Industry 4.0: A Way towards Enormous CO2 Emission and Challenges Approaching Sustainable Development

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Abstract— Industry 4.0 is a future development towards advance manufacturing that is being introduced by the German government in order to be global hub in manufacturing and to provide quality products at low cost and in relatively shorter period of time. The cited article is thought towards the major implication of industry fourth revolution on the world wide and also its negative implication that would affect the nature by adopting more machinery which would leads to enormous Co2 emission and obviously contribute to global warming which is really a concern for surviving life's. This article will also draw some spot light on the face of industry 4.0 that would become a key aspects in the development without considering the concept of sustainable development and would deplete the beauty of nature at the cost of business. Further this article will also focus on the remedial aspects that may be taken into consideration to provide advance manufacturing with the adaptation of industry 4.0 concepts and also would consider the health of nature and try to not affect it negatively.

Keywords: CO2 emission, adaptive manufacturing, quality control, E-Waste, Cyber Threats

I. INTRODUCTION

Industry mass manufacturing is the results of growing population, due to which the transition from the industrial first revolution to industrial fourth revolution had been seen. The production is also governed by the competitive environment that is being faced by giant manufacturer across the globe [4]. The concept of industry 4.0 is fashionable and productive due to its vast and efficient techniques of manufacturing concepts, industrialists as well the government of developed and developing countries are finding their bright future by adopting the techniques and doctrine of industry 4.0[3]. The adaptation of industry 4.0 can only be possible by integrating the concepts of various engineering fields as well as by focusing on the conventional concept of quality control[2]. Besides adapting the concept of industry 4.0 one should not ignore the other face of the concept and that is the manufacturing at the cost of the health of nature, it is obvious that the advance manufacturing require highly advance machine tools and technology not only in small quantity but at the larger scale to meet the production requirement [1]. The implication of this would contribute huge to the nature not in the upgrading way but in the severe negative way by injecting billion tons of CO2 products in the nature, due to this the planned way of achieving the sustainable development cannot be fulfilled at all and the glorious history of mankind can may pushed at great risk. The concept that the world is egger to adopt was introduced in the North America in the mid of 2012 by the renowned company General Electric [17], by carefully analyzing the concept of Industry 4.0 it has been summarized that the revolution is integration of physical aspects along with the cloud computation and advance engineering aspects of manufacturing, this will push the digitization to forward level by diversifying the field of advance and mass manufacturing by considering the quality aspects[11].

II. NEED OF INDUSTRY 4.0

The industrial revolution began in mid-17th century in the united kingdom in which the primary focus was to find the alternative of manpower and this led to the invention of steam engine due to which the alternative of manual power was discovered and the textile industry began its journey by relying upon on steam energy rather than fully inclining on manpower[19]. The Industry 2.0 was led on the bed rock of electrification and the demand was to replace the inefficient steam process work with the highly mechanized electrical machineries, in this context the name of 'Henry Ford' is on the top and he also referred as the pioneer of Industry 2.0 revolution[15]. Industry 3.0 came up with the concept of digitalization in the industrial work and this was the great jump in the advancement as well as in mass production , which led the foundation of Industry 4.0[1], the concept of 4th industrial revolution is directed basically on the atomization and advance techniques by integrating the advance concept of manufacturing as well as the concept of mass manufacturing[16], the concept is visualized in such a way that it will bring a major revolution in the mass manufacturing and will very much effective in providing the quality products at very reliable costs. Primarily the manufacturer and industrialist are thinking toward only the profitable aspects of industry 4.0 and they are either ignoring the concept of sustainable manufacturing or either they are unaware of it. The need of this revolution is demand of time and the adaptation must be there, but it should be in such a manner that it would not harm the climate. In present scenario the trend is that to be a leader manufacturer at any cost, nature can also be tolerable. The concept of sustainability is not the doctrine and the business is the primary focus.

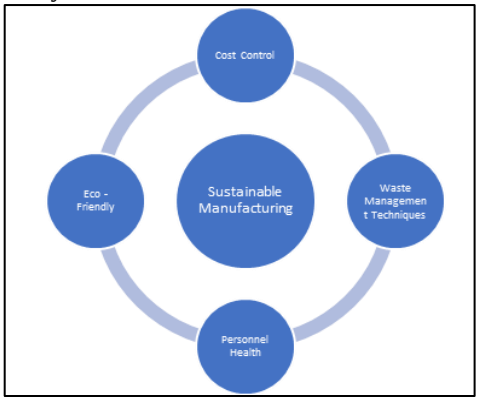

Fig. 1: block diagram for sustainable manufacturing

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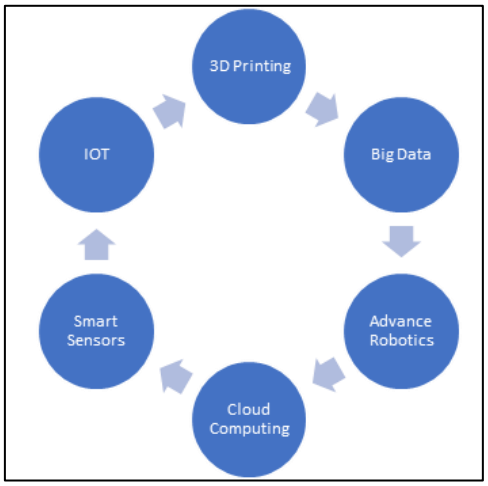

Fig. 2: Concept of Industry 4.0

III. Present Divulge of the Industry 4.0

When considering the present condition of the Industry 4.0, it is imperative to comprehend and focus on the preconditions that must be validate and satisfied with the goal that another innovative idea can be presented in mechanical assembling framework[7]. In any event of the production the accompanying must be satisfied: Stability of the generation must be ensured additionally during the progress stage of establishing framework of industry, Stepwise speculation and investigation should be conceivable as the vast majority of the modern procedures can't affaord the huge cost of the FMCG(Fast moving consumer and goods) and can't shoulder huge one-time ventures[21], A decent skill security is mauch needed as it important important for safe wprk enviornmment. Firmly associated is the cybersecurity issue must be fixed to deal with the external cyber therats that may approach and can damage the production of the industry. Besides the business idea isn't restricted just to the generation of innovative framework however it incorporates the total worth chain from providers to the vendors or consumers of one association towards the 'Associated Word' everything being equal and every one of big business' capacities and administrations[21].Industy 4.0 concept is now in dvelopment stage, in the countrie like Germany , U.S.A it is started with a weall palnned journey and its effectiveness is now being tested to meet the future requirement[18]. The concept is generally visualised as athefactory of future with the vast scope and expectation which is embedded in its concept of revolution[13].

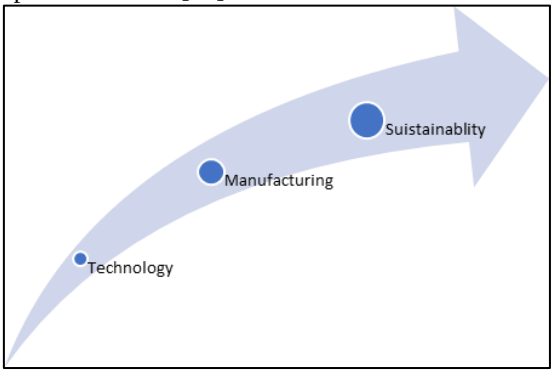

Fig. 3: Strategies that should at priorities

IV. Advance Machinery huge CO2 Emission

Industry 4.0 concept is bassically laid down on the bech of advance machinery which will repelce the manpower for high productivity and quality management. A close study of International Energy Agency reveals that, out of total CO2 emission the industry contribute about 24% of total emisssion and the study also revals that in next thirty years (upto 2050) the data of CO2 emission by industry may appraocah to 45%[16] , which is really the alarming situation for the survival on the earth surface and if the emission is not remoted than the effect of global warming would be extreme and severe[24].

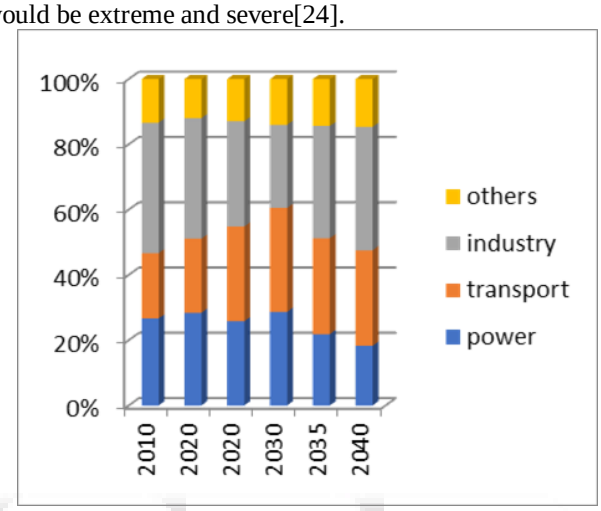

Fig. 4: Contribution of different sectors in CO2 emission in present as well as in future

A. Solutions for Low Carbon Emission Industry Setup:

Solution for the concerning problem may be solved by relying upon the sources that generate the energy by harneshing renewable sources through the concept known as Power Purchase Agreements(PPAs). The IEA have strong vision that the reduction in coarbon emission can be brought up by developing that technology that focus on the sustainable managemant and developments[12]. The major key aspects to reduce the carbonization in the atmosphere by adopting the vision of United Nation in which the 17 factors for sustainablity can bbe adopted to obtain a better results. The conventional machinery should be replaced in such a way that it can emitt the byproducts by eliminating the harmful contents by the process known as nutrralization[19].

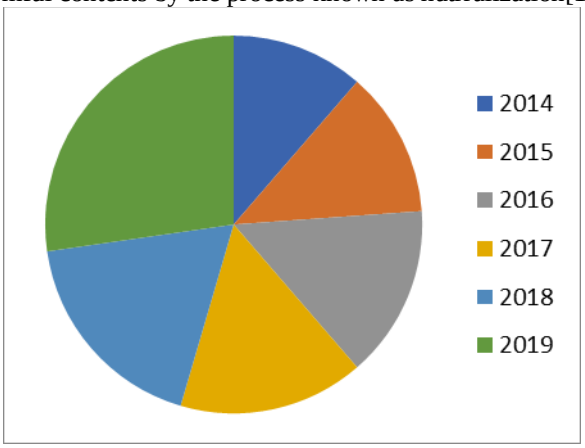

Fig. 5: Annual contribution of Industry in CO2 emission

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V. INDUSTRY E-WASTE GENERATION AND MANAGEMENT STRATIGIES

Electronic waste primairly consist if the waste generated by the semi- conductors as well as polymers that is being used to make the electronic circuits, the major geneartion of e-waste is obtained by the computers hardware, memory of gadgets as well machinery , Air- Conditioner that is being in industries etc.,. according to a Global E- Waste monitor in the year 2017[20], The leading producers of E-Wastes are U.S, Republic of china, Germany, Japan and India. The contribution of indian society as well as industries in generation of E-Waste is approximately approaches 2 million tonnes and only few amount of waste generated is being recycled by the major companies and rest are either dumped or misused[25]. The semiconductors chips contains the harmful contents of the elements like sulphur, phosphorous, Cadmium etc., which are contributing heavily in causing harmful chronic diseases. The semiconductor chips also contains the elements like Silver, Gold, which arecpricious and their recycling contribute in profit making for recyclers[17].

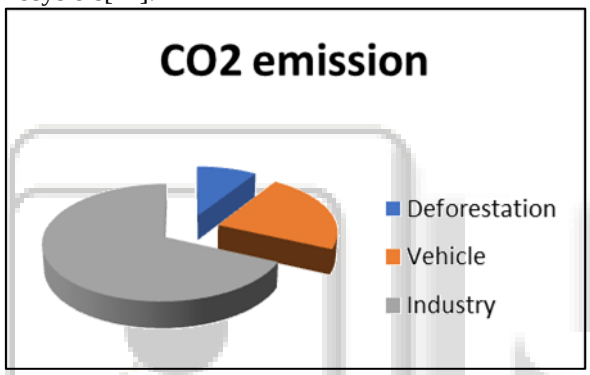

Fig. 6: major overall contributors CO2.

It is the demand of time that factors of sustainability must be utilized in the field of industrial advancement in order to grow by fulfilling the demand of consumers by looking deep into the health of atmosphere. The integral benefits of these would be such that the concept of industry 4th revolution will be grown on the bed rock of sustainability and versatility[21]. The management of E-Waste is has not approached the every corner of society, people are unaware of the E-Waste management and they are not knowing the harmful implication of that waste that is being generated by them self's.

ACKNOWLEDGEMENT

The cited article is the thought of the industrial 4.0 management strategies that is needed for the revolution of industrial development and its moral impact on the each and every class of society. In making this article the literature is thoroughly revised both from online and offline sources .the need of awareness is very essential for not only the industrial growth but also for the sustainable development. The present era is totally focusing on the impact of industry 4.0 on the mass production and quality output at very low cost, but they are not diverting their thinking on the aspects that will degrade the atmosphere and make it inappropriate for living. This article is results of careful analysis and research that is made to presents that aspects of industry 4.0 which is free from that aspects that will provide development at the cost of nature.

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