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1 INDUSTRY OVERVIEW - INDUSTRIAL ROBOTICS IN INDIA

Studies have shown that industrial robot usage has a positive correlation with productivity of nations. Lack of skilled labor coupled with stringent labor regulations has incentivized the use of robots in new manufacturing plant installations. For Indian manufacturing to remain globally competitive, adoption of robotics is inevitable in the long term.

India stands at 13th position worldwide for robot usage with a CAGR of over 29% through 2010-14. In terms of metrics like robot density, India lags behind indicating a potentially untapped market. In 2014, 2126¹ new robots were installed in India with automotive industry accounting for 71% of the installations. The average robot density in Indian manufacturing industry is 2 robots per 10,000 employees whereas it stands at 58 robots per 10,000 employees in the Indian automotive industry. With 62% of the installed robots catering to the welding process, it stands as the top demand creator.

One of the unique aspects of this industry is the significant value creation opportunity in the after sales services like maintenance and supply of spare parts. Companies have innovated with this aspect to differentiate their offerings. FANUC is the market leader in India with total robot installations of 4700 units accounting for approximately 55%² of the market value followed by ABB. A critical aspect of FANUC's strategy is offering world's lowest maintenance contracts costing only Rs 3.40 per hour³.

2 INDUSTRIAL ROBOTICS – VALUE CHAIN

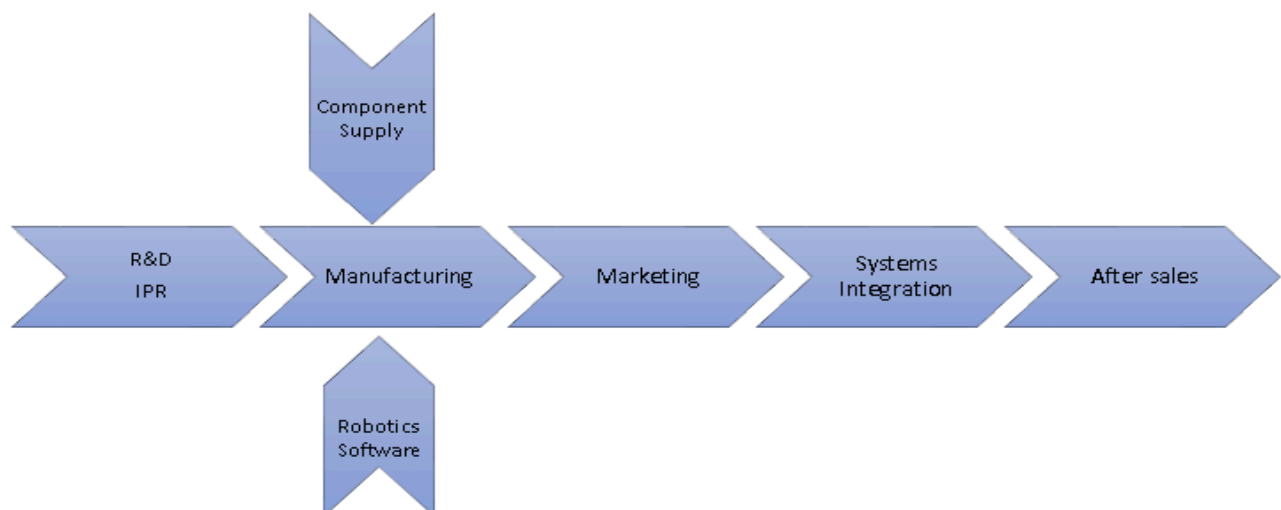


Figure 1 - Industrial robotics - value chain

¹ Study of emerging markets, with special focus on Aisa: Karin Roehricht

² <http://www.businesstoday.in/magazine/features/kulkarni-has-added-to-the-customer-base-of-fanuc-india/story/237491.html>

³ <http://www.fanucindia.com/about-us.aspx>

R&D includes System and software design, development and prototype testing. Some firms may even use Virtual reality⁴ simulation during this phase. Certain processes in this phase need to be carried out in close collaboration with specialized high-tech component suppliers and software providers to ensure compatibility. R&D is the major lever of value creation and IPR is crucial to facilitate this value capture.

ABB and FANUC play across the value chain. However, there exist specialized firms which are active in selective stages of the value chain. For example, **Fraunhofer** is an active *systems integrator*.

Standard robots by themselves are usually not adequate for direct industrial use and customization is carried out in the Systems Integration phase using special tools and drives. After sales is a key differentiator in the Indian context.

Robots are highly integrated products, so it is essential for any player to have complete control over the value chain. And hence both ABB and Fanuc have established themselves so as to be able to do that.

3 COMPANY OVERVIEW

3.1 FANUC

All of Fanuc's production plants (Oshino, Chikusei and Kirishima) are located in Japan. It operates 234 service centres around the world. It commands more than 20% global market share in industrial robots. Fanuc holds a yearly briefing on new products at Oshino campus. Fanuc has started to expand into the German market. It had till 2015 supplied about 2000 robots¹ to Volkswagen. VW has also indicated to buy more robots from Fanuc in the future. A significant reason for Fanuc's increased market share in Germany is because of its low prices. Still, Fanuc is able to extract a 40% margin⁵. At the manufacturing plant at Oshino, production is handled exclusively by robots. Around 80% of the assembly work is automated.

3.2 ABB

ABB has a wide range of robots for every industrial need. It is the leading supplier of industrial robotics also providing robot software, peripheral equipment, modular manufacturing cells and service for tasks such as welding, handling, assembly, painting and finishing, picking and packing, palletizing and machine tending. It selects and supplies the product which satisfies the customer's needs. Manufacturing is done in factories in Sweden and China.

⁴ The competitive outlook for the EU Robotics Industry, Simon Forge and Colin Blackman

⁵ <https://asia.nikkei.com/Business/Companies/How-Fanuc-quietly-took-over-the-world>

4 COMPETING STRATEGIES

4.1 FLEXIBILITY v/s COST OF OWNERSHIP

ABB is positioned in the market as a premium player offering greater flexibility whereas FANUC competes based on the lowest total cost of ownership.

ABB has built in flexibility in its after-sale service called ABB Robot Care. It is a remote service technology which can generate maintenance schedule based on the actual usage. ABB has also developed a service configurator tool which helps and recommends appropriate service level tailored to customer's needs⁶.

These factors suggest positioning of ABB high in flexibility and low on cost-effectiveness.

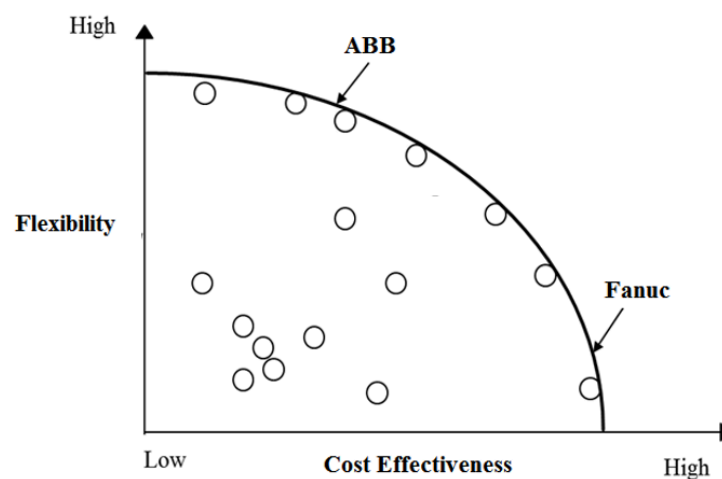


Figure 2: Operations Frontier for ABB and FANUC

4.2 TECHNOLOGY

4.2.1 Programming language and software⁷

Programming language and software is considered as a complementary asset of industrial robots. In order to get exclusivity on such a complementary asset, robot manufacturers develop their own programming language and software. ABB has developed and uses *RAPID* as the programming language for its robots while FANUC has developed and uses *TP* as its programming language of its industrial robots. While both languages function well, ABB's *RAPID* provides much more flexibility in programming and operating than FANUC's *TP*. Owing to less complexity, FANUC's *TP* is easier to learn as compared to *RAPID*. So, while *RAPID* competes on highly flexible and complex control, *TP* competes on ease of use.

⁶ https://library.e.abb.com/public/c4ee0a70400c05fec1257b2f0054c6c7/Robot_Care_20130308-LR.pdf

⁷ <https://www.robot-forum.com/robotforum/fanuc-robot-forum/curiosity-about-robot-brands/>

4.2.2 Smart Factory Software Development⁸

Players in robotics industry are adopting Internet of Things (IoT) to provide not only robots but a complete solution with real-time monitoring and diagnostics. As part of IoT, *Smart Factory Software* is being developed which connects all robots to a common server over the internet. The software monitors the operation of robots and predicts failure. This helps the robot owners plan their preventive maintenance before actual failure and minimize downtime of robots. FANUC has developed a solution dubbed as *Zero Downtime (ZDT)* by collaborating with Cisco and Rockwell Automation. The solution has been successfully deployed with robots in General Motors factories giving positive results. ABB has tied up with Microsoft and developed a similar solution called ABB AbilityTM connected services. ABB has collaborated with IBM to develop a comprehensive smart software solution but is yet to come up with a working prototype.

4.3 INNOVATION FRONTIER

4.3.1 Response to Disruption in Industrial Robotics

As investment in automation increased in developing countries such as India and China, demand for industrial robots has also increased. However, labour still plays an important role on the shop floor and thus it becomes important for robots and workers to work together. This has led to an increased demand for Collaborative Robots or ‘Co-bots’. These are specially designed to work with humans. They have built-in force torque sensors that detect if the arm collides with a worker and automatically stops the robotic arm thus preventing further damage.

The first entrant in the collaborative market space was Universal Robots which started the commercial sale of co-bots in 2005 and have sold around 3500 robots till 2015 acquiring 60% market share⁹. ABB and Fanuc both were considerably late in launching collaborative robots.

ABB responded to this demand trend by launching Yumi in 2015. Yumi had significant advantages over the competitor products such as compactness, precision, high-end camera part location and state of the art motion control. ABB Yumi has been a successful product. It won the Invention and Entrepreneurship in Robotics and Automation Award at Automatica 2016 organized by the International Federation of Robotics and the IEEE Robotics and Automation Society¹⁰. ABB’s one of the largest R&D centre in Bangalore India played a major role in the software development of Yumi. It was designed to be flexible, portable and low-cost at a selling price of \$40,000¹¹.

Fanuc responded to the disruption by launching the 35 Kg payload collaborative robot CR-35 iA in June 2015. It was bigger and 3 times stronger than any collaborative robot at the time of its launch. It is equipped with an integrated vision iRVision and a soft and gentle rubber cover to minimize impact to a worker.

⁸ <https://seekingalpha.com/article/4066774-fanuc-leads-way-smart-factory-software-now-kuka-abb-follow-closely>

⁹ <http://blog.robotiq.com/which-robot-brand-is-the-most-popular>

¹⁰ <https://www.roboticsbusinessreview.com/manufacturing/abbs-yumi-wins-iera-award-automatica-2016/>

¹¹ <https://www.therobotreport.com/abb-launches-yumi-and-acquires-gomtec/>

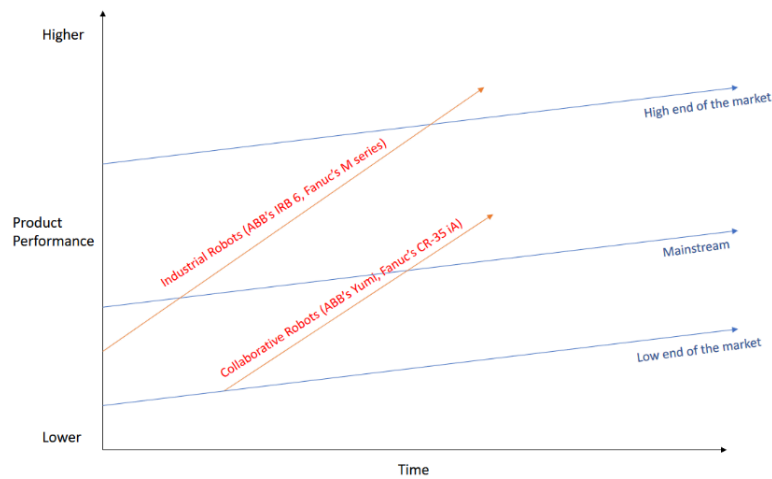


Figure 3: Innovation frontier

4.4 AFTER-SALES SERVICES

One of the major operational differentiation in the Indian context is the after-sales services. The average lifetime of a robot is 7-10 years and a significant portion of value is captured at this stage. There are four components in this landscape to measure the performance of competing players. FANUC takes the cost advantage with its least total cost of ownership offering. Its maintenance contract costs the lowest in the market. The next dimension is responsiveness, which related to the ability to respond to customer requests quickly. FANUC again reigns supreme with its pan-India network of 23 offices as compared to 4 ABB offices. In the context of reliability, both players are comparable on their offerings. The fourth dimension is flexibility where ABB ranks higher due to its offering of selling spare parts on a stand- alone basis in addition to maintenance service packages. On the other hand, FANUC doesn't sell spare parts and offers only maintenance service packages, inclusive of spare parts replacement.

After-sales service comparison in India

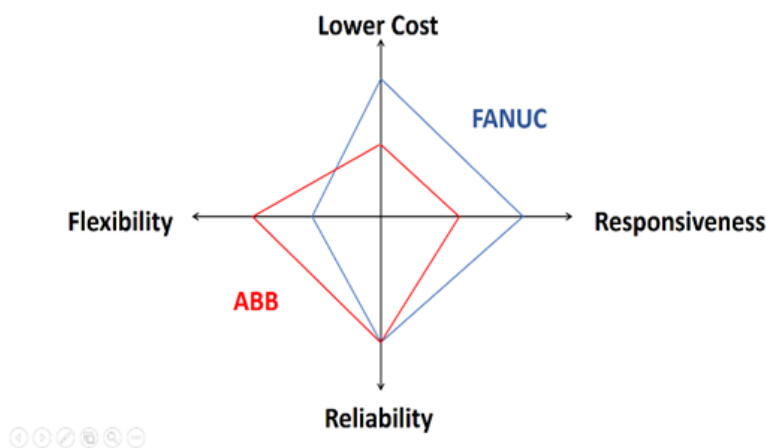


Figure 4- Radar Plot - After sales service

5 FEATURES AND SOURCES OF COMPETITIVE ADVANTAGE

Feature comparison is done between ABB and FANUC to arrive at sources of Competitive advantages:

Software – The motion to be followed by the robot is coded using a software program. The Software for ABB is much more flexible and has many more tweaks and knobs and it is positioned as a coder's software. FANUC, on the other hand provides a higher level of abstraction and thus fewer knobs and switches. Though this limits the scope of control the user can provide, it is much easier to learn and hence it is positioned as a customer's software. A cross-industry parallel would be the mobile phone OS. Android provides a high amount of customizability with a lot of switches and iOS provides ease of use due to abstraction in software.

Organization structure and offering – In the case of ABB, robotics based automation offerings and all other automation offerings are placed under two different divisions. This creates barriers to information flow. In Fanuc, all automation products (CNC machines, robots etc.) are placed under the same division. The sales force of FANUC is trained about the entire portfolio of the firm's automation based offerings. This enables FANUC to compete in the market by offering integrated solutions while ABB competes by offering standardised products closest to customer's requirements. This is significant as customers look for automation based solutions and not necessarily robot based solutions to defined problems. The organisation structure also helps FANUC to leverage its dominant presence in the CNC machine segment by increasing the chances of cross-selling.

Thus, Fanuc is able to develop an ecosystem of products with its customers instead of just single products. This is again similar to the iTunes ecosystem that apple can provide by selling different type of gadgets and devices to the same set customers and connect them through iTunes.

Price – ABB is positioned as a premium product in the robotics segment with cutting edge technology, high reliability and high flexibility. ABB products are hence more expensive. FANUC competes on the least total cost of ownership. Its products are priced much lower than ABB and the cost of maintenance is also very low. FANUC captures value by reselling, upselling and leveraging the relationship that it has with its customers and hence can have the product prices to be low.

Spare part availability – ABB sells its spare parts to customers if needed and they are very standardized. FANUC being an integrated solution provides does not sell spare parts.

Customers – ABB has a very diversified portfolio of customers from industrial, utility and transportation segments.

Doing a feature by feature comparison we see the following major advantages for the firm's customers:

ABB

1. Ease of availability of spare parts
2. More control on robots – Robots can be customized more and hence more flexibility

3. Apart from the features mentioned above, ABB provides consulting services to its B2B customers using its R&D centres
- 4.

FANUC

1. It provides the lowest total cost of ownership owing to its low product cost and maintenance cost
2. It provides a whole solution rather than just a product. Its wide array of robotic products along with other industrial products to its customers. It can do so with the trained sales force that can identify the needs and sell accordingly owing to their knowledge of the entire portfolio
3. Due to the fewer switches in its software, it is easier to learn, operate and code on.

Based on the features and customer benefits we can conclude that the following can be the competitive advantage of each firm:

ABB has a very good R&D which can be exemplified by its B2B consulting services. ABB also uses technology well by providing remote monitoring and maintenance which FANUC does not have.

FANUC, on the other hand, has an organization structure that helps it cross sell, upsell, provide an integrated system.

6 FANUC LAUNCHES FIELD: THE START OF PLATFORM WARS IN AUTOMATION?

The automation industry extends beyond robotics and includes elements like CNC machines, PLCs, sensors etc. In November 2016, FANUC announced the launch of FIELD (Fanuc Intelligent Edge Link and Drive). This is a platform to connect robots, CNC machines, PLCs, sensors and other peripheral devices to capture and analyse data and leverages advanced analytics to optimise the overall production process¹². This platform was developed by FANUC in collaboration with Cisco, Rockwell Automation and Preferred Networks which specialize in digitisation, industrial automation and Artificial Intelligence respectively. While there did exist some other platforms to integrate automated vehicles, FIELD platform is much more technologically advanced. The distinguishing feature of FIELD is distributed learning capabilities- meaning that robots and other connected devices can transmit their knowledge, allowing devices to learn from each other. FANUC being the global leader in automation services, can leverage its reach to customers to push the platform.

Interestingly, FANUC has made it an open platform, accessible to competitors and third- party players to write codes and develop applications on the platform. With the focus of the automation industry increasingly shifting from hardware to machine learning, IoT and advanced AI, FANUC is trying to leverage its existing position to create a dominant design for platform to connect automated devices.

¹² <http://www.fanucamerica.com/fanucamerica-news/press-releases/PressReleaseDetails.aspx?id=79>

7 WAY FORWARD

Currently, the major application for robotics is moving to auto industry, but going ahead food processing and material handling will become big customers. Parameters like payload, precision and reliability become less important and cost will be the most important parameter.

Because ABB caters to the premium segment, it may not be able to cater to these industries because of the high price. So, one possible way to go is that it should sell refurbished/used robots to such industries where price sensitivity is high

Similarly, looking at FANUC, since it has a narrow portfolio with industrial focus, it needs to expand its offerings to cater to these industries, without losing its current focus.

EXHIBITS

EXHIBIT 1: INTERVIEW WITH MR. SRIRAM KUMAR, ASSISTANT GENERAL MANAGER (ADMINISTRATION AND FACILITIES), FANUC INDIA PRIVATE LIMITED

In the Indian context, FANUC is positioned as the best choice for total cost of ownership offering focusing on longevity and cost efficiency. This is enabled by providing least cost to customer with zero downtime. Only FANUC has total industrial offerings in India acting as an integrated service provider. Thus, we sell industrial solutions with “all products in one room”. The products are manufactured in Japan with the system engineering and integration performed in India as per customer’s requirements. An example of robot application is petrol tanks which needs to be error free, suited for critical components

Top competition

ABB and Yaskawa motoman are the major competitors in India. Their selling is division based vs our industrial solution offering leveraging the complete product line.

Indian Buyer Context

Buyback is not a necessary feature in the Indian market, existing customer wants to automate increasingly. Once customers get acquired they get hooked on the automation benefits. An example is the shift from manual to auto washing machine, the aspiration level increases as robots make process easier and increase productivity with accuracy. Significant potential to grow into the painting space of automobile in India. The automation till now is in nascent stages, this if further fueled by industrial safety norms (health hazard issues by fumes in painting manually). FANUC is also looking in the growing food processing industry which and will compete with ABB in this space.

Sales & After-services

All sales personnel sell the complete package of FANUC solutions. We are a young team and service is the backbone of our India operations. Our after-sales service is considered best in the industry enabling us to reap benefits from repeat purchases. Again, the response time is best in India enabled by the nation-wide network of 22 offices. This has also been the traditional FANUC approach and we have a global belief in this philosophy.

EXHIBIT 2: SUMMARY OF INTERVIEW WITH ABB PERSONNEL

1. Naidu DSP, Group Manager at ABB GISL
2. Aparna Razdan, Simulation Engineer, Robotics Division ABB
3. Sagar Pardeshi, Design Engineer at ABB

Product offerings

ABB was the company to build World’s 1st Industrial robot. ABB has good market share from then due to its market leadership. The distinguishing aspects of ABB robots is the precision (in terms of mm) at which it handles the objects.

ABB India has wide range of products: 4-axis to 6-axis robots and 2 armed robots. ABB has 2 types of robots. General Purpose robots and Paint Robots. General purpose robots can be configured for many applications, like pick; place, palletize, welding, cutting, machine tending, etc. This covers products for every application and segment. The important parameters of a robot are precision, payload, reliability, and speed. When client comes in with specific requirements we select which product will be suitable for their needs and supply accordingly (No major play on customization). The average lifetime of a typical robot is 7-10 years. Our offline programming software is called Robot studio where we can program the motion of robot and then simulate it virtually to visualize these motions.

ABB has advantage in Paint applications - Robots have a 360-degree wrist movement allowing movement in any direction. It recently launched SCARA robot - small robot with focus on speed and accuracy. Also launched Yumi - human collaboration robot. Workers used to be afraid of safety in working with robots, Yumi is safe offering. Going forward ABB robots can also be seen in medicine and food industry riding on these offerings. In India, market growth focus is on material handling and food processing (same as FANUC). We are excited about developments with Patanjali in the recent month. At recent trade exhibition in Pune, customers keen on co-bots.

Competing on quality

ABB robots are expensive, with European quality legacy. All the European, especially German consider ABB to be the best in the industry. Big customers demand ABB in their factories (e.g. Ford, BMW). ABB has 71 customers in India.

Cost structure viz-a-viz competition

Fanuc provides cheaply as compared to ABB and this is a concern due to the price sensitive Indian market. Even though the robots supplied to India are manufactured in China, which should help with the prices. This is not realized due to the discriminatory import duties on China (ABB) vs Japan (FANUC) imposed by India. Another reason for this disparity is due to premium “Teaching pendant”. It is a processor which is provided with ABB products in which algorithms can be coded based on the needs of the customer. As the software technology is improving, ABB is looking for cheaper alternatives such as apps and maybe in future ABB can do away with the teaching pendant thus bringing the cost down.

Service offerings

While we provide automation solutions to customers, several products are delivered in collaboration with other companies (sourcing). ABB has four service centers in India, as opposed to another player KUKA. We also provide remote assistance to our customer. ABB has a service intelligence unit (SIU) with remote monitoring of the robots, we will be able to predict the service need in advance We provide one-year free service and sell spare parts also (FANUC doesn't have this option). ABB also has a research center in Bangalore which provides B2B research and technology solutions. ABB has departmental structure, and have standard product offerings (minor tweaking to suit customer's needs). Thus, we have separate robotics sales force.