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Resource Sharing and Business Convenience in Smart Manufacturing

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Abstract:
Globally, Smart Manufacturing has set its stage and this readiness has made a huge impact on the manufacturing techniques and standards. Using smart manufacturing techniques, India has an opportunity to pave its way to achieve the objective and aim of the 'Make in India' mission. The major objective is to encourage multi-national as well as national companies to manufacture products using state-of-the-art machinery, Industrial Internet of Things (IIoT), reliable resource sharing methods and other smart manufacturing components such as Big data, cloud computing, simulations, artificial intelligence and collaborative robots. This paper incorporates the resource sharing and networking methods and analogies used in Smart Manufacturing. Due to the increased production of goods using traditional techniques, an adaptation of Smart factories and shops is difficult and farfetched. Cloud-Based Design and Manufacturing (CBDM) has also taken a huge leap due to the rise of Smart Manufacturing. It refers to the transformation of a consumer-based product to a prosumer-based product development network. Using the concept of Cyber manufacturing and Predictive Engineering, manufacturing takes advantage of the advancements in Information Technology, making the journey from raw material to finished product much cheaper and faster. The creativity of Smart Manufacturing allows companies to make their quality control plan flexible and in reference to recent standards. Most importantly, it provides customers with what they need at an improved pace and a higher quality.

Keywords: *cloud-based design & manufacturing, Industrial IoT, resource sharing, smart manufacturing.*

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I. INTRODUCTION

Manufacturing firms are facing the competition of not only the quality of the goods but also the resource, market, technology and skilled labour. The layout of the manufacturing quality control is getting more complex day by day due to the new additions of technology and product-service analogy. These additions are made so as to decrease labour cost and increase production value. The resources for manufacturing vary on a very large scale and the management and sharing of such resources have been proven to be very complicated and sophisticated [3]. This problem of resource sharing and networking is responsible for the low manufacturing pace and degraded quality of finished products. Lack of networking reflects on the overall equipment efficiency and final quality of the product. The performance matrix is an essential part of a manufacturing unit which includes the scrap percentage, usage of oil/lubricate, efficiency of individual machines, set-up orientation, the safety of workers and the functioning of machines. Every shop works in accordance with the substantial gain or loss in the factors of this matrix. Using IoT and cloud-based services can surely cause a sudden rise in the performance graphs of manufacturing units.

The concept of resource sharing involves scheduled transfer of setups [1]. The demand has increased as the consumers have started asking for products/services for on-time delivery of better quality. For example, a shop consisting of a 6-DoF robot pick & place robot can be used for more than one applications. This robotic setup can be used by manufacturers of various industries such as automotive, storage and furniture. Certainly, the configurations, constraints and programming environment for every application are different, hence the transfer of work gets complicated. Hence, this space should have scheduled transfers and allocated time for specific jobs of various industries. Also, the scrap-cleaning and maintenance should be taken care of, afterwards. Nowadays, exclusive setups are highly undesirable since they lead to undesirable setup costs and increase the chance of rework and scrap percentage. The

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idea of sharing of resource and networking helps in high-quality schedules and the slot-problems obtained are reasonably undertaken. In this paper, the various technical aspects are explained and how can they be implemented in the manufacturing industry.

II. BUSINESS CONVENIENCE

Resource sharing involves collective usage of expensive machinery hence, reduces investment in equipment, the effect on the environment and the risk of sole ownership. It makes it much more convenient for a manufacturer to commence his enterprise, provided he has got the power of shared resource and the wide pool of networks. Resource sharing means that a unit i.e. a machine, a manufacturing resource or a workspaces can be shared among two or more parties. This increases the co-operation between firms and causes a direct impact on Business-to-Business relations. This coopetition is often known as the 'key to survival' as it yields opportunities for upsell and boosts up the sales of the joint-enterprise. The resource can also be shared between the government and the manufacturer. The government has control over sectors such as water, emission norms, sanitation and dump-yards which is not easily accessible to private manufacturers. The legal factors and government dependency involving sharing of resource is explained, later on. The consumers should have better relations with the business as the companies are fairly accessible to the resources. These developments in communications occur mainly due to the sharing of resourcein the pool of networking among buyers, consumers and the government. The purchase decision is also typically less complex than the process of selling and marketing to businesses or government.

Resource sharing is effective as most companies are striving to increase their operational efficiency by fine-tuning their manufacturing processes to focus on product planning and quality control. This network involves a number of components such as raw material, machinery, tools, labour, storage areas, stacking areas, procurement of finished goods and other logistical factors.

III. CLOUD-BASED DESIGN AND MANUFACTURING

Cloud-Based Design and Manufacturing has taken a huge leap in the recent years due to the rise of Smart Manufacturing. Although using cloud computing exhibits various benefits, several concerns might arise in the minds of the manufacturers. It refers to a prosumer-based product development network which enables a customer to design, reconstruct or deconstruct products or even services and reconfigure manufacturing techniques.

Resource sharing is utilized on an industrial as well as customer-level through Cloud computing. Various manufacturing resources and competences can be intelligently detected and connected to the world via the internet. Also, manufacturers are facing increasing pressure to revamp their affairs, therefore, CBDM has been an open option for most to modernize their IT setup. It can be automatically managed and controlled using IoT technologies and services.

Using Cloud computing, organizations can utilize every asset of their digital set up so as to claim resources, rent services, host, maintain and update tasks virtually [7]. Manufacturing companies with obsolete IT infrastructure can use this technology in order to make their business suppler and pro-active. They can have an improved perspective of the activity on their network, boost data encryption and initiate firewalls at both the programmer and consumer levels [4]. Many types of manufacturing resources are owned by various enterprises which are located all around the world. This makes the sharing of resource and networking very sophisticated and challenging. Hence, CBDM has become a prominent aspect in most organizations in which computing resources are made available on-demand to the user as needed.

Cloud-based Manufacturing is considered as a social networking analytical approach to the industry of Manufacturing and production [10]. To include cloud-based technology in Manufacturing, the enterprise calls for a complete change in their control plan. Most companies are comfortable with their operational efficiency, but with the increasing population, the demand increases. This increase exceeds the production rate, so as to be at par with the current requirement, every company needs to incorporate the idea of cloud-based sharing of resource and design. In order to understand the information, data analysis, and resources are available in the socio-technical and economical network of CBDM systems. It is essential to understand the structure of management, the collaboration policies and detection of specific helping hands in the industry.

IV. INDUSTIAL IOT

The Industrial Internet of Things is a part of the huge concept called the Internet of Things. The IoT is known to be a network of intelligent computers, devices, and machines that compile and execute large amounts of data. This collected data is sent to a centralized cloud-based system where it is included with previous stored data and shared with users and other machines, accordingly [2]. This application of IoT used in the industrial space i.e. a manufacturing unit or a project-based environment is called Industrial Internet of Things.

The main aim of using IIoT technology is to revolutionize manufacturing by enabling the procurement and accessibility of far greater amounts of data, at far greater speeds, and far greater efficiency [5]. The reason why the term 'IIoT' has become progressively pervasive now is due to the benefits causing the increase in mass customization and beneficial production control.

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This concept has been transforming the industry by allowing enterprises to break open databases and connect with raw material suppliers, inspection and quality control, auditors and machine repairers.

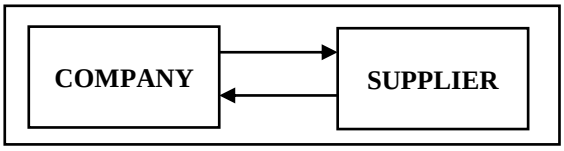

Fig.1 Combination of Company and supplier to transact using IoT

Using IIoT services, a company is enabled to stay in constant touch with their supplier and vice versa. Real-time operations can be carried out such as auditing of raw material and loading-unloading of billets. These RTOs helps to gain trust between both parties and causes an increase in production value.

The combination of machine-to-machine communication using big data analytics and IoT has been able to drive the manufacturing sector on a much higher pace. Many industries manufacturing chemicals, foods, automotive spare parts, food and beverages have incorporated this highly enhancing technique of production to increase productivity and performance [9].

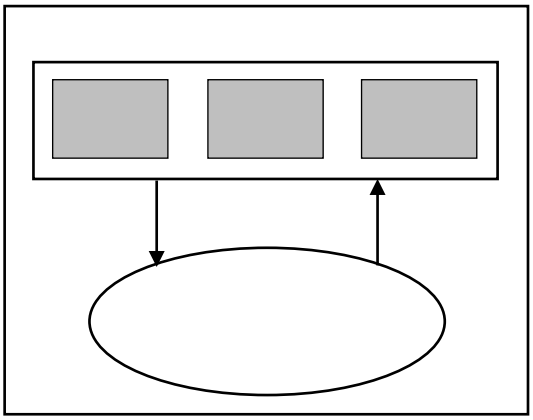

Fig.2 Combination of the processing line and Control room for operation handling and analysis using IoT.

Also, with the help of various IoT enabled devices, the processes and execution on the shop floor can be carried out in executive office spaces or control rooms. The leaders and management can have an exact and precise estimate on how their enterprise is doing, which will, in turn, help them to make finer and accurate decisions.

The data is accessible to a number of individuals invades privacy, but the companies' needs assurance on how their data is highly protected and secured using IIoT. The easy accessibility due to the sharing of resource is for the betterment of the workflow and not for leaking out confidential information.

The power of IIoT is unrestricted and endless, as data gets processed every minute and more machines connect with one another for the execution of that data. The operational analysis using IoT has created a great impact in delivering systematic and accurate data confirmation and production outcomes.

V. COLLABORATIVE ROBOTS

Collaborative robots also are known as Cobots have recently become an essential element in every shop of the industry. A cobot or co-robot is a robot intended to physically interact with humans in a shared workspace. This is unlike other robots, designed to operate autonomously or with limited guidance, which is what most industrial robots were up until the decade of the 2010s. Now, the scenario has changed and human-collaborating robots have become a part of the automated manufacturing and processing lines.

According to a study at MIT [11], Human-Robot teamwork is much more efficient than a robot-robot collaboration or a human-human collaboration. It talks about how existing manufacturing industrial robots have performed tasks efficiently but cannot be placed in a processing line without human collaboration. Companies such as BMW and ABB have taken under Cobot set-ups in the manufacturing lines to boost up productivity.

Cobots can be used in industries such as manufacturing, healthcare, agriculture and construction. From a business perspective, the selling of these cobots is subject to configurative systems [11]. Applications such as pick & place, machine trending, packaging and quality inspections can be done using collaborative robots.

These robots add up to the enterprise expense but cut off the labour charges, inspection duration, cycle time and machine maintenance costs. Sharing of these robots for various applications have proven to result in the increased fabrication of jobs. The networking between robots and humans can easily be configured and customized in accordance to the requirement of the application.

VI. SMART MANUFACTURING IN INDIA

Globally, Smart Manufacturing has set its stage and this readiness has made a huge impact on the manufacturing techniques and standards. According to International Yearbook of Industrial Statistics 2016- published by UNIDO, India has ranked 6th among the world's largest manufacturing nations. By 2020, India is expected to become a major automobile manufacturing hub and the third-largest market for automobiles in the world contributing approximately 25% of the GDP [8]. Hence, India has an upper hand to enhance its manufacturing techniques using huge automobile establishments.

The Germans announced 'Industry 4.0' while India and China launched 'Make in India' and 'Made in China 2025' respectively, with the common objective of inspiring multi-

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national as well as national companies to manufacture products using state-of-the-art machinery, Industrial Internet of Things, reliable resource sharing methods and other smart manufacturing components such as Big data, cloud computing, simulations etc. India's transformation of becoming an automation-based industry from and the agricultural-based country is on its peak. Programs such as 'Make in India' and 'Digital India' have been initiated to facilitate capital, execution of innovate ideas, skill development, conserve intellectual property & build state of the art manufacturing industries. India aims to eliminate obsolete and traditional methods and manufacturing and introduce the new enhanced ways of manufacturing.

The economic situation in India has been changing every now and then due to various budget and taxation factors. The demonetization of 2016 had affected the industry terribly. The sourcing of raw material, delivery of finished products, domestic as well as international sales had become even more complicated and difficult. With the help of smart technical aspects i.e. using cloud computing services and Industrial IoT to conduct business in the manufacturing industry, these issues can lead to better resource networking and better B2B and B2G relations.

The resistance towards new technology is a possibility and it is essential for the management in this industry to penetrate this education through simple but effective frameworks and setups. The possibility of India entering the Industry 4.0 has already touched, hence the business enterprises should set up business models building a holistic image of elements and components needed for digital transformation. Every enterprise should realize the importance of cloud-based design & manufacturing and IIoT and reduce the risk of transacting and conducting business by using digital methods. Entrepreneurs can create a progressive path to a smart business by rectifying and implementing new digital and technical capabilities that provide optimization now but also enable digital business concepts in the future.

Today, India's has achieved a visible momentum due to the various campaigns and missions. The advancement of the manufacturing leads to the opening of the doors of investment and external relations.

VII. PESTEL ANALYSIS

The PESTEL analysis, being a framework or tool used by marketers to analyze and monitor the macro-environmental (external marketing environment) factors have an impact on an organization. The manufacturing industry using the idea of shared resource in the pool of networking has the following factors:

P-Political: Sharing of the resource is highly influenced by political factors such as trading policies & ethics, funding, grants & initiatives and any other conflicts of interests. The Manufacturing Industry needs grants and funds from the government due to the economic recession. Using manufacturing technology, if a company disobeys any law, it is automatically intimated to the government. Various emission norms, the labour& trade policies and other B2B laws are drafted which every company has to follow.

E-Economical: Economy is the backbone that holds the country together, hence it is highly considerable. Factors such as taxation, audit and unemployment highly influence the manufacturing and resource sharing environment. India, despite having a large population has an unexpected low skilled labour force. Other than labour issues, taxes, duty charges and revenues also add up to the manufacturing economic situation.

S-Social: This is where the sharing of resource comes into the picture, it provides easy access and high business convenience. The customer attitude and brand positioning of the enterprise affect sales and production. The media also provides a medium for the enterprise to connect with other enterprises and customers. Mass customization is carried out to meet the demands of the customers.

T-Technological: The funding of R&D and the usage of new technology highly influence the manufacturing industry. Using IIoT and the power of cloud computing has helped the production and sales reach new heights. The procurement of raw material and delivery of finished products have also become easier and convenient. This helps in the networking between companies, customers and the government by providing a medium of communication and sharing of resource.

E-Environmental: The manufacturing industries have a direct impact on the environment. Enterprises need to take care of the usage of energy, safe waste disposal and dealing with the hazardous material. These environmental issues have led to the rise of CSR (Corporate Social Responsibility). Many industries have started programs such as tree sapling drives, river cleaning and manure production projects. The smoke quality and scrap removal have to be carried out in accordance with the norms designed by the government.

L-Legal: Every Enterprise has a few patents filed under their name. The copyrights need to be reserved and the patents need to be filed on time. The business and trade laws & agreements influence the sales and production of the company. The health, safety and working instructions need to be specified and verified.

The factors influence a business but it varies from enterprise to enterprise and from nation to nation. India being a highly populated and developing country, has huge opportunities to enter the smart manufacturing era. These factors are used to identify threats and weaknesses which is used in SWOT analysis.

VIII. SWOT ANALYSIS

SWOT stands for Strengths, Weaknesses, Opportunities and threats. These factors are framed using the PESTEL

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framework of manufacturing industries as mentioned before, and they have a direct impact on a business venture or project.

S-Strengths: Resource sharing and futuristic approach to technology strengthen the manufacturing plant. Using IIoT, Big Data Strategies, Cobots, Artificial Intelligence and other advanced enhancing technical concepts, a manufacturing plant can increase the production value, customer satisfaction and the quality of the product. Resource sharing also gives an enterprise the power of collaborations and interaction with consumers and potential buyers.

W-Weaknesses: An enterprise might get weak in the procurement of raw material, on-time delivery of products, small range but high production costs, outdated equipment and budget issues. Poor relations with traders result in inefficient sharing of resource which affects the outcome of the company sales & evaluation. Leakage of confidential information is possible which might lead to surreal risk in the business venture.

O-Opportunities: Training & Induction Programmes for employees to understand the new technology including CBDM and IIoT can be held. VR technologies can be used to train engineers hence, reducing training costs and increasing skill value. Skill improvement and humble relations with enterprises act as an opportunity for better production value and quality. Investing and funding for R&D can be initiated using the power of shared resource.

T-Threats: Lack of skilled personnel, rapid obsolesce of technology, competitive enterprises, leakage of resource and market fluctuations are always a threat in the manufacturing industry. The shared resource might also lead to the sharing of confidential information and the invasion of the company's privacy in the market.

IX. CONCLUSION

This paper was an oversight of the various technical concepts that can be used in the Manufacturing Industry and how can those concepts help in the business evaluation and customer satisfaction & value.

Sharing of Resource has immense application in the procurement and initial processing of raw material. The use of IoT has made it easy to carry out real-time operations such as tracking material, transfer of jobs and stacking of finished goods [6].

Despite the complications of sharing the resource, this technique can save loads of capital, time and skilled labour. Although, revolutionizing manufacturing after years of traditional techniques using conventional methods is a challenge and that has become every enterprise's priority now.Adding convenience to the business of the enterprise is one of the main objectives of Smart Manufacturing.

This may be a chance for the R&D cells of enterprises to increase and widen their perspective over the use of technology in Manufacturing. This research, along with the help of shared resource, IIoT, efficient B2B relations and other smart concepts, can help in the advancement and enhancement of Manufacturing.

REFERENCES

[1] Dong Chen, Peter B. Luh, Lakshman S. Thakur And Jack Moreno Jr, Optimization-based manufacturing scheduling with multiple resources, setup requirements, and transfer lots, 2Department of Electrical and Computer Engineering, and 3School of Business Administration, University of Connecticut, Storrs, CT 06269, USA

[2] MateenMajgaonkar, PayalYadav, HardikBamb, Pushkaraj Dhole, AvinashPlave, Smart Manufacturing using IoT, International Journal on Recent and Innovation Trends in Computing and Communication, Volume: 5 Issue: 12.

[3] Andrew Kusiak, Smart manufacturing, International Journal of Production Research, 2018.

[4] MichielSchipperus, Three Ways the Cloud is Transforming Manufacturing, www.manufacturing.net

[5] Bo Ding, Xiao-Yang Yu and Li-Juan Sun, A Cloud-Based Collaborative Manufacturing Resource Sharing Services, www.scialert.net

[6] Matt Goldner, Katie Birch, Resource sharing in a cloud computing age, Interlending& Document Supply, Vol. 40 No. 1.

[7] Till Becker, Hendrik Stern, Impact of resource sharing in manufacturing on logistical key figures, 48th CIRP Conference on Manufacturing Systems - CIRP CMS 2015

[8] Awadhesh Kumar Yadav, Suresh Kumar Gigoo, Study of Recent Manufacturing Trends towards Smart Automobile Vehicle, American Journal of Mechanical Engineering, 2017, Vol. 5, No. 4, 138-144

[9] AgnieszkaRadziwon, Arne Bilberg, Marcel Bogers, Erik Skov Madsen, The Smart Factory: Exploring Adaptive and Flexible Manufacturing Solutions, 24th DAAAM International Symposium on Intelligent Manufacturing and Automation, 2013.

[10] Klaus-Dieter Thoben, Stefan Wiesner, and Thorsten Wuest, "Industrie4.0" and Smart Manufacturing –A Review of Research Issues and Application Examples, International Journal of Automation Technology • January 2017

[11] How Human-Robot Teamwork will Upend Manufacturing, MIT Technology Review by Will Knight, September 2014.

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