



## **INTERNET OF THINGS (IOT) SKILLS REQUIRED OF GRADUATES OF BUSINESS EDUCATION FOR BUSINESS OPERATION IN DELTA STATE**

<sup>1</sup>**Ikenga Godwin Uzoamaka**

*School of secondary Education (Business)  
Federal College of Education (Technical), Asaba, Delta State  
Phone Number: 08037613472*

<sup>2</sup>**Egbule Collins Nnamdi**

*School of secondary Education (Business)  
Federal College of Education (Technical), Asaba, Delta State  
e-mail: [egbule.collins@yahoo.com](mailto:egbule.collins@yahoo.com)  
Phone Number: 08037934626*

### **Abstract**

The study investigated the Internet of Things (IOT) skills required of graduates of business education for business operation in Delta State. A research question guided the study and a hypothesis was tested. The descriptive survey design was adopted for the study. The population of the study comprised 115 business educators from five tertiary institutions in Delta State. A structured questionnaire which was validated by three experts was used to collect data for the study. The test of reliability of the instrument using Cronbach Alpha yielded reliability coefficient of 0.82 for internal consistency of the instrument. Mean and standard deviation was used to answer the research question while t-test was used to test the hypothesis at 0.05 level of significance. The finding of the study revealed that leadership, communication, team work, strategic planning, decision making, marketing management, innovation management, performance management and quality management skills are the IOT skills required of graduates of business education for business operation in Delta State. The respondents did not differ in their opinion based on gender. The study concludes that graduates of business education require specific IOT skills for business operations. Based on these findings, it was recommended that administrators of business education programme in conjunction with business education curriculum planners should review the business education curriculum to include the addition of courses that would cover technological innovations like the IOTs in the business programme in tertiary institutions

**Keywords:** Internet of Things, Skills, Business Education, Graduates, Business Operation

### **Introduction**

The advancement in technology globally has revolutionized every facet of human activities. The technological revolution has impacted the global business environment in various ways. The radical changes unleashed by the rise of the global digital economy are having profound implications for businesses, necessitating a major transformation. In order to fully participate in the globally competitive business environment, it is essential to provide people with the necessary training for the digital business environment (Enang and Okwute, 2019). The Internet of Things (IOT) is a technological revolution that allows for ubiquitous interaction among objects, people, and environments (Dutton, 2014). The Internet of Things (IOT) is a global platform of interconnected



devices that have been transformed from dumb and immovable physical devices into intelligent devices that can respond and act in real-time to the environment, humans, and other devices. However, since the term "IOT" was coined, different authors and researchers have defined and interpreted it in various ways that are appropriate for their application. Kevin Ashton coined the term during a 1999 presentation about radio frequency identification (RFID) at Procter and Gamble (P & G).

The Internet of Things (IOT) refers to a network of smart devices capable of sensing, tracking, and measuring events or processes and communicating the collected data to other devices or applications for processing or action via the internet or a network (Mirandi, Sicari, Pellegrini and Chlamtac, 2012). IOT devices may have built-in processing capabilities or may outsource processing to applications and devices in their surrounding environment (e.g., at a central location or in cloud). A smart watch (Apple's iWatch) with integrated heart rate monitor, motion sensors, location sensor, and many other capabilities in a small form factor is an example of an IOT device that has gained significant customer acceptance. Similarly, widely available smart phones have a plethora of integrated sensors and measuring capabilities that are being used for commercial purposes (e.g., Uber or Lyft) (Mahto and McDowell, 2018). IOT has been recognized as one of the foundation stones of Industry 4.0. IOT applications have transformed lives, adding enormous value to the activities of both individuals and businesses.

Today, billions of everyday objects are equipped with advanced sensors, wireless networks, and cutting-edge computing power. Wearables, smart home applications, advanced health care systems, "smart cities," and industrial automation have all resulted from this abundance (Chen and Ji, 2016). IOT appears to be on the verge of entering mainstream business use: The adoption of IOT technologies by businesses is increasing, with the global number of IOT-connected devices expected to reach 43 billion by 2023 (Gupta, Tsai, Rueb, Yamaji and Middleton, 2017). IOT reflects the growing trend of physical devices with computing and communication capabilities that can collectively gather information in real time (Chu, Matthews and Love, 2018). To maintain the pace, firms are starting to prepare for this digital transformation by attempting to streamline their organizations as well as projects with digital solutions such as Internet of Things (Jesse 2018). Through digitalization, IOT and Big Data are reshaping management and marketing strategies, which represents a new frontier in business competitiveness and is often referred to as the 4.0 Industrial Revolution (Zhou et al., 2015). These new paradigms have profoundly altered not only human relationships and daily activities, but also the management methods and processes of businesses. Ahmed, Yaqoob, Hashem, Khan, Ahmed, Imran, and Vasilakos (2017) stated that IOT assists businesses in: redesigning product and service production processes; providing new products and services with more advanced or efficient technologies; and, as a result, capturing large amounts of generated data to predict behavior, choices, and consumptions, thereby assisting decision-making processes and strategic planning. On these foundations, IOT is shifting the focus of business processes away from physical products and toward data-driven services. It is therefore imperative that business education keys into the changes that is happening in the global business environment to keep its graduates abreast with the skills needed to utilize these technologies.

The business education programme according to Enang and Okute (2019) is an academic programme that offers students the knowledge and abilities needed to carry out specific office tasks as well as the understandings and skills necessary to conduct personal affairs in the digital world while utilizing the services of the business world. Additionally, business education can be divided into two main categories: "education about business" and "education for business" (also known as vocational education) (consumer education). Onokpaunu (2016) defined business education as a component of general education that prepares students for employment and growth in entrepreneurship, teaching, and other office vocations. Ogudo and Crossdale-Owido (2020) saw



business education as an essential aspect of vocational education that provides students with self-actualization and self-reliant skills to actively contribute to individual economy, local and national industrial growth. Thus, business education is a specialized phase of vocational education that prepares students to enter the workforce as capable and intelligent members of the teaching and office occupations. It is therefore imperative for business education students who are expected to be managers upon graduation possess the needed IOT skills for the 21<sup>st</sup> century business environment.

A skill is the learned ability to perform an action with predictable outcomes and good execution, often in a limited amount of time, energy, or both. It is the ability and capacity gained through deliberate, systematic, and sustained effort to carry out complex activities or job functions involving ideas (cognitive skills), things (technical skills), and/or people in a smooth and adaptive manner (interpersonal skills). De Carvalho and Rabechini (2015) and Zuo, Zhao, Nguyen, Ma and Gao (2018) emphasized the importance of distinguishing soft and hard skills in business management, which assists project managers in understanding not only the technicality, but also the importance of resolving people-related issues among various stakeholders in order to achieve mutual understanding. Madanayake, Seidu and Young (2020) highlighted the skills that may be required in present and future job role, in managing implementation of IOT (Internet of Things). They are:

- a. Leadership (i.e. leading and guiding others through the overall process of implementing/exploiting interconnected IOT systems).
- b. Communication- oral/written (i.e. communicating overall managerial goals of IOT systems).
- c. Negotiation (i.e. negotiating with business partners/ clients/ supply chain members for maximizing the delivery value as well as for business development)
- d. Motivation (i.e. encouraging employees to use and share IOT tools and processes productively and effectively)
- e. Team Work (i.e. managing collaborative teams involved in the delivery of IOT projects including steering committee recruitment and delegation of authority according to each individual's competencies)
- f. Decision Making (i.e. making the right decisions to achieve organisational or managerial objectives)
- g. Strategic Planning ( i.e. Identify strategic objectives and implement strategies)
- h. Partnership and Alliances (i.e. initiating partnerships and alliances with other organisations based on IOT deliverables for business development)
- i. Finance Accounting and Budgeting (i.e. planning, allocating, monitoring and controlling the costs associated with IOT implementation/ exploitation)
- j. Marketing (i.e. promoting organisation's IOT capability to its clients and business partners, carry out research on the market position, absorptive capacity and appetite for IOT deliverables)
- k. Tendering and Procurement (i.e. facilitating and steering the procurement of IOT products and services including managing the contractual obligations underlying collaborative IOT Projects).
- l. Risk Management (i.e. managing the risks associated with using IOT tools and interconnected systems)
- m. Quality Management (i.e. establishing, managing and controlling the quality of IOT systems)
- n. Performance Management (i.e. evaluating the organisational IOT capability against a benchmark and Business Intelligence to gain insights through monitored IOT data).
- o. Operational Management (i.e. wireless protocols like Bluetooth/3G/4G low energy connections and automation of IOT hardware devices with sensor systems and intelligence software-automated room control systems, smart building)



- p. Technological infrastructure Management (i.e. installing, managing and maintaining general IT infrastructure, including cloud platform connectivity with specific software and hardware equipment requirements).
- q. Legislation Management (i.e. understanding the legal requirements of IOT protocols-regulations, privacy, security and copyright of IOT data)
- r. Innovation Management (i.e. support and facilitate experimenting new beneficial uses of the innovation processes for continuous improvement and change management)

The significance of having a strong leadership was also mentioned in achieving IOT business value. Eriksson, et al (2017) averred that a lack of convincing leadership is impeding the potential for the Internet of Things to be used to its fullest potential. On the other hand, creating a collaborative work environment among employees within an organization is crucial from the perspective of businesses. Therefore, businesses must develop specialized team-work collaboration management skills that come from organizational practices and the control of myriad inter-dependencies between projects and/or departments within the organization. This would also entail encouraging cross-departmental and/or cross-project learning and then tying the lessons learned to changes that are specific to the project (or context). These teamwork skills must be based on the ability to establish relationships and trust, to learn from one another, and to build on everyone's capacity for original thought (Reinhard, Jesper and Stefan, 2016). However, the extents to which these skills are required by business education graduates seem not to be clear. As a result, there is a need to capitalize on the opportunities provided by the technological revolution by determining the IOT skills required by graduates of business education for business operation in Delta State.

#### **Statement of the Problem**

Technology is revolutionizing the way business practices are conducted globally. Innovations in technology driven by strides made by developments in Internet of Things have brought about a technological revolution in the global business environment (Reinhard et al., 2016). This seems to be reshaping the skills expectations of industry for the management of the current business environment. The business education programme in tertiary institutions in Nigeria in general and Delta State in particular is expected to be at the forefront of promoting the development of new skills dimensions for effective functioning in the digitalized business environment. Sadly, the realization of this expectation appear to have presented a huge challenge to the business education programme. The ever increasing rate of unemployment among youths particularly graduates of tertiary institution is a clear indication that graduates including the business education graduates have failed to take advantage of the opportunities offered by the Internet of Things to make themselves facilitators of IOT, therefore becoming self employed in the tech industry. It is this perceived lapse that has necessitated this study.

#### **Research Question**

What are the internet of Things (IOT) skills required of graduates of business education for business operation in Delta State?

#### **Hypothesis**

The null hypothesis was tested at 0.05 level of significance:

There is no significant difference in the mean rating of male and female business educators on the internet of Things (IOT) Skills required of graduates of business education for business operation in Delta State.



### Method

The descriptive survey research design was adopted for the study. According to Nworgu (2015), survey research is an appropriate design which is used to identify characteristic of the population, situation or phenomena. Survey design is appropriate for this research work because it will seek the opinions of the respondents on the variables under study using questionnaire. The study was carried out in Delta State. The population of the study comprised 115 business educators from the five tertiary institutions offering business education programme in Delta state. The instrument for data collection was a researcher developed questionnaire. The instrument was titled "Internet of Things Skills Required of Graduates of Business Education for Business operation Questionnaire (IOTSRGBEIBPQ)". The Instrument contains 16 items on skills required of graduates of business education for business operation. The instrument was structured on a 4- point rating scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The instrument was validated by three experts in the School of Business Education, Federal College of Education (Technical), Asaba. The instrument was pilot tested on 10 business educators in Anambra State.

The application of Cronbach Alpha on the data collected yielded a coefficient value of 0.82 for internal consistency of the instrument. The researcher administered the questionnaire and the respondents were given enough time to complete the questionnaire on the spot . However, for those who could not complete the questionnaire, an appointment was made for the retrieval of the instrument. Out of the 115 copies of questionnaire administered, 106 copies were returned in good condition and were used for the collection of data for the study. The mean value was used to answer the research questions while the standard deviation was used to ascertain the homogeneity or otherwise of the respondents' ratings. In analyzing the mean value, any item with mean rating between 2.50 and above was regarded as agreed while any item below 2.50 was regarded as disagree. For the hypotheses, t-test statistic was used to test the null hypotheses at .05 level of significance. Meanwhile, a null hypothesis was rejected where the P - value is less than the stipulated level of significance (.05). Inclusively, if the p- value is greater than or equal to the stipulated level of significance (.05), the hypothesis was acceptable.

### Results

What are the internet of Things (IOT) Skills required of graduates of business education for business operation in Delta State?

**Table 1:  
Mean Ratings of Respondents' on the IOT Skills Required of Graduates of Business Education for Business operation (N=106)**

| S/No. | Item Statement   | Mean | SD  | Remarks |
|-------|--|------|-----|---------|
| 1.    | Leadership (i.e. leading and guiding others through the overall process of implementing/exploiting interconnected IOT systems).                            | 2.70 | .91 | Agree   |
| 2.    | Communication- oral/written (i.e. communicating overall managerial goals of IOT systems).  | 2.63 | .95 | Agree   |
| 3.    | Negotiation (i.e. negotiating with business partners/ clients/ supply chain members for maximizing the delivery value as well as for business development) | 2.71 | .76 | Agree   |
| 4.    | Motivation (i.e. encouraging employees to use and  | 2.69 | .82 | Agree   |



|     |   |             |      |              |
|-----|---|-------------|------|--------------|
| 4.  | Share IOT tools and processes productively and effectively)   |             |      |              |
| 5.  | Team Work (i.e. managing collaborative teams involved in the delivery of IOT projects including steering committee recruitment and delegation of authority according to each individual's competencies)         | 2.63        | .86  | Agree        |
| 6.  | Decision Making (i.e. making the right decisions to achieve organisational or managerial objectives)  | 2.57        | .97  | Agree        |
| 7.  | Strategic Planning ( i.e. Identify strategic objectives and implement strategies)   | 2.97        | .88  | Agree        |
| 8.  | Partnership and Alliances (i.e. initiating partnerships and alliances with other organisations based on IOT deliverables for business development)  | 2.72        | .92  | Agree        |
| 9.  | Tendering and Procurement (i.e. facilitating and steering the procurement of IOT products and services including managing the contractual obligations underlying collaborative IOT Projects).                   | 2.55        | 1.01 | Agree        |
| 10. | Risk Management (i.e. managing the risks associated with using IOT tools and interconnected systems)  | 2.60        | .96  | Agree        |
| 11. | Innovation Management (i.e. support and facilitate experimenting new beneficial uses of the innovation processes for continuous improvement and change management)  | 2.50        | .96  | Agree        |
| 12. | Technological infrastructure Management (i.e. installing, managing and maintaining general IT infrastructure, including cloud platform connectivity with specific software and hardware equipment requirements) | 2.66        | .72  | Agree        |
| 13. | Legislation Management (i.e. understanding the legal requirements of IOT protocols- regulations, privacy, security and copyright of IOT data)   | 2.76        | .88  | Agree        |
| 14. | Marketing (i.e. promoting organisation's IOT capability to its clients and business partners, carry out research on the market position, absorptive capacity and appetite for IOT deliverables)                 | 3.00        | .84  | Agree        |
| 15. | Performance Management (i.e. evaluating the organisational IOT capability against a benchmark and Business Intelligence to gain insights through monitored IOT data).   | 2.79        | .91  | Agree        |
| 16. | Quality Management (i.e. establishing, managing and controlling the quality of IOT systems)   | 2.80        | .75  | Agree        |
|     | <b>Cluster Mean</b>   | <b>2.70</b> |      | <b>Agree</b> |



Data in Table 1 reveal that the respondents rated all the items (1-16) with mean ratings ranging from 2.55 to 3.00 and standard deviations ranging between 0.76 to 0.96 on the internet of Things (IOT) Skills required of graduates of business education for business operation in Delta State. The cluster mean of 2.70 indicate that leadership, communication, team work, strategic planning, decision making, marketing management, innovation management, performance management and quality management skills are the IOT skills required of graduates of business education for business operation in Delta State.

### **Hypothesis**

There is no significant difference in the mean rating of male and female business educators on the internet of Things (IOT) Skills required of graduates of business education for business operation in Delta State.

**Table 2:**

**Summary of t-test Analysis of Mean Ratings of Male and Female Business Educators on the Internet of Things (IOT) Skills Required of Graduates of Business Education for business operation**

| <b>Variable</b>      | <b>N</b> | <b>X</b> | <b>SD</b> | <b>df</b> | <b>α</b> | <b>p-value</b> | <b>Decision</b> |
|----------------------|----------|----------|-----------|-----------|----------|----------------|-----------------|
| Male Business Edu.   | 40       | 2.68     | .96       |           |          |                |                 |
| Female Business Edu. | 66       | 2.61     | .96       | 104       | .05      | .36            | Not Significant |

Data in Table 2 showed that the p-value of .36 is greater than .05 alpha level of significance. This means that there is no statistical significant difference in the mean ratings of male and female business educators on the on the internet of Things (IOT) Skills required of graduates of business education for business operation in Delta State. The hypothesis was therefore accepted.

### **Discussion of Findings**

The finding of the study revealed that leadership, communication, team work, strategic planning, decision making, marketing management, innovation management, performance management and quality management skills among others are the IOTs skills required of graduates of business education for business operation in Delta State. The finding is in agreement with Madanayake, Seidu and Young (2020) who reported that for individuals to meet up with the demands of the global business environment with regards to IOT, they need to possess certain skills and knowledge like leadership, communication, negotiation, financial management, quality management and decision making skills. Eriksson, et al (2017) stated that leadership skills are a major skill set required for successful implementation of IOT for business operation. Reinhard, Jesper and Stefan (2016) asserted that teamwork skills is very important IOT skill because it promotes the ability of business education graduates to establish relationships and trust, learn from one another and build on everyone's capacity for original thought. Furthermore, finding of the study revealed no significant difference in the mean ratings of male and female business educators on the on the internet of Things (IOT) Skills required of graduates of business education for business operation in Delta State. The finding is an indication of the unanimity in opinion on the IOT skills required of business education graduates for business operations. This finding is in agreement with Madanayake, et al (2020) who stated that there is need for the identification of skills for the implementation of IOT in business



operations. Madanayake, et al stated that the three most important skills for future IOT implementation are innovation management, strategic planning and Information Management. The authors posited that strategic planning is a skill and a knowledge dimension that is vital not only for the present times but also for the future. It is therefore imperative that business education graduates who are trained business managers are equipped with these IOT skills for successful business operations.

### **Conclusion**

Based on the findings of the study, the researchers concludes that business education graduates require specific skills sets that would help to bridge the skills gap between the traditional businesses and the highly digitalized global business environment. The innovation taking place in the business world which is occasioned by the digital revolution resulting from activities of IOT, the business education programme needs to put in measures that would improve the knowledge and capacity of business education students to develop useful IOT skills for business operation upon graduation.

### **Recommendations**

The following recommendations were made based on the findings of the study:

1. Administrators of business education programme in conjunction with business education curriculum planners should review the business education curriculum to include the addition of courses that would cover technological innovations like the IOT in the business programme in tertiary institutions.
2. Administrators of business education programme in conjunction with Information and Communication Technologies firms to provide funds, IT infrastructure for the implementation of IOT infrastructure in the business education programme.

### **References**

- Ahmed, E., Yaqoob, I., Hashem, I.A.T., Khan, I., Ahmed, A.I.A., Imran, M. & Vasilakos, A. V., (2017). The role of big data analytics in Internet of Things. *Computer Network*, 129, 107–127. <https://doi.org/10.1016/j.comnet.2017.06.013>.
- Chen, B.W., Ji, W., (2016). Intelligent Marketing in Smart Cities: Crowdsourced data for geo-conquesting. *IT Professional*, 18, 18–24
- Chu, M., Matthews, J. & Love, P. E. D. (2018). *Integrating mobile building information modelling and augmented reality systems: An experimental study, automation in construction*. DOI:10.1016/j.autcon.2017.10.032.
- De Carvalho, M. M. & Rabechini Junior, R. (2015). Impact of risk management on project performance: The importance of soft skills. *International Journal of Production Research*. DOI:10.1080/00207543.2014.919423.
- Dutton, W. H. (2014). Putting things to work: social and policy challenges for the Internet of things. *Infomatics*, 16 (3) 1-21.
- Enang, C.E. & Okwute, A.L. (2019). Leveraging on new technologies for skill acquisition of business education in tertiary institutions in Nigeria for the e-world. *Nigerian Journal of Business Education (NIGJBED)*, 6(1), 331-337.
- Eriksson, C., Cheng, I., Pitman, K., Dixon, T., Van De Wetering, J., Sexton, M., et al. (2017). *Smart cities, big data and the built environment: What's required?* Retrieved from <http://www.rics.org/Global/RICS-SmartCities-Big-Data-REPORT-2017.pdf>.
- Gupta, A., Tsai, T., Rueb, D., Yamaji, M., & Middleton, P. (2017). *Forecast: Internet of*





- things — endpoints and associated services, worldwide, 2017. Gartner. Retrieved at. <https://www.gartner.com/en/documents/3840665/forecast-internet-of-things-endpoints-and-associated-ser>
- Jesse, N. (2018). *Internet of things and big data: The disruption of the value chain and the rise of new software ecosystems, AI and Society*. DOI:10.1007/s00146-018-0807-y.
- Karji, A., Woldesenbet, A. & Rokooei, S. (2017). *Integration of augmented reality, building information modeling, and image processing in construction management: A content analysis*. Proceedings of the Architectural Engineering National Conference 2017.
- Madanayake, U.H., Seidu R.D. & Young, B.E. (2020). *Investigating the skills and knowledge requirements for IOT implementation in construction*. Proceedings of the 5th NA International Conference on Industrial Engineering and Operations Management Detroit, Michigan, USA, August 10 – 14.
- Mahto R. & McDowell, W. (2018). *Internet of things (IOT) and entrepreneurship education: Opportunities and challenges*. Retrieved from <https://www.researchgate.net/publication/329844711>.
- Miorandi, D., Sicari, S., De Pellegrini, F., & Chlamtac, I. (2012). Internet of things: Vision, applications and research challenges. *Ad hoc networks*, 10(7), 1497-1516.
- Nworgu, B. G. (2015). *Educational research: Basic issues and methodology* (3<sup>rd</sup> edition). University Trust Publishers.
- Ogudo, P. A. & Crossdale-Ovwido, J. (2020). Globalization of business education curriculum experiences for enhanced students' employability status in Nigeria. *Nigerian Journal of Business Education (NIGJBED)*, 7(2), 387-392.
- Onokpaunu, M. O. (2016). Analysis of web-based instructional technologies for use by business education lecturers in tertiary institutions in Delta State. (*Unpublished Master's Thesis*, Department of Vocational Education, Nnamdi Azikiwe University, Awka, Anambra State).
- Reinhard, G., Jesper, V. & Stefan, S. (2016). *Industry 4.0: Building the digital enterprise*. 2016 Global Industry 4.0 Survey. DOI:10.1080/01969722.2015.1007734.
- Zuo, J., Zhao, X., Nguyen, Q. B. M., Ma, T. & Gao, S. (2018) *Soft skills of construction project management professionals and project success factors: A structural equation model, engineering*. Proceedings of the 5th NA International Conference on Industrial Engineering and Operations Management Detroit, Michigan, USA, August 10 - 14, 2020