

A STUDY OF THE IMPACT OF INTERNET OF THINGS ON FUNCTIONAL BUSINESS PROCESSES

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Abstract

Internet of things is an emerging technology which is gaining importance to be used in Enterprise Resource Planning for decision making at various levels and domains required to finalize on the design and operations of a manufacturing enterprise. An enterprise has a complex system which has a large number of design variables and the decisions required to be made needs real time data collected from various sources. ERP helps in acquiring data, communication and all decision making activities. Therefore, the performance of an ERP system is also affected because of Information technology infrastructure. The objective of this paper is to investigate the impact of emerging IoT on ERP in modern manufacturing. In order to do so, a thorough review of articles was done and data analysis was conducted using secondary data.

Index Terms: Inventory Management, Supply Chain management, Internet of Things, ERP, Quality Management, Packing Management, SAP, Artificial Intelligence.

I INTRODUCTION

An ERP system is important for an organization. It makes an organization more effective and efficient by helping them function as a single unit and a single source of data is accessible to all employees in an organization. IoT increases the quantity of data available for an ERP system which enables an organization to utilize and analyze the data effectively. It also assists in managing the products and services better. This also helps to increase the profitability of an organization. At present, the impact of IoT in an organization is becoming more prominent. With IoT, organizations can increase customer satisfaction by providing new services that they might not have the ability or idea to offer before. IoT impacts the ERP system in many ways. IoT assists an ERP system to connect the people, processes, data and things in a manner which enables better decision making. This can further improve the data processing.

II RESEARCH OBJECTIVES

To do an exploratory study on how Internet of Things can have an impact on the ERP systems and various business functional modules

III LITERATURE REVIEW

According to the survey conducted by Business Insider, the early adopters of IoT are majorly industrial companies which counts for 18 percent who makes industrial machinery using IoT devices. Nearly one-fifth of major manufacturing companies have already implemented IoT to reduce costs and have focused on increasing their productivity and quality efficiency. It is projected that manufacturing firms who are going to invest in IoT will be around \$140 billion over the next five years. The blend of IoT and ERP can provide valuable real-time data.

3.1 Impact of IOT on Enterprise Resource Planning

Integrating IoT with ERP will improve the efficiency of ERP systems by making it more intelligent, real-time and flexible. (Thangaiah, Sharma & Sundharam, 2018) points out that IoT will lead to productivity improvements through equipment maintenance, saving energy, optimizing inventory, and improving Labor efficiency. IoT helps in merging the real and virtual worlds of production with the internet making it possible to connect all aspects of production process which is machines, material, man and method. This enables machines and materials to communicate with each other and manage the enterprise operations themselves. For the automation of transactions with IoT, businesses need to deploy sensors, communicate with multiple devices and also install advanced analytics for actionable understanding. IoT will help manufacturing companies by collecting useful data from these sensors and communicates such data to workers in the factory, plant managers, software systems and many other components of the value chain.

3.2 Implementation of ERP in Manufacturing using IOT

Internet of things (IOT) can be implemented in many areas to facilitate the increase in production. (Bahri Mahmud, 2016).The most important areas, logistics activities and production reporting that are becoming the determinants or factors affecting the key performance

Index. The activities that provide relevant information are Inventory management and manufacturing production processes (Mahmud, 2016). The SAP ERP software captures and updates data in a normal computerized system. Internet is a benefits to the organization as it helps an ERP software focus on areas which deals with increasing the supply chain value. The move of logistics operations in the internet shifted the traditional logistics to E-logistics. The internet of things (IOT) enhanced the logistics operation performance providing the real time update that influence the management to make decision related to time and costs saving as well as improved operational efficiency by connecting the unconnected activities as the enhancement for the issues addressed in manufacturing logistics (Mahmud, 2016). The manufacturers and consumers were benefited .IoT can thus be effectively used in ERP supply chain, inventory management and packaging management.

3.2.1 IoT in ERP:Inventory Management

Evaluating inventory by using paper based, excel files and traditional enterprise software is costlier and may not solve all the problems of the business (Sizakele mathaba, 2016).So considering this problem here inventory management is done by using RFID and 2.0 technologies which is interconnected with each other by IoT. Here the complete communication is done with the help of sensors. On the other side web 2.0 tools used may communicate by using desktops or phones. RFID tags consist of two types, depending upon their power supply (Williams, 2016). They are active and passive. Web 2.0 allows web applications to be created, that are more operationally rich and quick to respond. Electronic Product Code is (EPC) is a unique global identifier of each product which is generally used for tracking the products(Adigun, 2016). The main drawback of using IoT in countries like South Africa is cost and it can be managed by collaborating with developing countries (Dlodlo, 2016).

3.2.2 IoT in ERP: Quality Management

Garrehy,P, 2015 has proposed in his study that Internet of Things is expanding the range of functionality and abilities of products therefore is imposing companies to take an overall view as how they should be doing their business from conception and design to manufacturing, operation and service to IT. The widest touted benefits is one where IoT-enabled Big Data analytics provides several new avenues to improve operational efficiencies, quality improvement and helps boost the bottom line operations. IoT aligns the company's facility's operation with its suppliers and customers and improves load forecasting and production scheduling along with enterprise resource planning (ERP), product lifecycle management (PLM), manufacturing execution (MES) and supplier relationship management (SRM) systems. 2 Few of the automobile companies using IoT devices in the production of their vehicles like Volkswagen who recently added a system that tracks all of their parts' supply pipeline so that they know where all parts are located. General Electric uses IoT technology at their Durathon battery factory in Schenectady, N.Y. to collect data about their round-the-clock processes by installing 10,000 sensors on their assembly line and in every single battery they make, so that the managers know the production status at any time and can share the data with other departments also (Garrehy, P, 2015). In addition to detecting future maintenance issues, IoT-enabled predictive maintenance practices which promises to eliminate ineffective preventive maintenance programs, therefore minimizing maintenance costs, increasing equipment reliability and availability, and thereby unlocking additional capacity while lowering the cost of production.

3.2.3 IoT in ERP: Packaging Management

(Wenxiang Li, Chunchun Pil, Mei Han, Chong Rani, Wei Chen and Peng Ke 2015), talked about IoT assisting in packaging for better control over the process. Implementing IoT sensors will share and process data regarding the product, their usage patterns and handling. The system when integrated with existing ERP system can effectively monitor the working conditions (Wenxiang Li, 2015). A methodology using Genetic Algorithm is used for scheduling sub processes. This method optimize the process by minimising costs as well as delays in production (Wei Chen, 2015). Simulations have been carried out to study the process. Depending on the objectives, different functions were developed, namely Cost Optimisation Scheduling (COS), Delay Optimisation Scheduling (DOS) and Random Scheduling (RAN). From the analysis, overall production delay for DOS is lower than RAN by more than 40 units. There is significant reduction in overall production cost for COS than RAN when the number of sub process exceeds 8 (Chunchun Pil, 2015). Utilization rate of facilities is higher for DOS and COS than RAN by 30% (Peng Ke, 2015). The limitation is that, it does not mention about utilization of data gathered from IoT sensors for efficient transportation of raw materials and finished goods.

3.2.4 IoT IN ERP: Supply Chain

In the present business scenario, most of the supply chains are struggling to sustain competitively in the global supply chain. This is due to the increasing complexity in each phase of the supply chain operations (M. Majeed, 2017). Companies have to be smarter by incorporating the necessary technologies to be more competitive and sustain in the global supply chain, that processes can be better managed and automated where necessary. Most companies are not able to succeed due to poor integrations of technology in their supply chain. RFID is mostly used for item level tagging and inventory management. However, the study proposes to use RFID at different points in the value chain to trigger various transactions and execute operations in an ERP system which would increase the efficiency significantly. RFID for the supply chain managers and it is also important that the cost of RFID tags come lower in cost as it should be more affordable (Thashika D Rupasinghe, 2016). In order for companies to sustain their business in the digital era, it is vital that they restructure their IT landscape to incorporate the technology as it will make it easier to compete in the global market. Hence iot can be widely used in the major functional areas of a manufacturing enterprise.

3.2.5 Integration of the IoT and Cloud ERP

ERP solutions are extensively influenced by recent improvements in cloud computing technology (Androcec et al, 2018). These advances resulted in emergence of Cloud based ERP systems which led to reshaping of business, technology and other aspects of ERP. According to research by IDC (Rain van Heur, 2015), by 2020 40% of data will be machine generated, with 20 to 50 billion of connected devices making this growth possible. The main characteristics of IoT and Cloud ERP complement each other where IoT on one hand provides interfaces to Physical environment in which enterprise operates, thus being able to collect huge amounts of data while on the other hand Cloud ERP enables vast resources to store, analyze and process this data. Cloud ERP can use this data to help people respond in a proper and timely manner to malfunctions, security risks, ineffectiveness and various other issues at the enterprise operational level. Cloud ERP can also use this data to aid activities of the management by providing detailed analysis of the data, statistics, and data visualizations, trends in the past and also future predictions. Hence these applications of IoT technology in enterprises can be grouped into (Lee and Lee, 2015) : a) providing Monitoring and Control, b) Big Data analytics and c) Information sharing and collaboration in the enterprise.

Samir Yerpude1 and Tarun Kumar Singhal, (2017), the study of the current research literature reveals that the accuracy of forecast increases with the usage of real time data collected automatically by the deployed IoT systems. With 3.5 billion users using internet in a single year at an average speed of 6.1Mbps 5, it becomes one of the most significant media of data exchange on real time basis. Precise forecasts facilitate businesses gain and sustain their strategic position in the market. Organizations use the facts for effective strategic analysis which help in mitigating the market risks. Organizations which have adopted IoT reveal an increase in revenue and a reduction in the costs i.e. real time data for demand forecasting. Higher customer satisfaction can be achieved through improved serviceability due to accurate forecasts. Accuracy of the forecasts will play a vital role to support the managers in making the right decisions, therefore the data on demand forecasting is crucial for business enterprise

IV SECONDARY DATA ANALYSIS

IoT collects data from devices all of types to monitor all the vital statistics of every asset, providing visibility into your assets' performance and quality improvement. Manufacturing firms are at the forefront of this revolution. According to a recent Price Waterhouse Cooper survey, 35 percent of U.S. manufacturers are already enhancing their manufacturing processes by collecting and using data generated by smart sensors. They also found that 38 percent of these firms currently build sensors into products to allow customers to collect data and 34 percent of the firms think the adoption of an IoT strategy in their operations is extremely critical.

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With the help of IoT, the checkout process is automated thereby reducing time by 80%. Also, productivity slightly improves by 3-5%. Better inventory control using automatic shelf monitoring and replenishment helps in 1% reduction of COGS. Layout optimization based on analysis of employee behavior in-store and energy management using IoT sensors improves the overall business process by 20% by cost cutting.

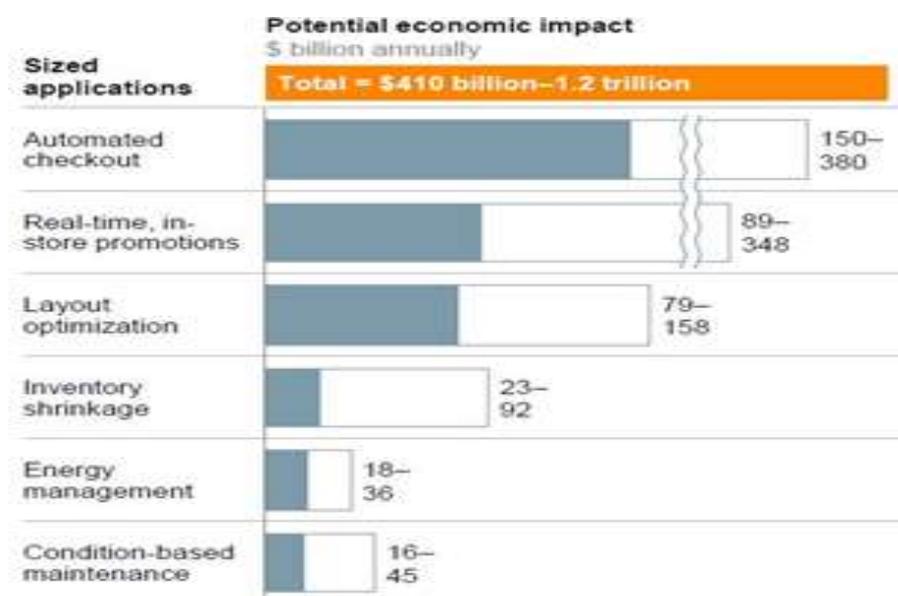


Figure: 1 Source: The internet of things: mapping the value beyond the hype (Richard Dobbs, June 2015)

The manufacturing industry is the world’s most creative at producing data. IoT systems consisting of sensors, applications, and platforms to aggregate, analyse and present real-time data will drive manufacturing’s global data output to well over 2,000 Petabytes next year. Combining ERP & IoT to fuel new revenue growth IoT is the growth substance manufacturing is looking for. In the manufacturing sector, around 1912 Petabytes of data is being generated. Integrating this data into existing ERP system helps to exploit the data for getting meaningful insights.

Annual new data stored by sector, 2017

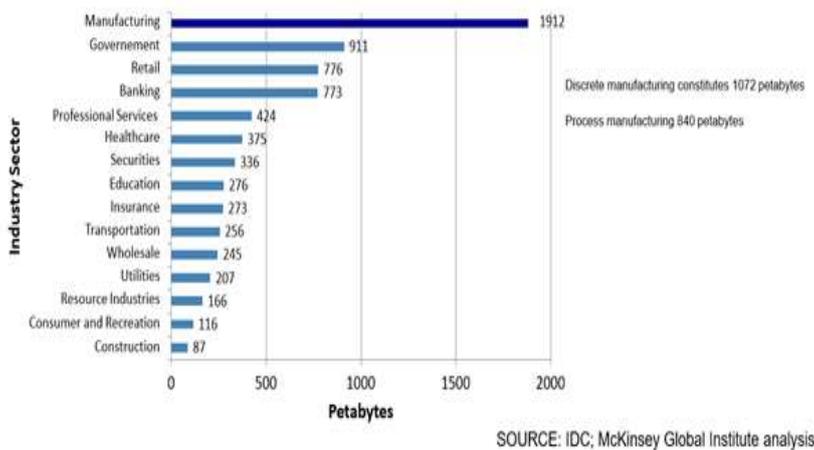


Figure:2 Source: Combining ERP & IoT To Fuel New Revenue Growth (Louis Columbus, March 2018)

Also, it is observed that China is the global leader in IoT that 23% of the Chinese companies are adopting IoT to increase their competitiveness. On the other hand, 19% American companies go for IoT for cost reduction while Malaysian companies (21%) rely on IoT to improve business process by integrating them with ERP.

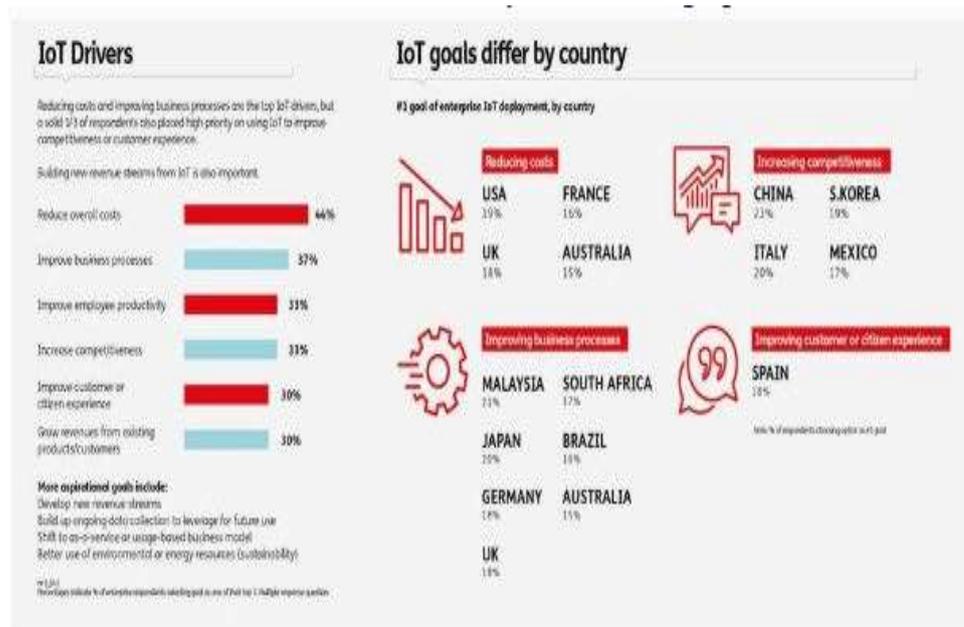


Figure: 3 Source: Challenges your Perspective of IoTs Growth, Forbes,(Richard Dobbs, March 2018)

Therefore, all the industries and all forms of IoT technology spending- hardware, software, services, and connectivity- represents a 16.7% increase over 2016. The trend is expected to continue with overall IoT spending exceeding \$1.4 trillion by 2021. Manufacturers will lead the way, spending \$183 billion in 2017 alone, according to IDC. Most of the money the manufacturers spend on the IoT in 2017 will be reserved for projects designed to improve production operations.

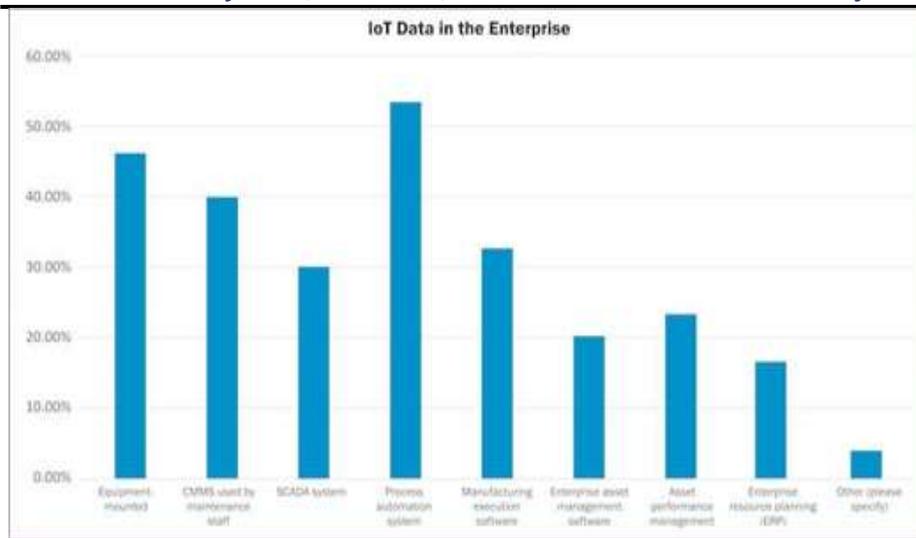


Figure:4 Source: www.controleng.com, ERP looks to embrace the Internet of The Internet of Things (IoT) (Sidney Hill, Jr. November 2017)

V CONCLUSION

For a manufacturing industry, IoT can be very advantageous. IoT can be used in many areas such as the manufacturing facility, supply chain and even serving the end consumers. An ERP system is designed to enable businesses to have access to data important for an organization. IoT can benefit the organization to further expand its present capacities and even improve the availability of data if used properly. Businesses which utilize innovative technology can reap the benefits of IoT and increase the value of their present ERP systems. Although the capabilities of IoT and its impact on ERP is yet to be explored further, companies should begin using IoT to gain a competitive edge. With the real-time data analysis, increasing customer service value, as well as potential for better products and more lines of products, IoT and ERP will soon be a typical business model.

REFERENCES

- [1]. Federico Civerchia et al (2017). Industrial Internet of Things Monitoring Solution for Advanced Predictive Maintenance Applications. Journal of Industrial Information Integration.
- [2] Wenxiang Li, et al.(2015). A Scheduling Method for IOT-aided Packaging and Printing Manufacturing System, 11th EAI International Conference on Heterogeneous Networking for Quality, Reliability, Security and Robustness .
- [3].Bahri Mahmud. (2016). Internet of Things (IoT) for Manufacturing Logistics on SAP ERP Applications, Department of Logistics Studies, Faculty of Business Information and Sciences, UCSI University, UCSI Heights (Taman Connaught) Cheras 56000 Kuala Lumpur Malaysia.
- [4]. M. Aabid A Majeed.(2017). Thashika D Rupasinghe, Internet of Things (IoT) Embedded Future Supply Chains for Industry 4.0: An Assessment from an ERP-based Fashion Apparel and Footwear Industry, International Journal of Supply Chain Management, .
- [5]. Moutaz Haddaraab.(2015).Ahmed Elragal, the Readiness of ERP Systems for the Factory of the Future, Procedia Computer Science. .
- [6]. Samir Yerpude1 and Tarun Kumar Singhal, Impact of Internet of Things (IoT) Data on Demand Forecasting, Indian Journal of Science and Technology.
- [7]. D. Mourtzis, E. Vlachou, N. Milas. (2016)Industrial Big Data as a result of IoT adoption in Manufacturing 5th CIRP Global Web Conference Research and Innovation for Future Production, Procedia CIRP 55, 290 – 295.
- [8]. Giovanni Miragliotta and Fadi Shrouf, Using Internet of Things to Improve Eco-efficiency in Manufacturing: A Review on Available Knowledge and a Framework for IoT Adoption.
- [9]. Zhuming Bi, et al.(2014). Internet of Things for Enterprise Systems of Modern Manufacturing IEEE TRANSACTIONS

ON INDUSTRIAL INFORMATICS.

[10]. IS Stephan Thangaiah, et al (July 2018), Internet of things (IoT) integration with enterprise resource planning application in manufacturing industries, International Journal of Mechanical Engineering and Technology (IJMET),

[11]. The McKinsey Global Institute (MGI), The Internet of things, mapping the value beyond the hype.

[12]. Androcec , Darko., Picek, Ruben., Mijac Marko. (2018). The Ontologically based Model for the Integration of the IoT and Cloud ERP Services. Proceedings of the 8th International Conference on Cloud Computing and Service Science, 481-488.