Supply Chain Management has become an important sector in the industries today. With help of modern technology, the supply chain management practices streamline business and increase the productivity in competitive marketplace today. Automation primarily entails detailed study and identification of repetitive and time-consuming tasks, and make the system error-free, to then automate them. Because supply chains involved and based on process-oriented tasks, it is very important to build these tasks error free and as efficient as possible. Supply chains can also be rife with errors as they encompass so many different processes, ranging from manual documentation, production, inventory, shipping, and more – all of which are logistics processes that can be automated. The thesis focused on finding the barriers and implementing the process of automation in various area of supply chain and comparing it with the conventional system.

I. INTRODUCTION

The global economy is currently going through the fourth technological revolution and Automation is the future. Today almost every industrial sector has implemented automation in their operations to tackle the rising need for delivering quality products and services and outpace their competitors.

Businesses are grappling today with tremendous amount of complexity and uncertainty in their supply chain and fulfilment operations driven by a host of factors like increasing number of customers on eCommerce platforms, high SKUs, lesser time to fulfil an order, increased number of returns and high variability in demand. These factors put a lot of pressure on warehousing operations, which forms an important node in the supply chain.

Automation is the umbrella term for the various technological apparatus such as artificial intelligence (AI), and robotics that are used in the production of goods and service with zero to minimal human labour. Some classic examples of automation range from household thermostats and self-governing system, automation is the face of technology in the modern world.

Automation in supply chain industry has revolutionised the entire system of handling the finished goods and thus improving various important factors which directly contribute the business.

Modern robots are the result of automation in the production sector evolving from the usage of simple hydraulic and pneumatic systems. Automation is used in most industrial processes to increase productivity and lower labour costs. Since its inception, industrial automation has significantly improved processes that were formerly done by hand. Fully automating a manufacturing organization’s processes with the most recent technologies often results in increased productivity, the manufacture of high-quality products, and lower labour and production costs.

Early Years of Automation.

One of the first forms of automation in the manufacturing sector was the car assembly line, which Ford Motor Company first deployed in 1913. Before then, a team of skilled and unskilled labourers assembled a car. Ford’s production rates and earnings improved as a result of factory automation. The mass manufacture of automobiles and the assembly line were both firsts in the world. It decreased the time needed to assemble an automobile from 12 hours to roughly 1.5 hours.

Automation development in the 20th century:

Japan was a pioneer in creating parts that aided industrial manufacturing automation in the 1930s. A single business created the first electrical timer, protective relays, and microswitch. Around this time, tremendous
research and development had taken place, leading to innovations like the solid-state proximity switch, and the rest of the world had begun to appreciate automation. During the Second World War, automation was heavily utilised in fighter aircraft, landing craft, warships, and tanks between 1939 and 1945. In 1945, Japan submitted to US and allied forces, and a programme to reconstruct its industries was started. In contrast to the conventional manufacturing techniques employed by the rest of the world, the initiative depended on cutting-edge technologies. Japan therefore rose to become the top industrial automation country in the world. Numerous reliable and high-quality cars might be produced by automakers like Honda, Toyota, and Nissan. They provided basic features that other automaker considered luxuries, along with affordable prices, which led to the development of Japan’s auto industry.

The manufacturing sector's level of industrial automation at the moment.

Modern industrial robots have superior degrees of freedom, visual systems, and high-quality computing capabilities. They still need some level of human involvement and are limited to highly structured areas. Industrial automation is typically better suited to large manufacturers and extended production runs since it is also fairly rigid and highly specialised for usage in small and medium-sized enterprises. The ability of computers and software to automate, integrate, and optimise various manufacturing system components is a key component of the manufacturing business. It is also known as computer integrated manufacturing as a result.

The development of industrial automation in the manufacturing sector has resulted in greater energy, resource, and raw material utilization throughout the world. Contrary to popular belief, the deployment of robots in the manufacturing sector is expected to increase employment, which will further the advantages and operations of industrial automation.

II. BREIF OF APPLICATION

For having a deep study about the changes after implementing automation in supply chain management system of different sector company, many pilot study will be carried out. The pilot study is very important before initiating full-scale research. A small experiment will be carried out to test supply chain management applications for the purpose of improving the quality and efficiency of the large-scale study later. Also, defects can be easily figured out in this step. Then a simulation model will be constructed. The Performance indicators for processes will be quantified. Evaluation will be happened according to the identified objectives with the help of the result of the pilot study.

1. MARICO LIMITED:

Marico is one of India’s leading consumer products companies in the global beauty and wellness space. During FY 2021-22, Marico recorded a turnover of about INR 95 billion (USD 1.3 billion) through its products sold in India and chosen markets in Asia and Africa. Marico touches the lives of 1 out of every 3 Indians, through its portfolio of brands such as Parachute, Saffola, FITTTIFY Gourmet, Saffola ImmuniVeda, Saffola Mealmaker, Hair & Care, Parachute Advansed, Nihar Naturals, Mediker, Coco Soul, Revive, Set Wet, Livon and Beardo and Just Herbs. The international consumer products portfolio contributes around 23% of the Group’s revenue, with brands like Parachute, Parachute Advansed, HairCode, Fiancée, Caivil, Hercules, Black Chic, Code 10, Ingwe, X-Men, Mediker SafeLife, Thuan Phat and Isoplus. Headquartered in Mumbai, we are present in over 25 countries across emerging markets of Asia and Africa. We operate seven factories in India, located at Puducherry, Perundurai, Jalgaon, Guwahati, Baddi, and Sanand.

Here we discuss about changing one of marico warehouse from conventional system to fully automated warehouse.

A leading consumer goods company in India, Marico Ltd enabled to store increased production of 60000KL pa in a warehouse space with the help of intralogistics automationsolution keeping three things in mind:

SPACE: To store more FG material and packing material in limited area

EFFICIENCY: Increase and maintain the production capacity of personal care products.

SCALABILITY: To meet the future production and storage expansion needs.
The Marico intends to increase the production capacity of hair oil, gel, and moisturizers. So, they came up with a green field plant with a captive warehouse. We observed the existing order fulfilment process and also conducted structured interviews with top executives, retailers and operations team to understand the business requirement in detail. The complexities were extremely high when handling the whole operation manually, hence automating the entire process was taken into consideration. Also, the existing process lacked agility and flexibility to cater to increased production and demand numbers.

Figure 1: Convention system of Warehouse

They partnered with the customer to understand the production requirement and did extensive data mining with the production & inventory data. This helped us to understand the warehouse storage & retrieval system requirement for different finished goods & packing materials such as empty bottles, caps, labels, pallets etc and an insight into the throughput requirement. With the help of this data, we simulated different scenarios on our design to arrive at the right technology mix.

We created a design that would result in maximum utilization of the warehouse space. Looking at the throughput requirement we suggested a “Goods-To-Person Automation” system as the backbone of the entire fulfilment operation.

Following technology mix was selected to meet the requirements:

- Crane based ASRS
- Mother-child warehouse shuttle system
- End of line packing and the integration of these systems with the existing SAP EWM module.

With a world class in-house manufacturing facility and modular design, we were able to manufacture and supply the entire automation equipment in a record time. With the help of a cross functional team of 30+
Engineers, installation and commissioning of the entire project was done. The direct integration between the SAP EWM & PLC module without the need of any middleware made the system easy to maintain and troubleshoot. With mother & child operating at a speed of 3 m/s, and 0.8m/sec respectively, the overall throughput of the system is 28 pallets per hour, enabling faster packaging of the goods, increased safety of the personnel, and material. Further with a travelling speed of 2.5m/s, each crane gives at throughput of 48 pallets per hour in and out. The height of this system is 24 meter high with11 levels enabling for an efficient vertical utilization of the space. The complete modular nature of our systems enables easy scalability with the addition of extra cranes, and shuttles for any future enhancements.

**Impacts:**

- Direct integration between the SAP EWM & PLC module, made the system easy to maintain
- 80% reduction in space, ASRS requires 2860 sq mtr of space versus block storage requires15000 sq mtr
- 144 pallets per hour in and out overall throughput to ensure efficient utilization of space

**ADVANTAGES:**

1. Enhanced client services.
2. Keeping your supply chain safe.
3. Observe shipping demands.

**DISADVANTAGES:**

1. Simple tasks: Small robots are quite useful in a warehouse setting, but they cannot fully replace a human worker. When it comes to navigating their surroundings and grabbing the proper products, warehouse robots used in current supply chain automation setups are incredibly accurate and efficient, but they lack dexterity. Most require carefully finished surfaces to function properly, and you will need to fetch a person if you need something from upstairs. Additionally, workers are better equipped to making decisions in the moment based on external stimuli.
2. Robotization Cost: The expense of entry is also one of the key reasons some organisations are delaying supply chain automation.

Costs might be a factor in the low adoption rates, according to Roberson. A new industrial robotic could cost anywhere between $50,000 and $80,000 on average.

**III. CONCLUSION**

Supply chains will likely continue to shift toward digital environments as customer bases expand in order to compete.

In order to manage a successful chain, getting visibility into your supply chains is increasingly becoming a prerequisite. Older analogue data storage techniques, along with the associated human errors, have been abandoned. Currently, politics are a bit of a mess, and this mess has an impact on global supply chains everywhere. Supply networks need to be prepared to respond as more tariffs are approved and other trade battles continue.

Regulations are subject to change at any time while negotiations continue. Supply chain managers should be on the watch for rapid changes in the global environment as things keep moving since disruption of supply networks is nearly a given in this type of atmosphere.
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