Ingredients for Industry 4.0 Get Set Go! – A Literature Review

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Abstract- Industry 4.0 adoption should not be done for the sake of jumping into the bandwagon. Most of the companies are falling into this trap. Instead force fitting technology, it should be implemented only when it makes business sense. Change management is a key ingredient for successful implementation of Industry 4.0. Each company needs to understand their current gaps in line with the Industry 4.0 challenges. There are four elements required to bring this change. Leadership qualities: Participation style of management, with the right behaviour traits. Customer focused: Use of industry 4.0 technology should be in line with the customer needs, feedbacks and transactions. This tool should be an enabler to increase the market reach and market share. Real-time feedback mechanism for product or service improvement. Right Knowledge Management and training: Skill gap analysis and right training to be provided for Operating team, programmers and service providers. Innovation Culture: Innovation attitude, promotion and execution of this culture is essential. The author has collected and analysed over 200 journals in the above category and made a text cloud to share the collective wisdom.

Keywords – Industry 4.0, Leadership qualities, Customer focussed, Right Knowledge Management and training, Innovation Culture

I. INTRODUCTION

The development of IOT , Sensors and analytical tools has helped the companies to generate volumes of information & data and to effectively analyze the same. Once detailed analysis is done, we can understand the customer needs better, actions and service towards the same can be done better.

New products and SMEs focused on innovation is a thriving business. The product life cycle is shrinking but the leverage of technology and internet is helping everyone to leverage the sales and encash the shorter life cycle.

With stagnation of growth in all the sectors ,its but natural for every company to look for alternate and switch to industry 4.0.During the industry 3.0 data capturing and accuracy of data have drastically improved, IOT now goes next step on real time and customers are not made aware that lots of information are gathered and analysed automatically to leverage on the buying patterns and to use their location and emotions for repeat orders.

II. LITERATURE REVIEW

Literatures were collated and literature review was done, very few case studies are on the industry4.0 journey, it is in the nascent stage. Literatures were from academic, industry specific, ioT and developments of sensors and the need on skill gap.

"By 2025 its estimated that the value generated by Manufacturers and suppliers is estimated to be around USD 3.7 trillion, Lot of hopes are on Industry 4.0 which will bring transformation in the next industrial revolution will take Manufacturing to discrete manufacturing. Only about 30 percent of companies have embarked this journey due to lack of awareness and apprehensions''(Christoph ,Andreas,Christian,Stefan & Florian ,(2019),Mc Kinsey.

Companies fall in trap to encash the potential because of three reason – 1. High cost of initial investment 2. fail to have short term vision for profitability 3. Caught in fancy technology instead focus on business value and 4. Lack of use cases. "(Christoph ,Andreas,Christian,Stefan & Florian ,(2019), Mc Kinsey). The author feels that this step of embarking into industry 4.0 should be done one step at a time with clear focus on customer satisfaction or meeting ever changing business needs and link with business financial goals.

2.1Leadership Style

"Strategic leaders are visionary and set directions in advance. (Arnott, 1995). Their power is enhanced when they opportunities in environment and allied critical sectors are exposed (Hambrick, 1981). Strategic leaders are the one who communicate decisions keeping future of their organization (Zaccaro, 1996). They set goals for the organization's KPIs and develop strategies, Design and execute right structures, processes, controls and core competencies for the organization, manage multiple constituencies, select key executives, groom the next generation of executives, provide direction with respect to organizational strategies, maintain an effective organizational culture, sustain a system of ethical values, and serve as the representative of the organization to government" Bernard M Bass (2007),

Leadership a strategic need "Mc Neilly suggested to focus on the following, -

1. Focus should be to avoid huge unwarranted investments and should be customer focussed. 2. Technology should be an enabler to handle weaknesses; 3. Important to understand and help to leverage on competition 4. Faster resolution of troubleshooting and adversity and build new products 5. Resistance to change should be removed 6. Treat people with respect, they in turn will deliver in full potential.". McNeilly (1996)

Leadership should be a visionary, "Strategic leaders are futuristic who set vision for the organization" (Arnott, 1995).

"Transformational leaders build capability with followers who in turn develop future leaders to develop and grow, the duty of leaders is to align the goals and empowering them." (Bass and Riggio, 2006). "This leadership consists of four elements: Team player charismatic a good motivator and inspirational, whenever the team faces challenges, and should also have high intellectual knowledge'' (Gumusluoğlu and Ilsev 2009).

There are many styles of leadership and enough research is done on merits and demerits, however for industry 4.0 the best suited style is participative leadership. "fast decision is encouraged in participative leadership this with autonomy helps to perform and complete the task easily." Katarzyna & Woszczyna ,(2015),"Building capabilities and training which enables for participative leadership to flourish , this helps in team spirit were in decision and delegation are done jointly" (Yukl, 2002)." Individual innovation are deterrent to team work whereas these type of leadership are considered better" Katarzyna & Woszczyna,(2015).

Participative leadership is recommended as this support in culture building, other researchers are also calling this by situational leadership or flexible leadership.

Figure - 1

2.2Attitude Towards Innovation

"About 350 People work at Mondelez digital factory at Sri city Chennai, India, their work apart from interventions when things are about to go wrong is limited. Mondelez India calls its Sri city Plant an "integrated digital factory ". Interchangeably this is SMART^{+KL} Factory". (PB Goutam (2019), The Hub, Business Today, Feb Issue.

There was a myth that industry 4.0 does not need any thinking and the programmers design in such a way that the need of human mind will be nil. This is the danger of having wrong perceptions.

Few researchers have dealt on this subject and with available literatures and a primary data study* its concluded that Kaizen or innovation is required.

Innovation builds the culture at workplace and brings motivation and ownership, this also builds creativity, which helps to challenge the status quo. These culture of kaizen and innovation takes any organisation to the next level of excellence, this automatically gives leverage on competition.

The other important point is that industry 4.0 should not be done for fancy or as a part of race were everyone is doing so we should too. These calls for huge investment and will not justify if wrongly planned and executed. Instead the approach should be to give consumer new innovative products to meet his /her ever changing requirements.

Problem-solving develops creative skills to the extent that one or more of the following conditions are satisfied: (1) The culture of thinking. (2) The thinking is unconventional, challenging status quo, this needs courage to do modification or get rejected and question the previously accepted ideas. (3) The thinking style also needs high level of persistence and motivation (4) When the problem is not defined properly, analysis of problems will be difficult. All the above points needs' kaizen ideas and kaizen culture to overcome.

*This Author has written a journal on the "The need for kaizen culture for future-ready Industry 4.0 Plants" – awaiting publication

Figure - 2

2.3 Right Knowledge Management and training

Building capabilities is very important, what capabilities is lacking now, what is needed for AI implementation and what are the changes in skill gap after we implement big data and AI to produce a new product or service.

"There are three types of capability gaps 1. Advanced cognitive- technological skills 2. Social and emotional knowledge 3. Basic production and processing knowledge. Germany % of demand for advanced analytics is 2% social and emotional skills is 1% and there is abundance of basic skills by 0.2%, while country like France demand for advanced analytics is 1.3% social and emotional skills is 0.6% and there is need of basic skills by 0.7%, advanced countries are slipping on basic knowledge which will be suicidal for future"(Jacques , Jeongmin , James , Lari , Helsinki, Eric , 2019 , Discussion paper , OECD skills database; McKinsey Global Institute analysis.)

Learning Factories are were "Products, processes, selling, purpose and the learning, factory is always focussed an example is at the Campus Velbert/Heiligenhaus Germany uses many scenarios that can be reproduced, thanks in holistic approach. The lock and key industry in the region produce mostly mechanical and electronic systems. They use mostly the same technologies offered in the learning, factory. So physical products and real processes can be

trained, analysed and optimized. The didactic concepts are new type of learning based on theoretical lectures followed by practical training and integrated workshops where the participants are able to work out their own optimization strategies" (Clemens & Dorothee .2015, Industry 4.0 Learning Factory for regional SMEs, Elsevier)

The purpose of our learning factory" for the aspect of efficient automation is:

- Understanding the means of modern Automation such as PLCs, CNC and Robot Control.
- Understanding different communication modes and the one which fits the technology and use need cases.
- The participants will have an opportunity to use of all new technologies and have workshops, where they can assess the transferability to use cases.
- Understanding the benefits of cyber physical systems web technologies, the usage of web standards in collaboration with automation systems is shown, such as web services of a PLC or web services for HMI, application (e.g. Apps Tablet).
- Use of real time data analysis and predictive maintenance is shown." (Clemens & Dorothee .2015, Industry 4.0 Learning Factory for regional SMEs, Elsevier)

Figure – 3

2.4 Customer Focused

The change to industry 4.0 is all about individual customer focused and personalized too. (Refer Table 2)

This calls for understanding, the ever-changing requirements, innovate, design and execute and leverage for the shorter product life (from now on the product life cycle will shrink significantly)

Table 1

	1st industrial revolution	2nd industrial revolution	3rd industrial revolution	4th industrial revolution
Period	1780-1860	1870-1950	1970-2000	2000 -
Technology innovation	steam power & machine tools	electricity	electronic, IT, automation	Internet connected sensors
Production paradigm	craft production	mass production	mass customization	personalized production

Table 2

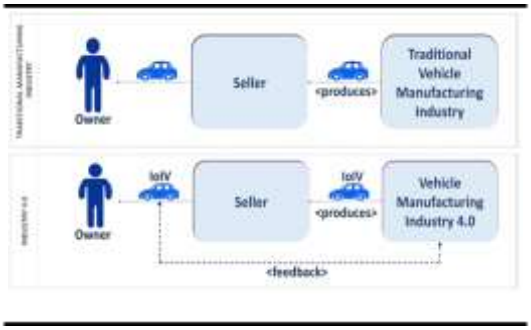

Table 1: Marco,Emilio,Mauro and Francesco ,(2017), Assembly system design in the Industry 4.0 era: a general framework-Researchgate 320496225

Table 2: Marianne, Elton , Gabriel , Ivanovitch ,Diego and Paolo ,(2018), A Customer Feedback Platform for Vehicle Manufacturing Compliant with Industry 4.0 Vision, Sensors

The big advantage with industry 4.0 is that we take personalized feedback from each consumer and put a corrective process, this will enhance the quality levels and ensure product quality and durability is improved. (Refer Table 2)

The author is working with an Coca-Cola bottler, and the challenge is to understand the consumer preferences, Pepsico is using R studio to program and forecast the exact needs month by month, an experiment is in progress.

The industry 4.0 should be exploited in forecast accuracy, use of information and technology to understand the consumer need and preferences and to manufacture and have control on each of the product manufactured till the end of life. This opportunity was never seen in industry 3.0

Customer focussed

1.Use of big data to understand the consumer

2.New products for everchanging requirements

3. Shorter development time for innovative products

4.Leverage on information, technologies and systems.

5.Use of advanced analytics to predict, forecast with higher accuracy.

Figure - 4

III. Conclusion

The study concludes with 4 elements which lead us to the successes of Industry 4.0, they are Participative leadership, promote innovation attitude, Knowledge management and customer focussed. There could be no right process to implement as each company needs to do SWOT done and work on the areas wherein, they can increase the market share and serviceability, the opportunities will be serviced by the digitalization and iOT. The decision to digitalize should not be done in a hurry and well thoughtful approach should be done.

IV. Research Gap

The implementation of industry 4.0 in large companies will call for huge investments and would be risky as the investment will be huge. However, based on the experiences of Germany, SMEs should have the strength for their own flexibility and proximity to customers, and are also good at low investment capacity and short-term strategy. This make SMEs more successful than large companies Production tools require too much investment, while collaboration tools and optimization tools are less expensive. Research should focus on adapting optimization tools to the characteristics of SMEs, mainly exploiting massive data to improve operational performance.

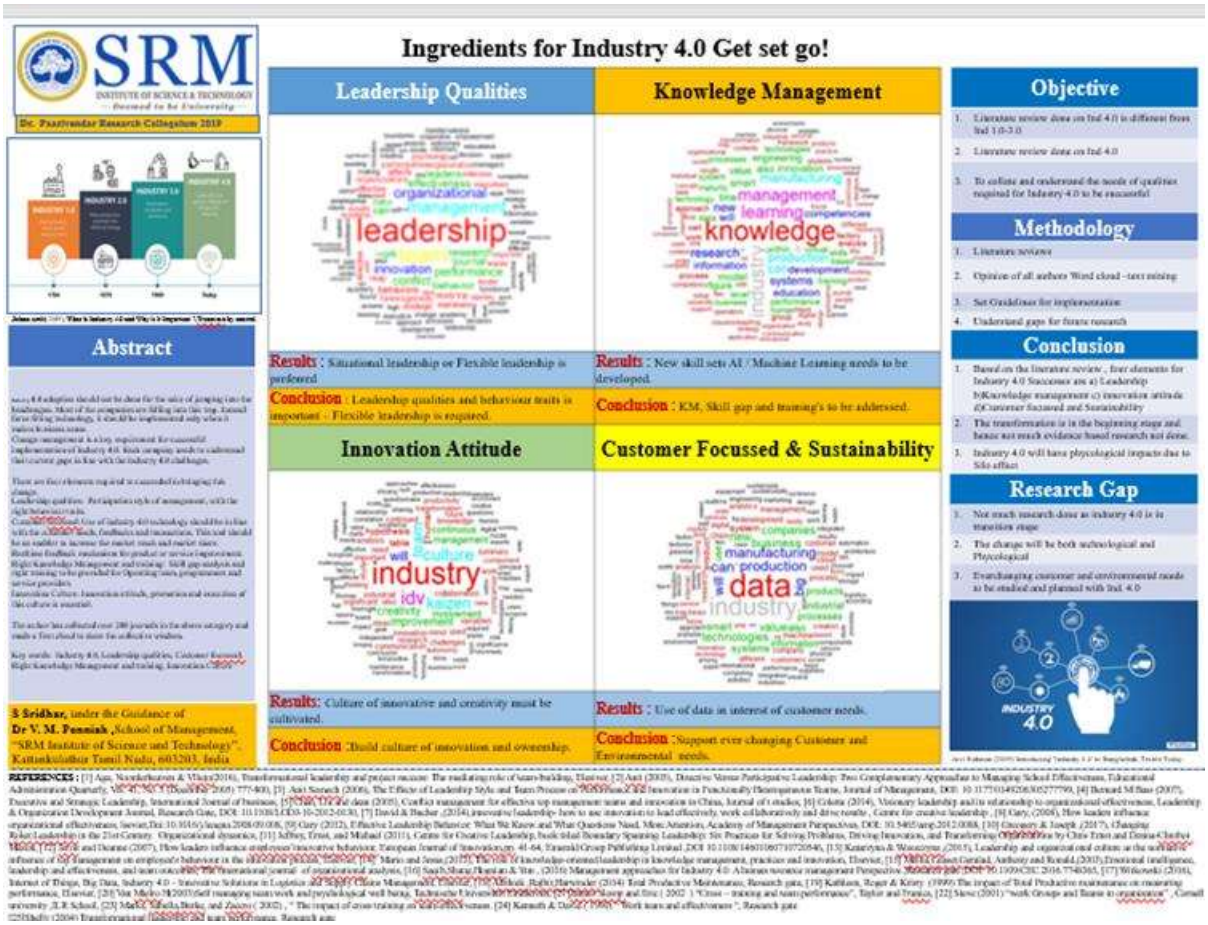

Figure - 5

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