amount of production data contained within a single setting or manufacturing site, companies can use this data to make real time adjustments in order to improve both product quality and production efficiency.

Improved supply chain transparency: Through improved tracking capabilities, companies can further streamline their supply chain and inventory control operations. The just in time concept, made famous through the Toyota Production System, can be made even more efficient through Industry 4.0 related technologies.

Flexible operations: Companies can use combinations of big data and real time information applications to implement flexible pricing models in real time.

Secure solutions: Japan has for a prolonged period been a rather soft target for cybercrimes. Companies still have a long way to go to bolster their cyber defences and there are significant opportunities for companies that can offer solutions to help companies realize the full benefits of connected manufacturing in a manner that does not invite cyber criminality.

Barriers to implementation

Complexities of combining new and legacy systems: Many SMEs have limited possibilities to invest in state of the art equipment and will have to operate fragmented production environment, combining both old and new equipment in on production line. Bringing legacy equipment up to standard through retrofitting of equipment that enables connectivity, will present a significant challenge to smaller businesses.

Security policy flexibility: Policies are also very important to enable companies to make full use of the IoT enabled technology. While strong cybersecurity defences are vital in order to prevent hacking, overly complex and restrictive policies also hamper companies’ abilities to take advantage.

Regulatory hurdles: Japan’s regulatory system has a setup that is slightly different than in many western markets. Basically, in most Western markets, everything that is not explicitly forbidden is allowed. In Japan, it is often a requirement to obtain a permission in order to pursue activities within certain areas, significantly slowing the process down.

Key takeaway: With Japan still lagging western nations in terms of cybersecurity and proprietary communication protocols prevalent in the market through legacy systems, there are significant opportunities for foreign actors to seize the initiative and penetrate the market that is still hesitating, and penetrate the market with a solution that can be adopted globally by Japanese companies. While
domestic regulations can prove a stumbling block, Japanese companies have a large overseas manufacturing base, which usually needs to be targeted through company headquarters in Japan

**Important industry fairs and events**

Japan hosts two major bi-annual automation events, the System Control Fair (SCF) and the International Robot Exhibition (iREX). The two events are held in conjunction, providing a unique insight into Japan’s view on the Industrial Internet of Things (IIoT) and Industry 4.0. Furthermore, the Japan International Machine Tool Fair (JIMTOF) is the biggest manufacturing related event in Japan and is held biannually on even years.
By Petter Sund.

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Business Sweden and the manufacturing industry in Japan

Business Sweden has been present in Japan since 1965 when the first trade office was opened (The Swedish Trade and Investment Council was then established in Tokyo in 1972). Throughout the years we have built a far-reaching network of contacts with specialized market knowledge which facilitates expansion of Swedish companies and attracts Japanese investments. We have been working closely with the Japanese manufacturing industry for a very long time and have helped Swedish companies develop their business in Japan through relevant market insights.

We have observed a changing attitude towards international business practices and increased openness towards foreign collaboration among Japanese companies. Swedish companies with Industry 4.0 and Internet of Things related products and services should examine the opportunities in Japan’s bid to catch Germany and the US within these areas.

Please contact Business Sweden in Tokyo for a discussion about current developments, potential areas of interest and key stakeholders for your company in the Japanese manufacturing industry. 

tokyo@business-sweden.se

+81-3-5562-5000
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