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A Study on Adoption of Automation in Production of the Indian Context

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Abstract:-Automation has revolutionized production management. It has become a part of multiple processes like assembling, testing, inspection and inventory management. The paper aims to understand industrial automation in the Indian context, analyst its pros and cons and develop a framework for Indian companies to automate their businesses. Additionally, it aims to address the unemployment concerns that come with automation. The study concludes that automation can be successfully implemented in India if software technology and IT infrastructure are employed optimally along with a sound public policy.

Keywords:-Automation, Manual Manufacturing, Supply Chain Management (SCM), Business Process Management System (BPMS)

I. OBJECTIVES OF THE STUDY

- Analyze automation trends prevalent in production
- Analyze supply chain and production trends existing in India
- Understanding the suitability of automation with respect to India and developing a framework for its initiation

II. INTRODUCTION

Automation has become all pervasive in the production management process with multiple processes like inventory management, material handling, testing, assembly of parts and so on being done with the help of machines and robots. However, this replacement of human laborers with artificial means has raised several comparisons with the manual labor system and whether it is an efficient or even a more ethical way forward. Multiple studies have been conducted which have compared the processes in which automation outperforms human efforts and vice versa.

In the case of testing or quality control to remove defects automation has an upper hand as *(Sharma 2014)* in his study on the quantitive analysis of manual and automated testing in software development found automated testing to be more reliable, less time consuming and tedious using multiple metrics like test execution, test case productivity, defect rejection metrics and test coverage metrics to evaluate the two types of testing.*Asfaw (2015)* in his study also concluded that automation testing is more efficient and accurate than manual testing using data from questionnaires, interviews and group discussions of persons involved in the field.

Nonetheless it might not be a wise or cost-efficient decision to automate the entire production process as each process in the manufacture of a product also needs to be looked at individually to decide whether such a process is better off being automated or done through manual labor.

(Najjar, Sheth 2014) In case of assembly reliant industries like the ball pen manufacturing industry where multiple spare parts need to be assembled automation has an advantage over manual assembly in majority of the processes involved. In production management product assembly line accounts for a majority of the cost of the product contributing to about 50% of the manufacturing cost *(G Boothroyd, et al, 1987)* thus processes that have multiple repetitive actions to be performed by manual labor should be replaced by automated processes as were the recommendations of Gajjar & Sheth's study.

Though from the above case automation replaced many processes, it might fail to do justice to a process that requires a certain amount of "human element" or qualitative analysis.

Automation cannot substitute every labor process, as in the case of visual inspection system of a product line, the automated system would need an extremely specific product design to use as a standard and may miss out on more qualitative defects that humans can spot. An automated process for inspection should be used in complement to the human eye as per the study *(Smith &Adendorf, 1991)*

Automation cannot be looked at only on a micro-level and its many macro and large-scale implications needed to be considered as well. One of the most commonly debated topics surrounding industrial automation is the loss of jobs and increase in idle workforce it will bring about. With

governments of industrialized countries torn between increasing productivity or lowering unemployment caused due to automation, adaptation of automation has become a public debate with personalities like Bill Gates suggesting a "robot tax" to be paid by companies when they replace people with robots in their production process. Yet automated production processes might boost the economy and provide job opportunities and openings in other sectors which require more creative and analytical thinking.

(Morse, A David 1962) in his study gives an insight into unemployment concerns that come with automation and gives examples of automation in various developed countries like Sweden; where the baking industry used automation to mass produce "knäckebröd" bread with a factory producing 120 tons of bread employing only a single person in-charge of material handling in the factory. The French National Railways have also rescued costs by automating their traffic controlling and processes in the marshaling yards. In the case of unemployment concerns that come with automation; they will be offset with rapid economic developments that will boost job growth.

III. AUTOMATION AND SUPPLY CHAIN TRENDS IN INDIA

To implement automation in India it is important to understand how supply chain management works in the country.

A. Objectives of Supply Chain

(B.S. Sahay, Jatinder N.D. Gupta, Ramneesh Mohan, 2006) in their research findings reveal that most of the Indian organizations have aligned their supply chain objectives with their business objectives. They are now on course of aligning their processes and management focus. Enhanced level of competitiveness would require Indian organizations to manage the three-dimensional alignment of achieving the agenda set by the business strategy.

a). Research limitations/implications

Further research work should focus on: assessing the current level of supply chain processes; identifying critical supply chain focus areas for the business; and establishing specific performance measures for continuous measurement of supply chain efficiency improvement.

b). Practical Implications

This paper provides a detailed study to help supply chain managers improve supply chain efficiency through alignment of supply chain objectives with business objectives, supply chain processes with management tools and supply chain focus areas with management focus. Improved supply chain efficiency will help Indian organizations maintain competitiveness in a rapidly globalizing economy.

c). Originality/value

The supply chain alignment model suggested in this paper provides a framework for realizing true supply chain efficiency and competitiveness. Different organizations will align their objectives, processes and management focus as per the focal areas of their organization depending on their capabilities and market situation. However, in every case Indian organizations need to act fast to capitalize on these opportunities to be competitive with the world market.

*(D.G. Kulkarni ; P.G. Ramdasi, 2004)*explain that 'customer delight' is the main objective of the SCM in India. To see this objective, succeed, there are a number of other supporting factors like cost reduction, management of inventories, transportation system and whole distribution networks so that organizations fulfils the demand at the right place, time, quality and at the lowest possible cost.

SCM is viewed as a method which presents integrated approach to resolve issues in sourcing customer service, demand flow, distribution etc. but, the performance of the whole chain than each link of the chain is extremely ineffective in India.

The industrial sectors in India which have adopted the SCM are the automobile, aerospace, chemicals, apparels, food, construction, pharmaceuticals, electromechanical tooling and computers. These are the large-scale industries which are into SC and constitute a minor part of the total industries in India. The remaining medium scale and small-scale industries are in a state of either financial turbulence, time scarcity to think about SC, uncertain about the benefits of the SC or are unaware from where to start in terms of supplier selection, inventory system, warehouse etc. Uncertain product life cycles, increased competitions and too much expectation of customers have forced many leading-edge companies to move from physical logistics management towards more advanced SCM.

IV. MODERN TRENDS IN SUPPLY CHAIN

A. Social and Environmental Responsibility

The international political climate inspired India's bold Bharat Stage norms to periodically replace high-carbon emission engines with progressively more efficient models. multi-modal transport system, Kochi Metro Rail Ltd., partnered with a women's empowerment and poverty eradication organization Kudumbasree to employ 780 women and transgendered workers to manage diverse aspects of its operations. Indian supply chains are likely to vamp up socially and environmentally conscious practices including monitoring fuel

usage patterns to reduce waste, upgrading commercial fleets to bolster driver safety and automating operations to enhance human labor.

B. Mega-Aggregation and Micro-Segmentation

The 'lean supply chain' seeks to consolidate activities into a core business model and leverage compounding efficiencies to invest in designing tailored products and solutions for diverse audience cohorts. It resonates with 'the hedgehog concept' of focusing on core competencies with an aggressive eye to detail while proactively culling efforts that are not mission critical. E-commerce billing platform, PayTM recently delisted 14 of its logistics solution providers, closed 30 courier aggregation centers and reduced its distribution radius by 35%. In mid-November, 2016, PayTM reported 3-4 million new users signed up for its services in a single day. Yet today, in the face of steep demand and momentous growth, the company chooses to deliver superior customer service with few, high-quality channels. Ultimately, the strategy aggregates the company's top priority zones and realigns a deeper, stratified focus on key service points. India is set to witness the emergence of mega-oil giants. ONGC's recent acquisition of the government's majority stake in HPCL illustrates an aggregated supply chain that will offset risks and leverage an integrated framework to efficiently segregate and pursue competitive opportunities in a global market. Upcoming mergers or acquisitions planned between IOC-OIL and BPCL-GAIL target similar outcomes. India's economic pace will inevitably increase her dependence on 3PL and 4PL players, paving the path for 7PL firms that result from a domino effect of consolidation and micro-segmentation. In the case of e-commerce, these integrated segregations constitute last-mile fever – a rush to provide customers diverse delivery options through hyper local markets with click-and-collect services and pick-up points at public transport hubs (as the Kochi metro network has already considered implementing).

C. Artificial intelligence in Supply Chains

Amazon's "cavernous fulfilment centers across the globe" already employ "squat wheeled machines" to transport boxes. Although manipulating objects and handling nimble motor tasks is still challenging for early generation bots, the technology progresses daily and is likely to be implemented in most tier 1 cities in 5 years. Additionally, intelligent analytical programs driven by machine learning algorithms, commonly used in high-frequency financial trades, linguistic platforms like Google Translate or navigation tools, will also permeate supply chains to optimize transportation through actual ETA calculations that account for soft variables like predicted driver behavior and inventory management through pattern-derived demand forecasts. These self-learning programs will not only report but automatically organize and infer actionable points from internal data logs.

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V. ADVANTAGES & DISADVANTAGES OF AUTOMATION IN PRODUCTION

	Advantages	Disadvantages
1	Increase in production of goods as robots and machines can work faster and longer	High initial investments involved in installation, training of personnel to operate the automated process, maintenance, etc
2	Minimization of wastage caused by human errors as accuracy in usage and handling of raw material is high	Heavy supporting infrastructure needed such as a developed IoT (internet of things) network, LAN wires, WiFi systems, etc
3	Reduction in time and costs involved in orientation, training and motivation of workers	Low pay and incentives to Automation Engineers in developing countries deters participation in such projects and results in projects being done at very low margins
4	Reduces chances of accidents as physically arduous or dangerous tasks can be automated	Increased concerns of labour unions and workforces regarding job loss
5	Better conformity and uniformity in production which removes chances of errors and defects	Government taxes or penalties might be imposed if automation causes large distress on a country's workforce
6	Ideal for mass and continuous production of goods	Low flexibility in production as automated machines can rarely be overhauled to make new products

Table 1: Advantages & Disadvantages of Automation in Production

VI. EMPLOYMENT CONCERNS ABOUT INDUSTRIAL AUTOMATION

The business environment today is volatile, uncertain, complex and ambiguous. As organizations look to expand globally and become leaders in their respective spheres, this environment also becomes extremely competitive. Managers therefore, are perpetually looking for ways to reduce costs and increase profit margins. Moreover, clients in developed countries are asking that their outsourcing partners in developing countries embrace automation as it helps increase their efficiency and reduce their costs while standardizing their products and services in terms of quality. This leads to only one conclusion: Automation in India is inevitable.

As the introduction of automation, robotics and technology increases in business process management, 70 per cent of the workload can be handled by machines, without the need for humans to intervene. This makes only 30% of jobs relevant. The $155-billion IT sector employs around 3.9 million people in the country, and McKinsey estimates that half of the existing workforce will be irrelevant as they are not skilled to stay tuned to the changing market needs. Furthermore, a quarter of people losing their jobs because of automation by 2021 will be from India. However, even while these statistics sound alarming, short-term unemployment might lead to higher economic growth in the long run which would stabilize employment rates.*(Morse, A David 1962).* Moreover,the cost of initial automation and robotics is high. In a country where wages are much lower than such costs, impact will be felt at a slower pace and much less than elsewhere.More than job cuts, new job creation is a big concern for India. Ironically, this can only be solved by automation. Cognizant's Center for the Future of Work lays out 21 types of new jobs that will be created in the next years due to automation. All these jobs fall in the categories of Coaching and Mentoring, Health and Physiology, and Connecting man and machine. These jobs will be capable of absorbing all those impacted by automation.

VII. CONCEPTUAL FRAMEWORK TO IMPLEMENT AUTOMATION

Owing to the competitiveness for global markets and the pressure from clients of developing countries, automation is the need of the hour for Indian businesses. However, there is no clear demand for it. It is a very big step for an organization to understand that it needs to automate and then implement it, one that the organization may not be able to take effectively.

Gerhardsson, Akerlund in their research thesis titled Process Automation with Business Process Management

(2014) combined descriptive and explorative methods of study, and devised a four-step framework that an organization must follow to make a smooth transition to automation.

It is recommended that Indian companies adopt this framework to make an effective, no-hassle transition while integrating their business processes with automation.

A. The Framework is Detailed as Follows:

a). Evaluation Process Automation Potential

The scope of automation differs from business-to-business. While businesses with highly customized, hand crafted products may not have a lot of scope for automation, businesses with standardized products have a lot of automation potential. The organization must therefore, understand the scope for automation its business holds and the degree to which it wants to automate. This is crucial as it paves the way for all other steps.

b). Determining Automation Requirements

Automation has its own requirements in terms of machines, data warehouse installation, servers and robotics. These require investment. An organization must therefore, align its budget with its requirements while ensuring its long-term goals are being met.

c). Finding the Appropriate BPMS Solution

BPMS and Automation have various dimensions- robotics, artificial intelligence, mechanization and management information systems. The organization must integrate all these into an effective solution to its cost-cutting and efficiency-increasing objectives. This requires internal cooperation and external expertise.

d). Selecting the BPMS Vendor

An organization must choose its vendor carefully as the vendor becomes the bridge between where the organization stands and where it wants to go with automation. The vendor must understand the organization's vision, automation requirements, budget and have an inherent understanding of the business's production process. Only then, can the organization's automation requirements be truly fulfilled.

VIII. SUITABILITY IN THE INDIAN CONTEXT

India has moved from a system of complex state taxes based on origin of goods and a central, federal tax where in Different states had different rates and levies for the taxes under their control, and the intricate web created strange incentives for companies, ones that seem very suboptimal from the perspective of the supply chain. India now have had a tax reform in the form of GST, coupled with the multiple steps taken by the government to improve the secondary sector production in India, provide a perfect environment to implement automation in India as a standard tax system standardizes the costs etc. undertaken to manufacture and allows large manufacturer to automate the whole production process between states as costs would remain constant. This would also increase the plant capacity and allow companies to take the full advantage of automating the production process and the cheap raw material availability in India, thus the benefits from economies of scale would be massive which would be a combined derivative of automation and the revised tax structure in India.

India has an opportunity to become a leading global food supplier if only it has an agile, adaptive, responsive and efficient supply chain systems and this is possible if India is able to automate the food supplying process. At the moment India still claims to be an agrarian nation and yet, numerous stake holders work in isolation. The food supply chain is complex with perishable goods and numerous small stake holders. In India, the infrastructure connecting these partners is very weak. Demand forecasting is totally absent and the farmers try to push whatever they produce into the market. Lack of technology applications where in cold chain logistic supply chains should take advantage of technology improvements in data capture and processing, product tracking and tracing, synchronized freight transport transmit times for time compression along the supply chain and supply-demand matching. The process of new product development, procurement and order to delivery processes should be well designed and well supported with the help of IT tools and software. Presence of large number of unorganized retailers, at present the unorganized retailers are linked with farmers through wholesalers or commission agents. The commission agents and wholesalers redundant supply chain practices make the process further inefficient. There is a colossal waste during the post-harvest storage and handling due to improper bagging without crating, lack of temperature-controlled vehicles, no cold chain facilities for preserving the produce, coupled with significant processing of the agricultural produce resulting in enormous losses to the nation. Given the characteristics of fruits and vegetables such as perishability, seasonality, bulkiness and delicate nature of the products coupled with inadequate storage and transport facilities, the supply chain can be made efficient by reducing the length of the chain improving cold chain facilities. Automating this process can improve the supply chain system and reduce pilferages and wastages massively. Automation implemented with a model that has not existed in India and if implemented would completely transform the food supply system. That’s basically weeding out the small-scale retailers and middle men from the food supply system and have a much larger organized retailor directly in contact with the farmers who would automated the complete food supply process from collecting the produce of

the farmers to packaging and processing food and exporting, by doing so we would cut cost massively and this would allow the Agro-industry to be a lot more efficient and positively contribute to the Indian wealth by and large.

IX. CONCLUSION & DISCUSSION

Automation provides lower costs, greater flexibility and increased productivity. Automated processes have increased safety of workers and reduced accidents by performing dangerous, dirty and hazardous jobs. They also have a relatively faster investment payback period of 2 years. (Farley, John U;Kahn, Barbara;Lehmann, Donald R;Moore, William L Sloan Management Review; Winter 1987)

Since the initial investment of automating a business is high, small to medium scale firms with little or no global customers would prefer manual production process which has a lower initial investment. Moreover, there are multiple concerns regarding loss of jobs and increased unemployment that comes with automation. However, the automation wave brings with it the creation of multiple jobs, therefore absorbing all those impacted by automation. Public policy should also be such that it embraces automation, while supporting workers through the creation of jobs, pension rights, and transfer rights. The public employment service so it can effectively place, counsel and relocate workers both locally and across state lines. *(Goldberg J. Arthur, 1962)*

In developing countries like India, technological infrastructure, especially telecommunications technology might not be adequate currently to support large-scale automation. Moreover, in an era of technological advancements, intelligent control systems in Indian business have still not taken the forefront. This is primarily because existing systems are inflexible and are programmed to be used only in ideal situations which rarely repeat themselves. Many of these challenges can be met by taking optimum advantage of emerging software technology. The ‘smart’, modern approach should be combined with traditional ways of thinking in automation. (Jaikaran Singh, Mukesh Tiwari; 2013 issue).

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