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# INDUSTRIAL MANUFACTURING AFTER-SALES SERVICE: HOW SYSTEM INTEGRATORS CAN ENABLE A CONNECTED FUTURE

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## Abstract

After-sales service and repairs form a major revenue source for industrial manufacturers. However, traditional models are reactive in nature, anticipating what may be required to service installed equipment. This creates concerns around the cost of operations. Today, the after-sales service segment in industrial manufacturing is at an inflection point due to the confluence of IoT, process automation and ability to take generate actionable insights from collected data. This paper focuses on how technology is reshaping the business processes in this space through servitization. It examines current and future business models. It also highlights the role systems integrators such as Infosys can play in the transformation of the after-sales market.

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## Introduction

Historically, the focus of industrial manufacturers has been product engineering, manufacturing and selling goods to customers. These goods include control valves, flow meters, heating, ventilation and air conditioning (HVAC) systems, injection systems, process control systems, and many other advanced engineering products that are installed in manufacturing plants, mines, oil and gas rigs, refineries, and other industrial sites. Ownership of these goods is typically transferred to the customer at the end of the sales cycle. The installed equipment data is primarily maintained for post-sales analytics and handling service maintenance requests.

Recently, the industrial manufacturing and after-sales segments are shifting from selling products to selling services. For example, instead of selling a control valve, a global market leader now sells the service of controlling the flow of liquid through a refinery. This is known as Product-as-a-Service or servitization.

Servitization has been around for decades. Caterpillar shifted its focus from selling equipment to providing remote fleet tracking and monitoring services. Komatsu and other earth-moving manufacturers transitioned from selling earthmover machinery to offering the ability to perform earth-moving activities. In other words, they shifted to leasing equipment for a specific use at a specific site.

## Change drivers

Industrial manufacturers are under intense pressure to increase margins and cut costs. As product innovation curves plateau, manufacturers need to identify new revenue streams. In an age where one must either innovate or retire, manufacturers are seeing the need to embed themselves as strategic partners in their customers' business, rather than remain mere suppliers. Doing this gives them a competitive advantage.

In his seminal work on Industry 4.0, Professor Kraus calls out three major indicators of a megatrend – physical, digital and biological. Figure-1 shows the 6 mega trends as per our analysis. These are being picked up by manufacturers and added to its portfolio and operations to stay ahead of the competition. Let us examine the physical and digital trends that are driving the shift towards servitization:

1. **Additive manufacturing –** There is tremendous evolution in the materials that can be used and designs that can be printed affordably using 3-D printers. In the service market where time is of paramount importance, possessing additive manufacturing capabilities will propel agile players ahead of competitors that rely on 'lengthy' supply chains from low cost countries for machined, forged or foundry-produced components.
2. **IoT sensors –** These collect real-time data from installed sites that are then relayed back to data centers. While IoT sensors are not new, their newfound abilities to communicate in a fast and secure manner through pervasive networks will make them more prevalent and also the coming of 5G is a game changer in this context.
3. **SaaS-based analytical products –** Products such as Oracle Adaptive Intelligence for Manufacturing can store data in data lakes and run analytics at faster speeds. Google's Tensor Flow, Microsoft AI platform, Microsoft Machine Learning studio are also enabling the manufacturers and companies to leverage cloud infrastructure and run analytical/ mathematical models at faster speed and helping being competitive. Previously, the hardware capability needed to run statistical models and heuristics was tremendous.

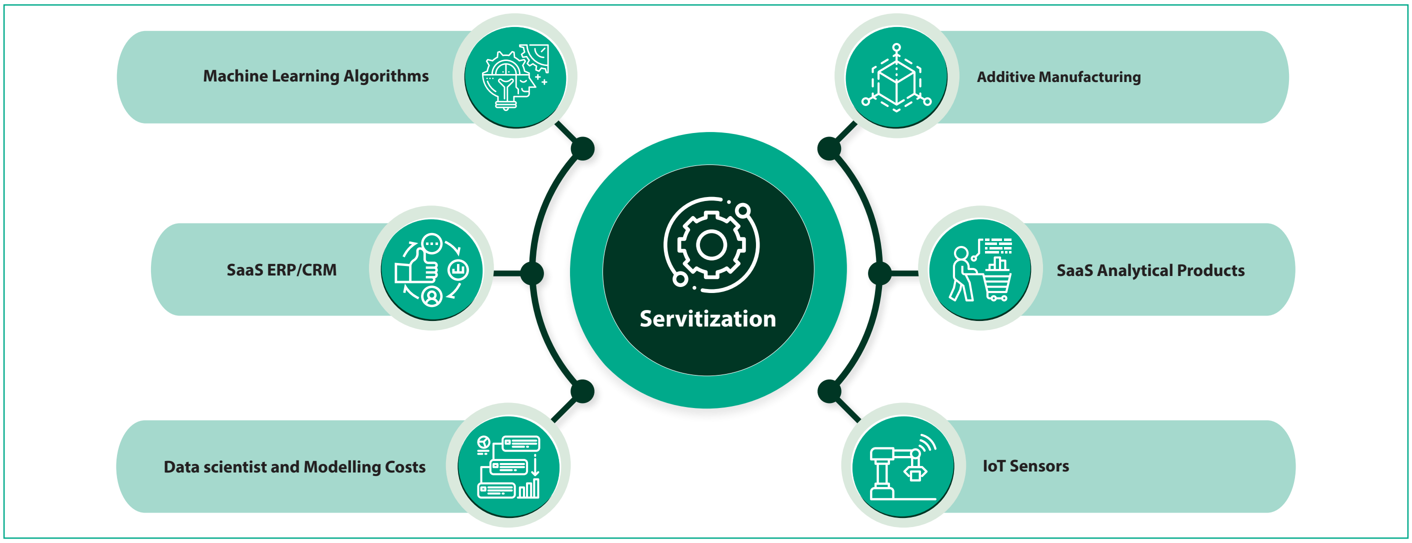


**Fig 1:** Servitization of Industrial Manufacturing – Change Drivers

4. **Machine learning and deep learning capabilities –** Machine learning provides the ability to make sense of large amounts of data and find patterns. Deep learning will further enhance this capability by enabling supply chain programs to take decisions on their own by creating artificial neural networks.

5. **Data scientists and modelling costs –** Previously, these costs were prohibitive and data science was not the core competency of industrial manufacturers. Retaining talent with these skillsets was also a challenge. Cloud-based SaaS offerings make these data models easily available in a pre-built manner. Additionally, data scientists can now be hired contractually rather than permanently. Also offerings like GitHub, GitLabs are game changer in getting the work hosted and delivered.

6. **Cloud-based SaaS ERP/CRM and supply chain systems –** These platforms are allowing service technicians to access real-time data in the field. In case of highly engineered systems, access to installed bills of materials, test metrics, and certifications are crucial for quickly and properly resolving issues on-site.

## Current and future business models

### The present model: Reactive semi-automated and semi-connected models

This model uses enterprise IT systems as transaction-recording systems. Finished goods are sold and ownership is transferred at the point of sale. Then, it is the customer's responsibility to maintain the asset either in-house or through AMCs. Figure-2 represents a process flow of current state of manufacturing repairs. It highlights the reactive nature of process, it starts when customer connects the manufacturer for a problem. t is up to the customer to raise service requests for maintenance or repair.

### Challenges in the present model

Since many service centers are scattered across a geography to serve local customers, there is always a struggle between improving service levels and reducing inventory.

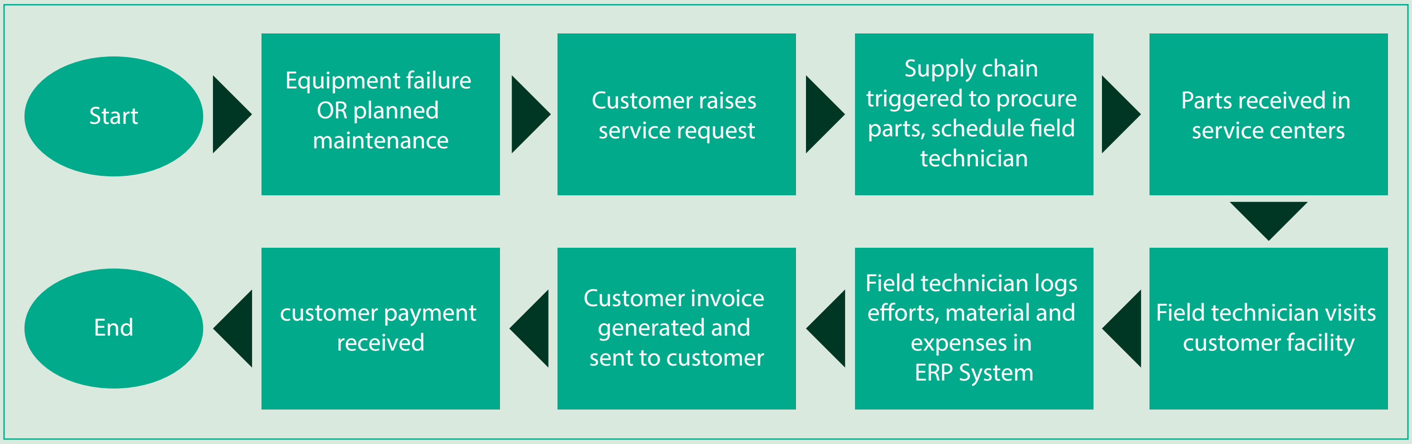


**Fig 2:** Characteristics of the current business model – reactive, manual and resource intensive

The high number of service centers and non-reliability of historical data to foresee future maintenance requests exacerbate the problem of high inventory carrying costs.

The knowledge to repair and solve a problem is more people driven and less system driven. With the attrition of repair technicians the knowledge is lost and needs more effort and time for companies to upskill a new onboarded member. Field technicians and repair technicians are often situated far away from the organization, leading to higher attrition rates. This creates challenges of system training and knowledge drain. A buyer sitting in a manufacturing plant knows the latest changes in the ERP and usually has IT system analysts readily available at site to help. As opposed to this, users in service centers do not enjoy these privileges. Service center technicians often perform multiple roles like order entry, parts buying, planning, warehouse management, shop floor operations, and shipping tasks. This is evident from the number of tickets raised by service centers compared to tickets raised by personnel in central facilities for a similar number of transactions. These problems indicate a need for a more connected and better managed process flow which is in synch with the trend today.

### The future model: Fully automated and connected systems for better reliability and service

Figure-3 represents the process or mechanism of how the future model of after-sales service will look like. Here is what the future model of after-sales service will look like:

- IoT sensors on the equipment will continuously relay operating and ambient parameters. For example, IoT sensors attached to a control valve installed on an oil rig will relay viscosity, temperature, particle density, and chemical composition of the crude oil being pumped out. They will report on the operating condition of the equipment such as RPM of the motor, power surge/dips, and wear and tear of moving parts. They will also track the ambient conditions of the installation such as temperature, humidity, salt deposits, etc.

- This data will then be fed into SaaS based platforms for real-time analysis. This will predict and provide insights into possible equipment failure, need for scheduled maintenance and need for ad-hoc emergency maintenance. As a designer/ manufacturer of the product the operating condition and data limits will be available. With data coming in and some simple analysis can help indicates areas of concern/ problem. All these predictions will be based on historical data, real-time IoT-based data, install base master data from the ERP, and mathematical models provided by product engineers.
- APIs, interface and software bots (through RPA) will do the job of creating a service request in the ERP system with all the necessary details. These will include addresses, install base serial numbers, parts required for maintenance, etc. Bots will identify field technician availability by sifting through technician calendars and, if required, calling or chatting with the technician. The bots will relay this information to the customer and secure a gate pass and entry protocol for the technician.
- Meanwhile, the service parts planning engine of the ERP will place a request for the parts required. Instead of carrying low-running or long lead time parts in the inventory, a request will be sent directly to a 3-D printer facility for that region. This request will be automatically converted into a work order in the 'printing' facility. It will then be queued for processing and the required part will be printed and made available for the technician. Alternatively these part can be carrier in some regional/ central warehouses by manufacturer rather than by customers and can be automatically made available as per need. There will be premiums charged on the product availability as customer no longer needs to carry the inventory.

The goal here is to achieve a largely touchless process when carrying out the actual maintenance. The only exception may be the shipping and receiving processes at the service center. The use of virtual reality gadgets like Google Glass and SaaS-based mobile applications that access master data will make the job of field technicians paperless and efficient. If equipment has been brought in for repair to the service center, repair personnel can leverage chat bots with voice-activated commands to perform all the transactions in the ERP/MES/ WMS. When there is an update in the operating procedure or an upgrade in the underlying platform, service center technicians need not be bothered with training and documentation as bots will take care of the system transactions.

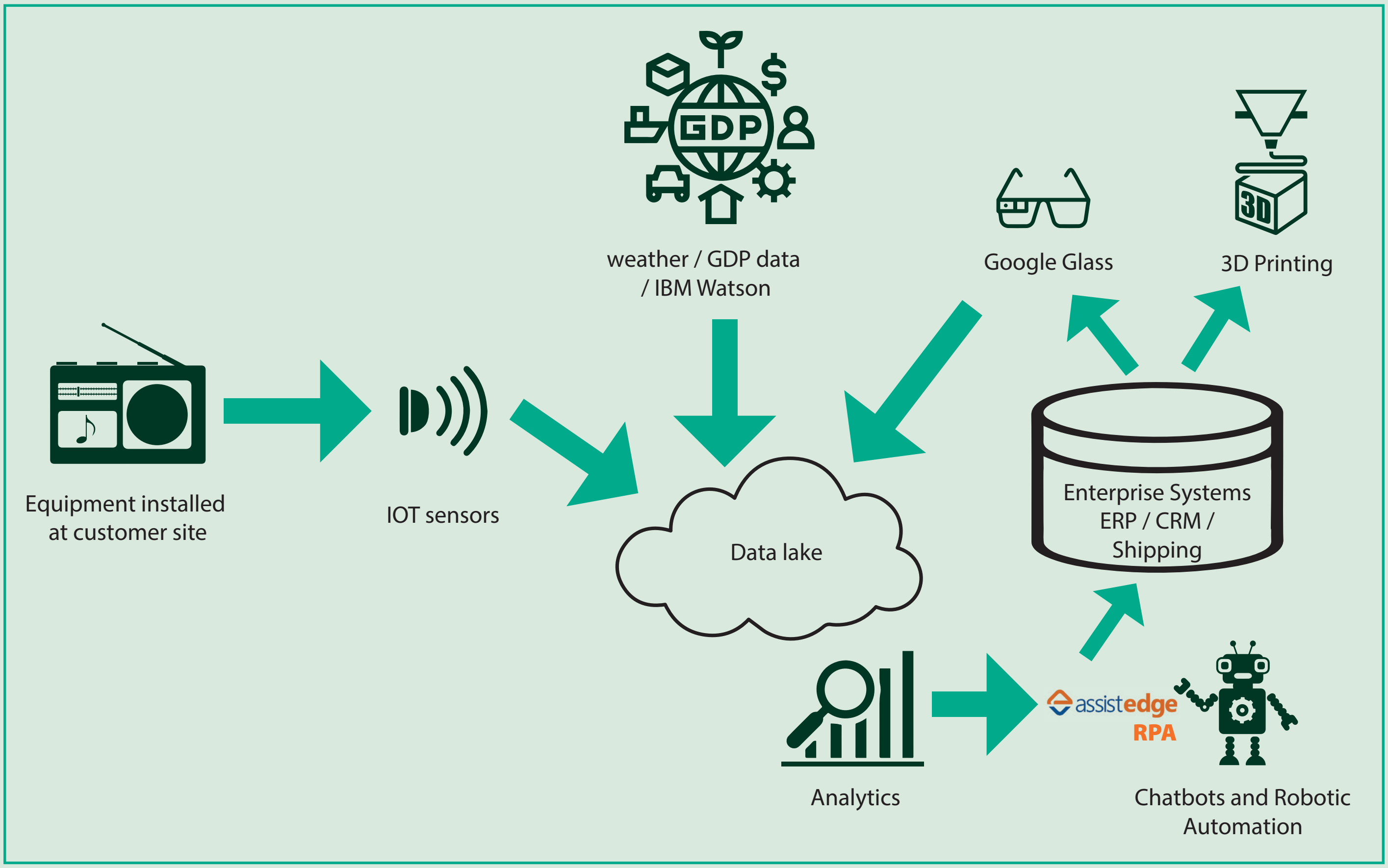


**Fig 3:** Connected Future - proactive in nature, automated, very few human touchpoints

## Organizational pillars for a digitally connected future

The future processes as discussed in the previous sections are closer than we think, and is being shaped into reality through smaller, strategic and functional innovations.

For manufacturers of industrial equipment and machinery, meeting customer requirements such as cost, service level and equipment availability (uptime) will help scale brand value. For OEMs, merely designing a better product will no longer be the competitive differentiator. They will need a robust digital strategy that encompasses the factors mentioned in Fig 4. Figure 4 depicts that the future of manufacturer will be more driven by IOT and Sensors, Data Analytics/ AI/ ML driven capabilities. These will drive a lot of digital effort and will improve the supply chain making it more robust.

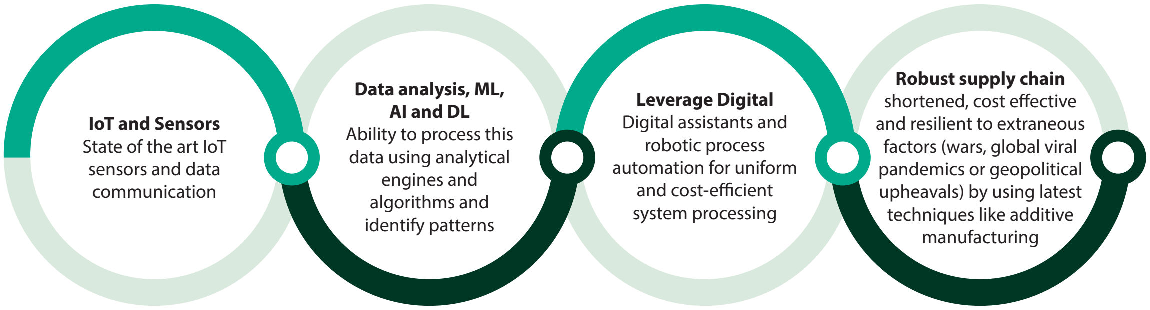


**Fig 4:** Digital Pillars for a Connected Future

## Role of systems integrators during this paradigm shift

In the future servitization model, the opportunities for System Integrators (SIs) are abundant. As explained above, the business model is based on a robust digital framework. Thus, SIs must shift from the traditional mindset of implementing product functionalities (ERP, MES, WMS, transportation systems, etc.) to enhancing functionality by embedding the latest technology trends in supply chain systems.


**Fig 5:** System Integrators – Focus Areas

Figure-5 shows the key focus areas of SIs partnering with industrial manufacturers. The SIs has to partner with the manufacturing companies and help them align and pave the road for their servitization. The key focus areas are:

1. Innovative lease management solutions – In the traditional model, ERP and allied systems handle processes from design to shipping. In the new model, the focus should shift to leasing and install base. Thus, OEMs will no longer shift ownership at the point of installation. Instead, they will need innovative solutions in lease management.
2. Pre-built connected and automated solutions – Instead of a traditional user training or train-the-trainer approach, SIs should propose implementation of chatbots and unassisted bots to perform repetitive transactions. They must provide options of industry-leading platforms such as Blue Prism, Automation Anywhere, UIPath, or captive products such as Infosys AssistEdge. These RPA bots and chatbots must be able to run on cloud platforms such as Azure or AWS. There should be a defined path of continuous development and deployment of these bots to handle system upgrades, changes in business requirements and alignment with business expansions or contractions – organically or through M&As.
3. Deep analytics – SIs must partner with providers of analytical solutions such as IBM Analytics, AWS Lambda, Googles Tensor flow, Microsofts Machine Learning studio, Oracle Adaptive Manufacturing, and others. These solutions should focus on specific industry segments and leverage close association with their customers.
4. Comprehensive knowledge capture – An engineering body of knowledge must be developed in the SI's organization to suggest and develop solutions on IoT/ sensors/engineering analytics of OEM products. This will require investment in knowledge universities that can produce peer-reviewed authoritative papers.
5. Continuous training – SI consultants must be trained to adapt to the changing landscape. A siloed consulting approach will not work. Consultants must be experts in at least one of the allied technologies and be aware of the basics of all. These include robotic process automation, chatbots, data analysis, technological advances in product engineering, and manufacturing.

## Conclusion

The after-sales market typically comprises of several small service centers spread across territories that maintain their own inventory. There is a direct correlation between higher service levels and higher inventory costs. Service centers often experience high employee attrition, are resistant to change, and rely on manual and resource intensive processes. As more and more manufacturers adopt servitization business models, they need to transform the after-sales market from product-centric to a service-centric one. The increasing maturity and cost-effectiveness of IoT sensors, additive manufacturing, data science, SaaS analytics, etc., make this a viable business stream. Systems integrators can play a role in helping manufacturers transition from current semi-automated, semi-connected servitization models to fully automated and connected ones. By developing solutions that enable real-time insights and near touchless service processes, SIs can help industrial manufacturers boost service levels, slash inventory costs, improve technician productivity, and enhance the customer experience.

For more information, contact askus@infosys.com

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