Industry 4.0: Skills & Up Skilling for the Future Employment in Manufacturing Industries

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Abstract

Today manufacturing industries are changing rapidly by implementing & adopting new technology like Industry 4.0. The Industry 4.0 comprises of cyber physical system, IoT, Artificial Intelligence, Big data, cloud computing, Robotics, Augmented reality and additive manufacturing to convert the present factory into smart factory. Therefore organization need to update themselves with current and most demanding skill sets by acquiring new technology. In this scenario traditional skill sets are important but adopting new technology and skills to the existing employees becomes more challenging & crucial. Up skilling is the technique of imparting and learning new skills, methods & techniques to improve work environment. This will ensure the employees to acquire the latest skills for better prospect considering the demand of the industry. Current research study will be conducted on analysing the future demand of employment in manufacturing industries with emergence of Industry 4.0 and its effect on employee skills. This paper will try to highlight on skill requirement in Industry 4.0 technology landscape & up skilling will help the industries to cope up with future employment.

This study will be of descriptive in nature. Survey will be conducted to collect the primary data. Secondary data from various research papers, journals and research articles. Purposive sampling method will be applied. Data analysis will be conducted using statistical software (SPSS) and suitable recommendations will be provided.

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1. Introduction

In Today's scenario of technological environment the employees of the manufacturing industry is looking for steady and rapid growth by acquiring latest technology skills to retain

in the industry. Manufacturing industry is facing a big challenge of adopting and implementation of Industry4.0 technology to cope up with competition. Manufacturing industries are facing through consistent change in technology bought by digital transformation. Therefore it become very mandatory to acquire the new talent in the organization equipped with new skills and technology. Up skilling is a process through, which an employee can acquire advance skills required to perform the day to day routines jobs. For better prospect of organization as well as employee (Existing as well as new employees) they must be technologically sound and ready to adopt the change. Employees need to acquire both hard skills and soft skills. New skills are necessary to ensure future growth and profitability of the organizations. In every organization there is always a skill gap is always present, because the technology is changing with rapid speed and need to fulfil it to cope up with the competitive environment. i. As digitalization and automation is growing exponentially in every organization, it becomes equally important to educate and train the existing employees with the automation as well as recruit the new talent with required skill set.

Industry expectations are increasing from the new prospects that they should have the excellent digital skills and depth of domain – functional business knowledge. Today the companies leading in the market in every domain can be observed with giving high priority to learning and development of employees.

Current research paper is based on feedback of the human resource managers from manufacturing industry residing in Pune District based on expectation from the existing and new prospects regarding the skills required in Industry 4.0 technology landscape & up skilling the skills for facing the future challenge of the competitive environment .

2. Literature Review

Dr. Sudarshan Pawar & Prof. Manoj Sathe (2020)[1] According to Researcher study conducted based on Primary & secondary data it reveals that Manufacturing Industry is going through industrial 4.0 revolution and advance technologies like AI, Robotics, AR, VR has been implemented in many Industries. It is a perception of many experts that human will be replaced by machines and many employees may lose their jobs. But in reality it is not true, as new technologies are adopting by the industry, so employees need to acquire new skills to

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[1]**Dr. Sudarshan Pawar & Prof. Manoj Sathe (2020)** : Up Skilling the Skills for Future Employment
Challenge-2030

cope up with new environment. The researcher in their research paper inferred that employees and employer need to acquire new skills through innovative skill based trainings known as up skilling the present employees.

Hence in order to cope up with competition in next one decade industries need to classify themselves by providing advanced training & learning mechanism and development exposure to their existing employees. The Study concludes that there is a resistance for up skilling the skills from employee as well as employer. Apart from this the study highlighted on up skilling will lead to better job opportunities and will keep organization dynamic & competitive. Therefore study concludes that for having an agile, innovative and intellectual human resource in the organization, they should continuously support and motivate the employees for learning and up skilling their existing skills.

W. Maisiri1*#, H. Darwish1 & L. van Dyk: (2019)[2]According to Researcher conducted a study based on secondary data and reveals that Manufacturing Industry has seen & undergone with three industrial revolutions: the first industrial revolution (mechanisation), the second industrial revolution (mass production and electricity), and the third industrial revolution (automation) These revolutions not only influenced mass production and business models: they also affected the skills required by future employees in various industries From one consecutive industrial revolution to the other, few jobs vanished, while others were created. Further, some skills became absolute and redundant while others became valuable. The upcoming fourth industrial revolution is no exception with regard to the replacement of jobs and skills. Industry 4.0, an proved landscape initiative driving the fourth industrial revolution, is dominated by significant technological advancement that requires a specialised and skilled workforce.

M.kamarun Nihar (2019) [3]Researcher conducted a study based on secondary data and reveals that there is a need of re skilling the skills of employees. It became essential for the existing workforce to sustain in the future. Researcher focused on three elements of skill i.e. resilience, resourcefulness and flexibility etc. By the year of 2030 there will be tremendous technological advancement and it will create the highly skilled employees.

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[2] AN INVESTIGATION OF INDUSTRY 4.0 SKILLS REQUIREMENTS: South African Journal of Industrial Engineering November 2019 Vol 30(3) Special Edition, pp 90-105
[3]https://www.westmonroe.com/perspectives/signature-research/the-upskilling-crisis-effectively-enabling and-retraining-employees-for-the-future

Sally-Anne Barnes, Jenny Bimrose and Alan Brown [4](2006) According to research findings older employees are facing the challenge of adoptability in continuing the education regarding change in technology. Researchers have highlighted that future employees should bring the advanced skill set and competencies. Researchers mentioned in the study that the employees over the age of 40 are considered as older employee. Therefore for them adopting the change is the only key to sustain in highly competitive market.

ILO Report (2019)[5]Report highlights that for lifelong learning and progress, skills should be developed with linkages industrial policies. Industries as well as employees should anticipate the skills in advance. To reduce the gap between the skill required and actual skills, better utilization of skills and advanced plan is essential. Report concludes that world of work is changing with faster speed hence workers also need to adopt the change by learning the new skills.

Adam Etzion, Content Manager @ Gloat (2020) [6]Current article published in a blog and it defines up skilling as a process to learn new things or teach new skills to employees. Whereas re skilling is a process to learn or train the employees so they can do a different job. Author explained that we are in a fourth industry revolution i.e. Industry 4.0. It deals with the concepts like AI, Automation that revolutionizing the industries in an unprecedented space. Therefore by 2030 any of the jobs will get replaced by emerging technologies. Therefore to sustain by and after 2030 one must adopt the requirement through proper training and organization should recruit the young professionals with highly demanding skills.

3. Objectives

Current study was conducted with the following aims and objectives.

1) To understand the requirement of future Skillsets for Industry 4.0 for employees in Manufacturing Industries.
2) To analyse the reasons for employee up skilling due to emergence of Industry 4.0.
3) To understand the resistance of employee for up skilling.

Hypothesis

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[4] Sally-Anne Barnes, Jenny Bimrose and Alan Brown: European Conference on educational Research ECER 2006
[5]ILO Report (2019), "Skilling is the answer to challenges of future",
[6]Adam Etzion, Content Manager @ Gloat (2020), "Upskilling, Reskilling and Preparing for the Future"

H1:- "Lack of adoption of Industry 4.0 and organizational culture resistance are the hurdles in Up skilling the skills among the employees".

H2:- "Up skilling of skills will lead to better job opportunities and keep employees motivated".

The First objective of this research is carried out through Systematic Literature Review (SLR) from secondary data source.

W. Maisiri1*#, H. Darwish1 & L. van Dyk2[7]: Researcher conducted a study based on secondary data and the findings of the SLR pointed out that non-technical skills, also referred to as 'soft' skills, comprises of **Thinking Skills, Social Skills & Personal Skills** are tremendously essential in all employees in the Industry 4.0 era in manufacturing industry. Therefore, to be competent and remain relevant, it is essential to have balance skills between balance technical and non-technical skills in the employees of the future. The Non-technical skills cannot be easily be automated; therefore they will remain prominent & significant in Industry 4.0. Because of the speedy change in technological advances that invites prominently new skills sets, lifelong learning abilities become crucial in the future workforce. Apart from the above skills further nontechnical skills such as emotional intelligence, critical thinking, creativity, innovation communication, collaboration, leadership, and teamwork need to be essential for all employees from Strategic level to operational level of the organization. Technical skills will significantly important in the engineers of the future. Technological skills, programming skills, and digital skills are relevant in Industry 4.0. Digital skills that were

Table 1 : Skills requirement for Industry 4.0 technology Landscape		
Skills category	**Skills sub-category**	**Skills set**
Technical skills	Technological skills	• Designing skills that incorporate virtualising, simulating, interoperability, modularising, decentralising capabilities. • Fault and error recovery skills • Application and use of technological skills • Process digitalisation and understanding • Ability to work with the Internet of Things, autonomous robots, 3D printing, and other advanced technologies • Interaction with modern interfaces
	Programming skills	• Computational skills • Simulation skills • Coding • Computer and software programming skills • Software development
	Digital skills	• Data analytics/data processing • IT/data/cyber security • Cloud computing skills • IT knowledge and abilities • Artificial intelligence skills • Digital content creation skills
Non-technical skills/soft skills	Thinking skills	• Creativity, innovation, practical ingenuity • Critical and logical thinking • Flexibility • Complex problem solving, trouble-shooting • Analytical thinking skills • Technical and literate communication • Collaboration (including machine-human) • Interdisciplinary skills
	Social skills	• Teamwork • Perspective-taking • Professional ethics • Understanding of diversity • Self-awareness, self-organisation • Interpersonal skills • Intercultural skills
	Personal skills	• Social responsibility and accountability • Lifelong learning skills • Leadership skills/people management • Emotional intelligence • Negotiation skills • Entrepreneurship • Adaptability

[7]**W. Maisiri1*#, H. Darwish1 & L. van Dyk2:** AN INVESTIGATION OF INDUSTRY 4.0 SKILLS REQUIREMENTS: South African Journal of Industrial Engineering November 2019 Vol 30(3) Special Edition, pp 90-105

pointed out as outstandingly significant include data analytics and cyber security skills. The use of learning factories was identified as having the capability of balancing the skills required in the workforce of the future.

4. Research Methodology

Research is a systematic inquiry of facts. Current research paper consisting of Descriptive Research Design. An effort has been made to describe the existing scenario by collecting the feedback from the human resource Department of the organization..

Purposive Sampling method was used to approach and collect the feedback. Total 30 Human resource managers were approached from manufacturing industries.

Manufacturing industries like Automobile, Electronics, and Industrial equipment were considered for the study as Pune city is surrounded by these industries as well as Pune City is known as Manufacturing hub. Both primary and secondary data used for research analysis. Primary data was collected by distributing a structured questionnaire and personal interview with HR managers. Whereas secondary data was collected from different websites, research journals, research papers, books and blogs.

Data analysis is done with Microsoft excel and SPSS software by applying descriptive statistics and hypothesis testing methods.

5. Data Analysis

1) HR Managers

HR Managers	Frequency	Percentage
Manufacturing industries like Automobile, Electronics, and Industrial equipment	30	100%

Respondents of the survey were HR managers representing Manufacturing industry. Responses were collected regarding expectation and requirement of skills from existing employees and new employees.

2) Reasons for employee up skilling

Reasons for up skilling	Fully Agree	Agree	Neutral	Disagree	Fully disagree
1)Automotive, Industrial equipment's, Electronic Industries are adopting Industry 4.0 technology Landscape	66%	9%	5%	14%	6%
2) New technology skills like AI, AR, VR were outsourced	33%	13%	4%	35%	15%
3) Automation and AI, Big data, AR, VR , IoT requires advanced technical & Analytical Skill set	72%	7%	3%	12%	6%
4) To remain competitive in industry employee need to acquire new skill sets	52%	14%	12%	15%	17%
5) Up skilling will make employee confident & efficient and organization will become more effective.	74%	10%	10%	5%	1%
6) Up skilling will increase employee moral & productivity	83%	8%	2%	5%	2%
7) Up skilling will optimize time, efforts and money	65%	14%	6%	13%	2%

From the above table the following analysis is carried out : It can be analysed that there are number of reasons that emphasizes the need of employee up skilling.

The technology is changing with a rapid speed and there is a need to acquire the skills among the employees.

❖ Around 75% respondents were agreeing that there is a need of up skilling the skills.

❖ Around 46% HR managers believe that if employees do not up skill their skill then companies may outsource it.

❖ Around 79% of the respondents shown their willingness towards emergence of automation and AI requires up skilling of the employee skill.

Around 68% respondents were agreeing that to remain in competition one must adopt the new skills.

Around 84% respondents shown their willingness for Up skilling will make employee and organization more effective

Around 91% respondents shown their positive replies for Up skilling will increase employee productivity. Around 77% respondents had replied positive for Up skilling can optimize time, efforts and money

3) Skill sets required to face future demand in next 10 Years

Skill Set		Mean (1-Not Important to 5-Very Important)
Conceptual Skills	Flexibility in embracing the change	3.6
	Self-initiative and self-direction	4.2
	Openness	4
	Collaborative Leadership	4.5
	Global Thinking	4
	Creativity	4.3
Digital Skills	Digital Business Analysis	4.2
	Digitally Design & Data Visualization	5
	Digital Project Management	4
	Digital Marketing	3.1
	Data Science & Data Analytics	5
	Social Media Skill	4.5
Intellectual Skills	Creative and Innovative	3.6
	Critical thinking	4.2
	Social Intelligence	4.3

Above table illustrates the three types of skills that employees need to upgrade. Those were Conceptual skills, Digital skills and Intellectual skills. Looking towards the mean value it can be observed that all the skills carry their own importance and HR managers' perception that organizations are expected their employees with the above mentioned skill sets.

6. Hypothesis Testing

H0:- "Lack of adoption of new technology and Organizational culture resistance does not influence the Up skilling the skills among the employees".

H1:- "Lack of adoption of new technology and Organizational culture resistance are the major hurdles in Up skilling the skills among the employees".

Challenges in Up skilling the employee Skills	Mean	S.D.
Employee Resistance to Up skilling	4.8	0.732
Organizational Resistance	4.5	0.704
Unavailability of effective trainer/Experts	2.7	0.543
Leadership Resistance	3.2	0.627
Unable to identify the need of Up skilling	3.1	0.61
Cost of Up skilling	3.7	0.734

Above table reflects the mean values and standard deviation in respondent's responses from the mean value. Challenges in up skilling were asked to HR managers and their responses were received with a liker scale of fully agree (5) to fully disagree (1).

Mean values clearly shows that employee resistance and employer resistance are the major road blocks in up-skilling the employee skills. To verify the validity of mean value, standard

deviation was calculated and all the values of standard deviation show that there is very less deviation exists in mean values and actual responses.

Therefore this data supports the alternative hypothesis. Therefore it can be inferred that Employee resistance and employer resistance are the biggest challenge in up skilling the employees skills for better future of both employee as well as employer.

H0:- "Up skilling of skills is unrelated with better job opportunities and keeping employees competitive".

H2:- "Up skilling of skills will lead to better job opportunities and keep employees competitive".

Variable 1	Variable 2	Chi-square value	Degree of Freedom	p-value
Importance of Up skilling the employee skills	**Better Job Opportunities**	37.132a	16	0.032
	Keep employee Competitive	52.994a	16	0.002

Chi-square test was run to check the association between Up skilling and getting better job opportunities and keeping employee competitive in future. 95% of confidence level and 5% of significance level was set during analysis. Result of the chi-square reflects that p-value for both the variable was less than 0.05 i.e. 0.032and 0.002 for better job opportunities and keeping employee competitive respectively.

Therefore p-value does not support to null hypothesis. Hence alternative hypothesis is accepted. Therefore Up skilling of employee skills will give better job opportunity as well as it will keep employee competitive in future.

7. Findings (Inferences)

❖ Study was conducted with reference to Manufacturing industry situated in Pune city and around. 30 Human resource managers from each type of industries are interviewed with the aim of understanding the urge of up skilling to employee's skill to face the employability challenge in coming one decade.

❖ Study found that around **77% of HR managers** feels that as industry is being disrupted by technological changes, hence employees need to up skill their existing skills and they expressed that otherwise their jobs will be overcome by others as 46% respondents replied that new skill set will be outsourced.

❖ In Many automobile industries Artificial intelligence, IoT, Big data, Data Analytics, CPS automation has brought tremendous innovations were you require skilled workforce. Hence to cope up with these technological changes 79% of HR managers believe that there is need of Up skilling the skills of employees.

❖ **84% of the HR Managers** agree that Up skilling will increase the efficiency of the organization and **91%** agree that it will increase the productivity of the employees.

❖ Data analysis explores that there are three types of skill set that need to improve among the employees. Those skills are Conceptual skills, Digital skills and Intellectual skills

Future Research: Further the future research study can be conducted on **"The role of Industries, educational institutes and government to produce skilled workforce for future challenges of Industry 4.0".**

8. Conclusion

Manufacturing industries are witnessing through industrial 4.0 revolutions with new technologies like robotics, AI, Data Analytics, IoT, AR, and VR to transform the industry in to smart digital industry. Due to emergence of industry 4.0 it was assumed that many employees are going to lose their present jobs due to non-availability of required advance skills. In reality the fact is not true, the employees need to learn and adopt the new technologies to cope up with present technological environment. Hence employees as well as employers need to focus on up skilling the existing skills by learning advanced technologies to cope up with the competition.

Therefore in order to face tough competition in next one decade manufacturing industries must focus on providing advanced training, learning and development exposure to their employees. The study concludes that there is a resistance for adopting the up skilling the employee skills by employee as well as employer. In addition to this according to HR managers interviewed in the study up skilling will give better job opportunities and will keep employee more competitive. Therefore study concludes that for having a robust, innovative, skilled and creative human resource in the organization, it is mandatory to have unconditional support and motivation from HR Managers to learn and up skill existing skills of employees to cope up with competition and technological environment. Further the future research study can be conducted on **"The role of Industries, educational institutes and government to produce skilled workforce for future challenges of Industry 4.0".**

References:

1. **Dr. Sudarshan Pawar & Prof. Manoj Sathe (2020)** : Up Skilling the Skills for Future Employment Challenge-2030

2. **W. Maisiri1*#, H. Darwish1 & L. van Dyk2 (2019)** : AN INVESTIGATION OF INDUSTRY 4.0 SKILLS REQUIREMENTS: South African Journal of Industrial Engineering November 2019 Vol 30(3) Special Edition, pp 90-105

3. https://www.westmonroe.com/perspectives/signature-research/the-upskilling-crisis-effectively-enabling-and-retraining-employees-for-the-future

4. **Sally-Anne Barnes, Jenny Bimrose and Alan Brown**(2006): European Conference on educational Research ECER 2006

5. **ILO Report (2019)**, "Skilling is the answer to challenges of future",

6. **Adam Etzion, Content Manager** @ Gloat (2020), "Upskilling, Reskilling and Preparing for the Future"

7. **W. Maisiri1*#, H. Darwish1 & L. van Dyk2(2019)** : AN INVESTIGATION OF INDUSTRY 4.0 SKILLS REQUIREMENTS: South African Journal of Industrial Engineering November 2019 Vol 30(3) Special Edition, pp 90-105