International Journal of Industrial Administration (IJIA)
(A research journal of Chartered Institute of Industrial Administrators and Arbitrators)
Vol. 1, Issue 1, June 2021 *p-ISSN:2811-2946; e-ISSN 2811-2954 (online)*
www.industrialadministrators.institute *editor.ijia@industrialadministrators.institute*

Shaping The Future of Industrial Organizations by Tracking Changes from Disruptive Innovations in Technology

E. E. Jumbo [1] and L. Amadi [2]
dredjumbo@yahoo.com
[1] Dept. of Mechanical Engineering, Niger Delta University, Bayelsa State, Nigeria.
[2] National Open University of Nigeria, Port Harcourt Study Center, Nigeria.

Abstract

Modern industrial organizations are product and service based entities that rely on the prevalence of specific technologies to establish their business concerns. Sometimes, they are public organizations that are structured to serve the interests of the larger society, outside financial benefits and objectives. The progress made by these organizations in discharge of their functions are often fraught with inefficiencies due to human errors and lack of adequate service capacities. The sure solution to these problems is instructively found in the application of specific technologies intended to create values that enhance and support human aspirations. In this study, such values begin from innovative ideas which are the basis for the creation of new technologies or deployment of existing technologies to transform the way products are designed or fabricated. These technologies are disruptive to the existing models of production and are supported by other innovations within the Industry 4.0 technologies. These technologies are further incorporated into the production process with tools that can track the changes that they introduce. Like every feedback mechanism, these tracking components enables the inventors of these technologies to evaluate the success or failure of their design with the view to reconfigure, override or completely change the character or platform of such innovation. This paper thus resolved the various structural components of this change tracking mechanism and how they can be optimized for greater industrial benefit.

Keywords: *industrial organizations, innovation process, front-end technology, Industry 4.0 Innovations, globalization, changing demographics, global responsibility, lean manufacturing*

1. Introduction

Industrial organizations are those institutions whose products or services impacts on a large or significant majority of persons within a defined space and time. This imply that if a business objective is to touch or change an aspect of the lives of its beneficiaries, at a steady incremental rate to the point where it becomes relevant to the socio-economic capacity of a large number of person, then that business assume the status of an industrial organization. Importantly, this industrial organization must have as its central objective a defining capacity for positive change which must be the product of innovation and technology re-tooling ventures. Accordingly, in a 2014 interview, Jeff Bezos opined that:

> *"I bet 70% of intervention we do focuses on slightly improving a process. That incremental invention is a huge part of what makes Amazon thick. There is a second kind of intervention, which is more clean-sheet and larger scale…. We have culture that supports the risk taking and time frames required for that"*[1]

In the view above, Bezos drew attention to the fact that calculated attempts in the improvement of processes within the manufacturing endeavour enhanced the productivity of the system. Thus,

improvement occasioned by incremental upgrade of inventive ideas resultantly increased the size and capacity of the process and upscale its productivity into a large operational system capable of classification as an 'industrial organization'. Further, he observed that, "there is a second kind of intervention, which is more clean-sheet and larger scale implying that, improving a productive process requires cost reduction with a focus on expansion. These ingredients are properly managed to maintain a steady growth from a small scale entrepreneur to a large scale industrialist, as the case of Amazon. The foregoing implies that innovative ideas situate at the heart of any improvements in the production practices of an organization. This is significantly demonstrated in the launch of *Amazon Prince* where Jeff Bezos informed his employees of a new innovation, that for orders above $25, shipping cost would be free after payment of an annual subscription.

Although the idea did not go down well with his employees, he pushed it through and this resulted higher purchases which comes with rise in annual subscription. Instructively, McGinn, at p.58 of [1] observed that due to this innovation, the company rakes in over a billion dollars annually before 2014, which was the year of report.

2. Tracking Industrial Performance by Implementation and Nurturing of New Ideas

Industrial performance can be tracked during the implementation phase of a new idea. This is achievable by a combination of factors which includes:

i. being strategic in making technical investments analysis
ii. assessment of perceivable benefits of cross-cutting and next generation technologies that have broadest impacts on a wide majority of persons and the corporate plans or policy of reduction in production cost thus making the products and services affordable across all regions and markets. [2]

These performance indicators are crucial during the implementation phase of the new idea as they are the measurement yardstick for the corporate ability of the organization to upscale its processes in response to a demand or objective for the attainment of the status of industrial organization. Having established the critical indicators for an entrepreneurial organization, it is important to understand how these indicators affects or influence the spirit and purpose of the new idea which is an innovative process. It would thus be noted that a 'new idea' is an untested concept in the line of the organization's ventures. Corporately, it is a new conception only existing in the mind of the corporate entity, as a result of 'mental understanding, awareness, or activity, a thought, conception or motion'. [3]

According to the definition in [3], an idea is also 'an impression, view or belief, a plan of action, an intention or a groundless supposition; fantasy'. These various meanings of the word 'idea' is crucial to an organization's product or service innovation process, if the meanings are understood within their context of applications in the industrial development process. Thus, a new idea intended for an organization's progress is an impetus for up-scaled activity, significant of which is an upgrade to the classification as an industrial organization. As observed, idea driven innovation requires some level of collaboration and commitment within the network of operators of the system. [4]

This imply that the effects of a new idea can be tracked on the basis of its implementation. The measurement of this industrial performance of a new idea cannot be done in isolation of the views of Massey [4] who attributed the success of innovation to the commitments and collaboration of the operators within the system. Consequently, industrial organizations with a focus on competitive strategies integrate within their internal structures, processes and products range that depends on the components of innovation in order to succeed. [5-7]

In view of the foregoing, the relevance of innovation as a product of the direct and traceable effects of new ideas, is more substantiated when seen as a crucial part of the corporate strategies dealing with many tested factors such as, manufacturing development processes, indexes of product performance in the market, creation of well established brand concept, user loyalty, advancement of graduated products and competitive advantage in the market. [8]

Further, in order to track the performance effectiveness of new ideas by assessing the benefits of the innovation they have brought, studies have severally posited that innovation have ensured some significant impacts that were relevant to organizational performance by reason of the fact that they have afforded significant stabilization that are strategic enough to assuage the attendant complications and challenges of competition in highly penetrated markets. [9] [10]

Although the findings of Sajid *et al* utilized the effectiveness or success of new product development (NPD) in assessing the impact of innovation on the manufacturing process, the aim of this study is to use the *gain of function theory* of the NPD in this instance to track the effectiveness of the new idea that produced the innovation and by it make projections as to the overall industry performance, which is founded on the proper implementation of the new idea.

3. Mainstreaming of Industrial 4.0 Synergies by Integration of Sustainable Front-End Technological Innovations

Industrial synergies are those derivable benefits that accrue from the accumulation and processing of different resources geared towards the actualization of benefits common to all. In this regard, literatures abound that deals with the ongoing efforts of manufacturing organizations in research that unravel efficient synergies of Industry 4.0 Technologies with existing manufacturing templates. These front-end technologies are capable of repositioning all industrial processes and tracking appreciable changes that are incidental to the corporate objectives and customer satisfaction. As has been observed in various literatures, this production up-scaling by integration of advanced technologies is referred to 'lean automation' which was proposed in the 1990s. [11]

It should be noted that this advancement resulted effective and more efficient production systems with significant improvement in productivity. Consequently, it has been argued that the integration of Industry 4.0 automation and lean technology should result increased benefits. [12] This imply that Industry 4.0 can be designed to incorporate measures that are capable of tracking various degrees of progress in design templates, which becomes direct measurable consequence of the lean manufacturing ideology.

While the lean philosophy deals with technical efforts at reduction or elimination of production complications using simple hardware and software interface solutions; Industry 4.0 technologies facilitates simple solutions to known production complexities, by deploying intelligent decentralization of operations and implementing data driven control solutions from the user point. The critical

importance of this mainstreaming to the industrial upscaling process is the measurable synergy of these technologies at the point of their design interface. Hence, inter-operability throughput of these technologies is fundamental to their deployment objectives. Thus, the industrial administrator who is charged with the responsibility of maintaining a smooth operation is faced with the challenge of understanding the complexity of the system and how it can be used to deliver efficient and time bound results.

The foregoing notwithstanding, these front-end cutting edge technologies have been shown to possess potentials for sustainable innovations that are trackable on the basis of lean concepts derived from lean thinking being the building model for integrated Industry 4.0 Innovations. [13] In this regard, synergy with Industry 4.0 technologies aims at up-scaling the production process into heavy output, characteristic of expansion in production activities. The success of these initiative is not only crucial to the production process, but relevant to the substance of industrial growth founded on reliable ideas. [14] [15] Consequently, it has been observed that new ideas should result new products or services, which requires an organizational environment that enhances the performance of the new product. [8] The feedback mechanism as regards the performance of these new ideas also forms a means of tracking the changes in consumption behaviors of the consumers of the technologies that these innovations bring to the production process.

4. The Roles of Industry 4.0 Technologies to Change Tracking Capacity of Innovation

In view of the forgoing interplay of change tracking capability of Industry 4.0 technologies, it is important to note that the disruptive capability of these technologies to current industrial practices is significant to conclude that initiatives such as; 5G network connectivity has the capacity to transfer very large data including images for processing within infinitesimal time under massive machine to machine communications. This internet of things (IoT) features of Industry 4.0 technologies can connect billions of devices to interact with each other without human interventions. The implication of this, is that production scale-up would operate at a speed beyond consumption of goods as new products designs can be simultaneously produced in different parts of the world without shipping the goods and attracting cost as is the current practice. Thus, a crucial change to be tracked is that of the cost of production which would be drastically low thereby reducing the cost of goods. In a 2018 study [16], the benefits of 5G network was revealed to include:

i. enhanced mobile broad band
ii. massive machine type communication
iii. ultra-reliable and low latency mobile communications

In addition to the identified features, the report advanced the scale-up possibilities in business agility implying that very many industries will experience diversity of services and business models. The issue of operational sustainability i.e., end to end management and deployment, flexibility, scalability, energy efficiency would form the priority of modern integrated manufacturing. This paper is of the crucial view that the industrial administrator must understand the various parameters that define modern industrial practices. This is the only way to understand the management of resources under such advanced work environment.

The foregoing notwithstanding, Industry 4.0 technologies have been seen as the next hub of industrial revolution. [17] Thus, the McKinsey's White Paper draw attention to two key areas that organizations wishing to upscale their production activities should focus on. First, the operational priorities required

in order to successfully achieve a scaleup in production capacity can be realized by integrating and making the production process to focus on value, mobilizing the organization to quickly understand the new ideas and innovative processes for the new infrastructure. In the foregoing regard, key value drivers that are determinative for capturing the impact of the scaleup conditions, also covers efficient manufacturing of sizable quantity of products that satisfy the demands. Instructively, this manufacturing system utilize integrated product data model that runs from design to product commissioning. The industrial administrators are the drivers of these operational priorities and should be trained to re-invent the process where the need arises.

The second area is the mass-customized manufacturing which incorporate product design variance that also guarantees high volume of output with high quality standards. Since quality is critical under this model of manufacturing, Industry 4.0 technologies are centered on sensor based real time quality inspection that results flexibility in routing and scheduling of production lines, production load balancing and performance management. This model also enhances the extension of the automated assembly line.

Thus, the role of Industry 4.0 technologies in the 'servitisation of modern manufacturing' output also supports the expansion and optimization of global value chains (GVCs) which has some associated need for increased connectivity and requisite platforms for information/data sharing across a large range of use cases. The industrial administrator is expected to not only understand the interface and inter-operability of these platforms but the scales of operational dynamics, the response time to future changes in technologies and the various external pressures and market demands. In view of these ideals, it has been suggested that Industry 4.0 technologies, especially the 5G concerns, should be driven to contribute or enhance opportunities for cost effective and reliable support structure in the advancement of production activities, as to:

- realize the ultimate concept of an efficient and flexible connected factory
- participate in globally and highly automated 'connected value chains' at competitive costs, for both low and high data rate use cases
- bring machine-type communications to a new level across the complete product life cycle and fully embrace the 'connected-products' paradigms. [18]

Relatedly, while identifying and sustaining the roles of Industry 4.0 technologies in the tracking of changes that they have resulted, the concept of re-industrialization must not only sustain the dynamism of disruptive ideas and innovations, but must do so under well-defined socio-economic parameters,[18] which themselves are key indicators for measurement of changes. These key indicators are not limited to the following trends:

i. *Changing demographics:* This trend deals with issues such as increasing world population ageing communities, expanding urbanization, etc. The implication of this indicator is that upscaling manufacturing activities should be dependent on research and design into products that would be relevant and appealing to this dynamic demographic trend.

ii. *Globalization and future market driven investments:* understanding the concept of globalization is crucial to the advancement of technology and production capacity optimization. This means that future markets trends must be considered in the planning process for upscaling of manufacturing activities under Industry 4.0 technologies. Thus, the change tracking yardstick in this trend is the capability of the production system to sustain advancements in global links and product connectivity.

iii. *Advancements in dynamic technological innovation:* This is a key trend in the determination and tracking of changes brought into the society by upscaling production practices. Under this trend, dynamic nature of current technologies is a pointer to newer models. This means that a design must have features that can be optimized or re-invented to yield better result. Further, such technologies must guarantee the operational possibilities of sensing and digitalization which enables data applications such as; virtualization, augmented realities, internet of things, technology penetration, industrial diffusion, ubiquitous connectivity, high data potency and portability.

iv. *Global knowledge economy:* This trend is a sustainable potential within the area of knowledge, enhancing industrial operation that deals with technological throughput. The changes this indicator brings is the direct increase in quality of life and national GDP. Consequently, there are countries with little or no mineral resources but has a lot of very knowledgeable citizens that create values that are relevant to human comfort. These group of persons utilize their human intellect to create value that solve human problems. Thus, a positive difference in the quality of life indicate a change in individual orientation with respect to issues addressed by that technology.

v. *Mass Customization Technology:* This trend indicates the growing possibilities of personalization and customization of massly produced items. Thus, where possibilities indicate that products can be personally made outside the specifications of the design templates, then the direct application of such possibilities is a measurement yardstick for tracking of changes introduced by that innovative idea.

vi. *Distribution of global responsibility:* Developments in global trend indicates increasing global co-operation, and technologically driven collaborations and partnerships. This practice is a major yardstick for development of the ideals that drive society; and in most cases define the future of certain commercial and industrial practices.

The trends identified above are by no means exhaustive. However, they serve as guides and pointers to the emergence of future production enablers that would continue to reshape production practices and investment patterns. A proper understanding of the dynamics of these parameters is paramount to modern industrial administrators.

5. Conclusions

We have observed that change is dynamic and necessary for any god measure of progress in a particular line of activity. In respect of the views of this paper, technologically driven changes are traceable within the content and context of their applications. Thus, any innovation that requires scientific and logical implementation must produce a change that is positive and directed towards better living or working standard.

In view of the foregoing the application of Industry 4.0 technologies draw attention to the increasing need for better industrial practices that will ensure:

i. flexibility and reconfigurable, adaptive and evolving factories capable of small and large scale production within lean manufacturing templates.

ii. quality guaranteed high performance production that is enhanced by advanced technology which integrates flexible manufacturing cells, precision zero defect regimes within the confines of efficient energy resources.
iii. encourages direct application of various lean manufacturing practices, including reduction in consumption of production consumable such as energy, water, space etc.
iv. reduction in vibration transients, noise pollution and emissions of unfriendly gases and fluid into the environment.

In view of the foregoing industrial administrators are to be in tune with industry practices that ultimately result smart factories, digitally driven factories and virtual or cloud enabled factories. An understanding of the changes these disruptive innovations are capable of introducing into the work environment makes the industrial administrator an ever competent resource person to a constantly changing work environment.

References

1. McGinn, D. :'The Numbers in Jeff Bezos Head', *Harvard Business Review*, 2014, p. 58-61
2. Merfeld, D. :'Q & A' *Mechanical Engineering the Magazine of ASME, Dec. 2019 ed., p. 18.*
3. Definition of idea as provided for in www.dictionary.com visited 10th Nov. 2020.
4. Massey, D. :"Bringing Utility Innovation to Market", *Energy World (Magazine of the Energy Institute), Jan. 2020, p. 7.*
5. Acs, Z. J. and Audretsch, D. B., :"Innovation in Large and Small Firms: An Empirical Analysis," *American Economic Review*, vol. 78, no. 4, pp. 678-690, 1988.
6. Argyris, C. and Schon, D. A.,: *Organizational Learning: A Theory of Action Perspective*, Reading, MA: Addison Wesley, 1978.
7. Dibella, A.,: "Gearing up to Become a Learning Organization," *Journal for Quality & Participation*, vol. 20, no. 3, pp. 12-14, 1997.
8. Sajid, M., Al-bloush, H.B., AL-Faieq, M., Monsef, S., and Sadeghi, M.: 'Role of Innovation in the Development of New Products for Improving Organizational Performance', *Journal of Advanced Management Science Vol. 3, No. 3, September 2015*
9. Bartel, A.,: "Formal Employee Training Programs and Their Impact on Labour productivity," *NBER Working paper No. 3026*, 1989
10. Booz, Allen, and Hamilton, :'New Product Management for the 1980s', *New York: Booz, Allen & Hamilton, Inc*, 1982.
11. Sanders, A., Subramanian, K.R.K., Redlich, T. and Wulfsberg, J. P. :'Industry 4.0 and Lean Management-Synergy or Contradiction', *Conference Paper in IFIP Advances in Information and Communication Technology,* August 2017.
12. Kolberg, D., Zühlke, D.: 'Lean Automation Enabled by Industry 4.0 Technologies' *IFAC-Papers OnLine* 48(3), 1870–1875 (2015)
13. Staufen, A.G.: 'China-Industry 4.0 Index 2015': *Industry 4.0 and Lean Study* (2015)
14. Clark, K. and Fujimoto, T.: 'Product Development in the World Auto Industry: Strategy, Organization and Performance', *Boston: Harvard Business School*, 1988.
15. Clark, S. C., Dobbins, H. G. and Ladd, T. R. "Exploratory Field Study of Training Motivation," *Group & Organization Management*, vol. 18, no. 3, pp. 292-307, 1993.
16. ITU Regional Forum on "Internet of Things, Telecommunication, Network and Big Data as Basic Infrastructure for Digital economy", Saint-Petersburg, Russian Federation, 4-6 June, 2018.
17. The Next Economic Growth Engine Scaling Fourth Industrial Revolution Technologies in Production WEF/McKinse, White Paper, 2018.
18. Haerick, W. and Gupta, M.: 'White Paper: 5G and the Factories of the Future', *iMinds Publications*, 2015