Competencies Required for Adaptation in the Fourth Industrial Revolution: Business Educators' Perspectives

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Abstract - **The need for job security in the fourth industrial revolution necessitated the study to ascertain the competencies that could be aligned with the jobs and opportunities in the fourth industrial revolution as perceived by business educators. One research question guided the study, and two null hypotheses were tested at 0.05 level of significance. Survey research design was used. Population of the study comprised 98 business educators from four tertiary institutions offering business education courses in Anambra State. There was no sampling, hence, the whole population was used. Structured questionnaire was the instrument for data collection. The instrument was validated by five experts. Data collected were analyzed using mean and standard deviation for the research question while null hypotheses were tested using the z test at 0.05 level of significance. Findings from the study revealed that creativity, empathy, cognitive flexibility, among others were considered as competencies required for adaptation in the fourth industrial revolution. Also, there was no significant difference in the mean ratings of the respondents on the competencies required for adaption in the fourth industrial revolution as a result of gender and location. Based on the findings, it was therefore recommended that business educators should be re-oriented with high-tech resources to blend their knowledge with the contemporary competencies needed for adaptation in the 4IR.**
Keywords: **Artificial intelligence, Business Educators, Competencies, Fourth Industrial Revolution, Machine Learning**

I. INTRODUCTION

Industrial Revolution (IR) could simply be described as the transition from the use of manual methods of solving the humanity problems to the use of mechanical and machine methods. Industrial Revolution has under gone several stages over time. According to Schwab (2015) the first industrial revolution changed the human lives and economy from an agrarian and handicraft economy to the one dominated by industries and machines.

According to the author, the second revolution facilitated mass production through oil and electricity and the third industrial revolution facilitated the information technology to automate production while the fourth industrial revolution was seen with the technological revolution. Although each industrial revolution is often considered a separate event, together they can be better understood as a series of events building upon innovations of the previous revolution and leading to more advanced forms of using machines.

The era of Fourth Industrial Revolution (4IR) is the fourth major industrial era since the initial industrial revolution of the 18th century (Peters, 2017). It is a term used to describe the rapid and abrupt changes in the way of using machines which are brought about by the technological advancement. The fourth industrial revolution is described as the era when individuals move between the digital domains and the offline reality with the use of connected technology to enable and manage their lives. It describes a time when new technologies blur the physical, digital, biological and socio-cultural boundaries of life (Prisecaru, 2016). According to Min, Jeanne and Suk (2018), the fourth industrial revolution is characterized by a range of new technologies that are permeating the physical and biological spheres of life which affect the way we live and work. It is progressively impacting in today's world.

Currently, many jobs are being automated through technologies such as artificial intelligence (AI), the Internet of Things (IoT), cloud computing, 3D printing, bioengineering, machine learning, robotics, nanotechnology, genetics and biotechnology (Wrigley, 2018). With this impending disruption of jobs and skills by machines, some core skills required across occupations might change. Most low manual skilled jobs could be replaced, and high-tech skills could be highly demanded. Penprase (2018); Alhloul and Kiss (2022) opined that jobs requiring higher skills are less likely to be replaced in the 4IR. This increase in dichotomization could lead to increased tension in the society.

For a world that would be shaped by technologies, it is important that students who are the future workforce should be prepared to complement the work done by machines and mechanical technologies. As Starkey in Sharkova (2014) Opined that academic faculty should focus on the use of digital technologies in schooling in educationally meaningful ways. This is important, as educating students in this era and balancing the needs of the economy and the society is of paramount. This calls for teachers' commitment in integrating technology in the scheme of work and

consistently responding to external pressure and constraints arising in the use of new technologies (Obidile, 2013). Business educators are therefore expected to impart the necessary competencies that could be aligned with the jobs and opportunities in the fourth industrial revolution into the students, so as to enhance their employment and retention rate on graduation.

A. Statement of the Problem

The concern about human job security necessitated the study to ascertain the competencies required for adaptation in the fourth industrial revolution. As technology has brought a lot of challenges and opportunities to every sector of the economy including education and industry, technology utilization in schools has brought about intense demand to build students' skills which are compatible with the development. Failing to train the next generation of workers for the digitally driven economy could bring about undesired effects which include; greater income inequality and increased unemployment.

The fourth industrial revolution is a time of ubiquitous change characterized by a fusion of technologies that is blurring the lines between the physical, digital and biological spheres (Klaus, 2015), workplaces are therefore expected to rely more heavily on adaptable personnel whose jobs are facilitated by the technology with which they work (Xu, Jeanne & Suk, 2018). In order to adapt to the fourth industrial revolution challenges, teachers are expected to impart a strong set of competencies that could help their students acquire the required competencies needed for success in the fourth industrial revolution. As Zervoudi (2018); Czaller, Eriksson and Lengyel (2021) opined that low level of training is one of the factors that could expose workers to the risk of automation. Since it is expected that in the 4IR, some jobs would disappear and some non-existing ones would be in existence, it is therefore important that teachers would align the skills of the future workforce with the needed competencies in the 4IR to keep pace with the technological changes. Hence, the need to ascertain the competencies required for adaptation in the fourth industrial revolution.

B. Research Question

The following research question guided the study.

What are the perceived competencies required for adaptation in the fourth industrial revolution?

C. Null Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

HO$_1$: There is no significant difference in the mean ratings of male and female business educators' responses on the competencies required for adaptation in the fourth industrial revolution.

HO$_2$: There is no significant difference in the respondents' mean ratings on the competencies required for adaptation in the fourth industrial revolution as a result of their location (urban and rural).

II. REVIEW OF LITERATURE

Several studies affirmed that there are fears that technology could displace humans through automation in the fourth industrial revolution (Dregger, Niehaus, Ittermann, Hirsch-Kreinsen & Ten Hompel, 2016; Zervoudi, 2018). Although according to Schwab (2017), the fourth industrial revolution brings new challenges and opportunities that require human intelligence and skills. This entails that human intelligence and skills are of great importance in the 4IR. In order to avoid skill mismatch which could result due to the changing nature of jobs as a result of advances in technology in the fourth industrial revolution, educators are expected to prepare students for the future jobs.

It is expected that access to education should be a precondition for access to opportunities. Educated people are expected to be productive and employable. Investment in education and training is effective only if the right competencies are in place to tackle the technological and societal challenges. Education should focus on learning and developing competencies necessary to synthesize information and nurture new knowledge to solve problems in the society. Following the rapid advancement of technology in the modern workplace, new categories of jobs and skills would be created while some would be partly or wholly displaced.

Currently, technologies are transforming production procedures and business models in the industry and beyond. This advancement in technology is expected to transform the traditional ways of carrying out activities. A vast range of these technologies are already impacting in the world of business, therefore new skills and opportunities are expected to be created. Such opportunities and skills could be utilized when the necessary competencies are imparted to the future workforce. It is therefore important that we identify potential competencies that could be necessary in the labour market as a result of transformation that the fourth industrial revolution has brought.

Competence as defined by Bartram (2006); Wesselink and Wals (2011) is a set of combined behavior that are important in carrying out the task in specific contexts. According to Mulder, Gulikers, Biemans and Wesselink (2009), competence is a set of integrated capabilities consisting of clusters of knowledge, skills and attitudes necessarily conditional for task performance and problem solving and for being able to function effectively in a certain profession, organization, job, role and situation. Rychen and Salganik (2003) defined competence as the ability to successfully meet complex demands in a particular context through the mobilization of psychological prerequisites (including both cognitive and non-cognitive aspects). Competencies in the

context of this study are series of integrated capabilities consisting of knowledge, skills and attitude necessary for taking actions and evaluating opportunities to create value. It is important that necessary competencies should be imparted to the future workforce (students) to serve as connection between technology and the world of work, so as to adapt to the future work demands which are brought about by technological changes in the fourth industrial revolution. Some of these competencies listed by some scholars include; technical skill (Fitsilis, Tsoutsa & Gerogiannis, 2018); analytical skill (Alhloul & Kiss, 2022); Communication, critical thinking, creative thinking, collaboration, adaptability, initiative, leadership, social emotional learning, teamwork, self-confidence, empathy, growth mindset, cultural awareness competencies (Global Business Coalition for Education, 2018).

There is no doubt that technologies have played several roles in the society which include; being drivers of change, rising geopolitical volatility, rapid urbanization, changing work environment, flexible working arrangements, advances in computing power and improving the quality in education (Cunha, Heckman & Schennach, 2010; Anderson, 2012; Sabzian, Pourhossein & Sodouri, 2013; Penuel in Håkansson Lindqvist, 2013; Alonsoperez, F., Alonsoperez, V., Uruguay & Kruijssen, 2018; Davidescu, Apostu, Paul & Casuneanu, 2020). Conversely, they could speed up the trend towards automation which could bring about the skill gap among workers, increase how fast the knowledge and skills become outdated, increase talent shortage and mass unemployment. It is therefore pertinent that educational institutions should enhance their training systems and policies to withstand the challenges of the fourth industrial revolution. Several researchers have tried to ascertain the opportunities and challenges of the fourth industrial revolution (Min, Jeanne & Suk, 2018) but there are sparse literature studies on the competencies required for adaptation in the fourth industrial revolution which the present study contributes significantly.

A. Ecological Systems Theory

The theory used in the study is the Ecological Systems Theory. Ecological systems theory was developed by Bronfenbrenner in 1965. The theory highlights the impact of certain environmental variables on human development. It identifies some environmental systems with which an individual interacts as he learns. The theory stresses that individuals move through series of life transitions, all of which necessitate environmental support and coping skills. This encompasses moving through series of technological advancement which requires coping skills for easy adaptation.

Ecological systems theory relates with the learner centric ecology of resources model inspired by Vygotsky's socio-cultural philosophy (Vygotsky, 1978; 1986). The learner centric ecology of resources model attempts to pull together a set of inter-related resource elements like technology and able partners who know more about what is to be learnt in order to understand their interrelatedness to improve learners' achievement. The 'able partners' therefore need to provide appropriate challenging activities and the right quality of assistance needed. This agrees with the present study as it sought to identify from the 'able partners' (facilitators) the competencies needed by the learners/students to enable them adapt in the fourth industrial revolution. To Bruner (1961), the purpose of education is not only to impart knowledge, but instead to facilitate a child's thinking and problem solving skills which can then be transferred to a range of situations for adaptation. This helps the learner to be inducted into the culture of her society and be empowered as an autonomous learner (Becker & Varelas, 1995).

The theory is related to the present study in the sense that the competencies that could be aligned with the jobs and opportunities in the fourth industrial revolution could be identified by the business educators as they serve as able partners who could provide the right quality of assistance needed by students for adaptation in the event of technological challenges as in the case of the fourth industrial revolution.

III. METHODOLOGY

The study used a descriptive survey research design. The population of the study comprised 98 business educators from four tertiary institutions offering business education courses in Anambra State. No sampling was done hence, the whole population was used. Anambra State was chosen as the area of the study because the State has a huge number of tertiary institutions with large number of business educators. Structured questionnaire titled "Competencies required for Adaptation in the Fourth Industrial Revolution (CRAFIR)" was the instrument for data collection.

The instrument was developed by the researchers after extensive review of the existing literature studies. The instrument was validated by five experts. Three experts from the Department of Technology and Vocational Education and two experts from Measurement and Evaluation Unit, all in Nnamdi Azikiwe University, Awka. The instrument consisted of two sections. Section A sought for the background information of the respondents and Section B contained 24 items covering the research question. The instrument was a 5-point scale of Very Highly Required (VHR=5 points); Highly Required (HR=4 points) Moderately Required (MR=3 points); Lowly Required (LR=2 points); Very Lowly Required (VLR=1 point).

The trial test was conducted using 10 business educators from tertiary institutions in Enugu State who were not part of the population to ascertain the reliability of the instrument. The reliability coefficient of 0.86 was obtained using Cronbach Alpha's method. Ninety-eight copies of the instrument were distributed by the researchers with the help of two research assistants. Out of the number distributed, eighty-six copies were duly filled, collected back and used for data analysis.

Data collected were analyzed using mean and standard deviation for the research question while hypotheses were tested using the z test at 0.05 level of significance. Any item with a mean rating of 3.00 and above was regarded as competency required while any item with a mean rating below 3.00 was not regarded as competency required for adaptation in the fourth industrial revolution. For the test of hypothesis, where the calculated z was greater than the critical z, the null hypothesis was rejected but where otherwise, the hypothesis was retained.

IV. RESULTS

Findings of the study are shown in the Tables as follows.

TABLE I RESPONDENTS' MEAN RATINGS AND STANDARD DEVIATION ON THE COMPETENCIES REQUIRED FOR ADAPTATION IN THE FOURTH INDUSTRIAL REVOLUTION

Sl. No.	Competencies Required	X	SD	Remark
1	Cognitive flexibility	3.90	0.22	Required
2	Ingenuity	3.70	0.17	Required
3	Problem sensitivity	3.60	0.18	Required
4	Critical thinking	3.80	0.20	Required
5	Adaptability	3.50	0.18	Required
6	Creativity	3.90	0.20	Required
7	Emotional intelligence	3.80	0.19	Required
8	Empathy	3.40	0.15	Required
9	Risk taking	3.80	0.19	Required
10	Human interaction	3.10	0.10	Required
11	Technological literacy	4.20	0.35	Required
12	Complex problem solving skill	3.70	0.16	Required
13	Communication skill	3.60	0.18	Required
14	Leadership skill	3.50	0.15	Required
15	Active listening skill	3.60	0.17	Required
16	Technical skill	3.80	0.20	Required
17	Artistry	3.40	0.12	Required
18	Information organization skill	3.80	0.18	Required
19	Negotiation skill	3.60	0.17	Required
20	System analysis skill	3.80	0.19	Required
21	Resource management skill	3.70	0.15	Required
22	Data management skill	3.60	0.20	Required
23	Media management skill	3.70	0.15	Required
24	Web management skill	4.00	0.25	Required

Source: Researchers' field work

The data shown in Table I reveal that the twenty-four items listed were agreed by the respondents as competencies required for adaptation in the fourth industrial revolution with mean and standard deviation values ranging from 3.10 – 4.20 and 0.10 – 0.35 respectively.

A. Null Hypothesis 1

There is no significance difference in the mean ratings of male and female business educators' responses on the competencies required for adaptation in the fourth industrial revolution.

TABLE II THE Z-TEST RESULT OF MALE AND FEMALE RESPONDENTS ON THE COMPETENCIES REQUIRED IN THE FOURTH INDUSTRIAL REVOLUTION

Groups	X	SD	N	Df	Std Error	z-cal	z-crit	Decision
Males	3.285	0.538	34	84	0.06	0.874	1.960	Retained
Females	3.402	0.573	52					

Results from Table II show that in order to test the hypothesis, the mean values of the two groups were computed, the result of the computed yielded the z-value of 0.874 and z-critical value of 1.960 at 0.05 level of significance and 84 Df. Hence, the null hypothesis is retained. This implies that, there is no significant difference in the mean ratings of male and female business educators on the competencies required for adaptation in the fourth industrial revolution.

B. Null Hypothesis 2

There is no significant difference in the mean ratings of the business educators' responses from urban and rural areas on the competencies required for adaptation in the fourth industrial revolution. To test the second null hypothesis, the mean values of the two groups were computed, and the result is shown in Table III.

TABLE III THE Z TEST RESULT OF THE RESPONDENTS FROM URBAN AND RURAL AREAS ON THE COMPETENCIES REQUIRED IN THE FOURTH INDUSTRIAL REVOLUTION

Groups	X	SD	N	Df	Std Error	z-cal	z-crit	Decision
Urban	3.527	0.539	62	84	0.04	0.832	1.960	Retained
Rural	3.458	0.516	24					

Results from Table III of the z-test analysis show that the calculated z value of 0.832 is less than the critical z value of 1.960 at 0.05 level of significance and 84 Df. This implies that there is no significant difference in the mean ratings of business educators from urban and rural areas on their perception of the competencies required for adaptation in the fourth industrial revolution.

V. FINDINGS AND DISCUSSION

Findings from the study revealed that Cognitive flexibility, Ingenuity, Problem sensitivity, Critical thinking, Adaptability, Creativity, Emotional intelligence, Empathy, Risk taking, Human interaction, Technological literacy, Complex problem solving skill, Communication skill, Leadership skill, Active listening skill, Technical skill, Artistry, Information organization skill, Negotiation skill, System analysis skill, Resource management skill, Data management skill, Media management skill and Web management skill were considered as competencies required for adaptation in the fourth industrial revolution. This is in line with the study of Mohamed, Ahamat and Ismail (2021) which listed innovativeness and flexibility, analytical thinking, self-reliance, decision-making, professional development/readiness to learn, among others, as the framework for employees' competencies in the fourth IR. From the findings, it could be deducted that more of the technological competencies and less of the manual skills are needed in the fourth industrial revolution. This depicts that some manual skills could be partly or wholly displaced by the use of advanced machines, and this could increase the rate of unemployment.

Although human interaction was regarded as one of the competencies required, it could be noted that it had the lowest mean. This could be as a result of the gradual introduction of high automated technologies (which brings about more interaction with machines) and this could pose a problem to the society as it could dwindle the cultural practices and encourage self-centred attitude. It is important that human interaction be encouraged in the fourth industrial revolution amidst high technology usage. Machines should be used to

assist in doing things but not to take the place of human as human interaction with its environment is paramount and cannot be neglected.

Findings from the study also revealed that, there was no significant difference in the mean ratings of male and female business educators' responses on the competencies required for adaptation in the fourth industrial revolution. This revealed that both male and female business educators' responses were similar regarding the competencies required for adaptation in the fourth industrial revolution. Furthermore, the findings revealed that there was no significant difference in the mean ratings of the respondents from urban and rural areas on the competencies required for adaptation in the fourth industrial revolution. This could be as a result of the rapid development, adoption and utilization of the technologies in the society that made business educators both in the rural area and the urban area to have similar responses on the competencies required for adaptation in the fourth industrial revolution.

VI. CONCLUSION AND RECOMMENDATIONS

The study therefore concludes that technologically driven competencies are required than manual skills for adaptation in the fourth industrial revolution. The researchers therefore recommend that,

1. Stakeholders in education should support up-skilling and re-skilling of business educators through organizing free high-tech skill training programmes, so as to meet the challenges of 4IR.
2. Business education programme should be equipped with high-tech resources so as to blend business educators' knowledge with the contemporary competencies needed for adaptation in the 4th industrial revolution.
3. Business educators should consistently respond to external pressure and constraints arising from the use of new technologies in order to create a hybrid teaching and learning model that could enhance the use of technology in the teaching and learning processes.

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