Harnessing The Power of the Internet of Things (IoT) to Achieve an Agile Business Education Model: A Visionary Paper

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Abstract— **The emergence of artificial intelligence, big data, and the Internet of Things (IoT) has shifted human-human, human-machine, and machine-machine interaction to a new level. This shift is affecting all aspects of society's behavior toward the adoption of technology. One important pillar of society that is especially impacted by this radical change is that of education. The advancement of new technologies as well as the occurrence of unexpected global events has forced education systems in many countries to look differently at traditional educational issues and work toward becoming a more agile education system. This means being responsive to any unpredicted changes that may occur in the education environment. Indeed, the agility of business schools and technological adaptability is one of the standards required by program accreditation organizations (i.e., AACSB). This paper discusses the application of IoT in business education, focusing on the opportunities, challenges, and paths forward this presents.**

Keywords— IoT; Business Education; Education Agility; Higher Education

I. INTRODUCTION

Recent advancements in communication technologies, big data, and cloud computing have transformed the landscape of everyday activity. Undoubtedly, advancements in technologies such as artificial intelligence, big data, and the Internet of Things (IoT) have dramatically enhanced several arenas of communication, including higher education institutions. According to [1], the IoT, which connects processes, devices, and people, enhances the volume of data we collect, enabling key participants in the educational process to transform this into valuable information [2]. The education sector is thus perceived as an efficient environment for the utilization of the IoT and big data. In addition, [3] noted that the disruptive impact of technology in contemporary educational institutions has transformed education from a knowledge-transfer model to one that is active, collaborative, and self-directed. This change is viewed by many researchers as being increasingly utilized through the potential offered by the IoT. For instance, the implementation of IoT in business education has led to the development of smart classrooms that allow greater interaction between students and lecturers. This has helped to enhance the lifelong learning and soft skills of students.

However, higher education institutions have recently been compelled to find high-end information and communication technology-enabled solutions to overcome restrictions placed on conducting on-campus, face-to-face classes due to the recent lockdown regulations imposed as a result of the COVID-19 pandemic. This has forced educational institutions to shift their activities toward online distance learning and adopt online learning platforms that mimic traditional classrooms. Novel technologies have been employed and faculties, staff, and students have faced a radical move toward the increasing adoption of information technology. The pandemic has thus driven educational institutions to be ready and more responsive to any future emergency that may occur; in other words, they need to be agile higher education institutions.

The IoT can be a perfect solution for higher education institutions striving to be agile in their activities. When effectively employed in higher education institutions, the IoT provides the flexibility, interactivity, adaptability, and responsiveness needed. This paper therefore demonstrates how the IoT can be utilized in business schools to provide an agile higher education system.

II. THE IMPORTANCE OF EDUCATIONAL AGILITY IN THE EVENT OF A PANDEMIC

The recent global outbreak of COVID-19 has made it clear that universities and schools need to be more agile than ever. In this regard, [4] argued that for higher education institutions this refers to their ability to continue classes even if faculty members, staff, and students are unable to attend campus in person. It is essential to continue our educational activities during the pandemic and ensure continuity of classes. Moreover, schools, colleges, institutes, and universities are required to follow all the standard operating procedures, while teachers need to ensure they meet their learning and academic

objectives. Higher education institutions must therefore embrace agility so that they can adapt and initiate necessary adjustments in response to any unpredictable events and circumstances. On a similar note, [5] defined agility as the ability to adapt to a continuously changing environment. In the field of education, agility can thus be defined as fast adaption to any sudden changes in the institution environment, either internally or externally. This will enhance the operational performance of HEIs, improving quality of workflow and operational output, eventually resulting in greater levels of satisfaction among the main stakeholders. Researchers have also found that in response to external and internal pressures, agile organizations can act quickly and adapt, which is essential when conditions are likely to change. Among the aspects of an institution that need to change are structural processes, mindset (i.e., beliefs), behaviors (i.e., skills), and culture [6]. An alternative way of construing agility is that it encapsulates the ability of institutions to identify external opportunities and threats in order to rapidly generate a competitive advantage in their supply chain. To that end, they must therefore restructure their resources, knowledge, and assets [7]. The dependence of an organization's agility on its IT infrastructure becomes even more critical in environments where the inputs and outputs are knowledge-intensive, as in the case of universities.

In recent years, there have been growing calls from international accreditation bodies for greater agility in their business education programs. For instance, the Association to Advance Collegiate Schools of Business (AACSB), has called for a more holistic approach to interactive teaching and the incorporation of data analytics into business programs [8]. For example, it states that students on all accounting programs must be able to employ analytical skills and access a range of information technology tools. Within their curricula, accounting degree programs currently incorporate existing and emerging accounting and business practices into three core elements.

- Information and communication technologies as well as business applications encompassing data creation and management, data security, and information storage.

- Data science and analytical skills, such as those related to statistical analyses and interpretations, text analytic techniques, predictive analytical methods, machine learning systems, visualization, and robotic process automation.

- Developing an IT agility mindset among key participants in higher education institutions such as faculty members, staff, and students, thus ensuring the development of lifelong learning skills as well as soft skills in addition to the knowledge needed in the marketplace.

However, ensuring agility in business education should not only take into account the need to enhance the IT and analytical knowledge of students and faculty but also a smart dimension that harnesses the potential of the IoT. Incorporating the latter into business education will make it more agile and resistant to any unexpected event. In the current COVID-19 pandemic, the continuity plans of universities should address four main domains:

(1)   Smart enabled IT Infrastructure

(2)   Smart enabled Faculty, Staff, and Students

(3)   Smart enabled teaching material

(4)   Access to the Internet

These four domains are depicted in Figure (1). The following sections discuss each of these domains in turn.

A. Smart enabled IT infrastructure

A smart enabled IT infrastructure is one that includes setting up traditional courses on a web-based learning platform (Blackboard, Zoom, Microsoft Teams, etc.) and establishing communication protocols with and among students, faculty, and staff. Universities have to ascertain whether the IT infrastructure can keep everyone connected without interruptions [4].

Transforming the traditional classroom into a smart classroom is important in harnessing the power of the IoT. For example, the attendance and interactions of students are captured in a continuous manner by IoT-enabled cameras. These images or videos are stored on the cloud and analyzed periodically with the help of Face Recognition API [9]. The smart classroom provides a smart learning environment allowing students and lecturers to access digital resources in an interactive manner to overcome time and location barriers.

In addition, the internet of tangible things is a new, non-traditional tangible user interface (TUIs) that is being developed to connect a physical set of objects with the connective capability of the internet to monitor the activity of students in real time. Using IoT technology, the Internet of Tangible Things (IoT) can help children develop social, emotional, cognitive, and visual skills. This model has proved its worth with the best results generated for hearing impaired students [10].

The smart classroom that utilizes IoT technologies incorporates smart teaching aids and the control of appliances inside the classroom, such as smart interactive boards, video conferencing cameras, smart control, and smart enabled learning devices. To increase student-teacher interaction, teacher perception and student perception are closely integrated (especially in rural areas). This app is installed on a teacher's mobile and can be used to control in-class electrical appliances. This enhanced teaching and learning experience will be beneficial for business education [11].

B. Smart enabled Faculty, staff, and students

Faculty readiness is essential for managing the pandemic. The challenge is to ensure that faculty members who have not previously taught an online format are adequately prepared to deal with a switch from traditional classroom delivery to online mode. The continuity plans developed by universities should require all faculties to attend training workshops on how to use the electronic learning platform, modify course content to adapt to the online mode, and familiarize themselves with online assessment methods and tools. The concerns that remain are as follows:

- How to help students be more participative and compliant with the academic agenda?

- How to introduce a fool proof exam system?

- Ease of use of the technology (by teachers and students)?

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- Technological coverage?
- What will be mandatory?
- What privileges will be given to students?

Higher education institutions have witnessed radical changes in not only methodologies and techniques but also a profound transformation of instructors' mindsets as well as social perceptions. Pursuing a dynamic, adaptable, and open learning environment for students is creating the need for more sophisticated and enriched principles for teaching and learning. In addition, universities should ensure students become familiar with online learning platforms through workshops and training. As part of the business continuity plans of universities, students should be ready to switch from face-to-face learning mode to a distance-learning mode. Universities should ensure that students identify a contact in the IT department, in addition to online resources, that will help support their learning in the virtual environment.

C. Smart enabled Teaching Material

To harness the maximum benefits of IoT in business education, business programs should pay attention to the teaching materials used. In this regard, traditional teaching materials should be modernized to be IoT-enabled to facilitate interactivity in smart classrooms. A shift is required in this regard to incorporate multimedia as well as smart assessment tools that capture the advantages offered by the IoT.

D. Access to the Internet

In addition to the above-mentioned domain, a fourth element should be considered to ensure the successful incorporation of IoT into business education, namely access to the internet. Business schools should consider the availability of high-speed wireless internet connections for all faculty, staff, and students participating in the education process: this should provide the required bandwidth for video and audio streaming with no interruptions. In addition, smart devices incorporated into the business education process should be interconnected with all elements. This requires higher education institutions to transform themselves into a smart campus that includes IoT-enabled hotspots.
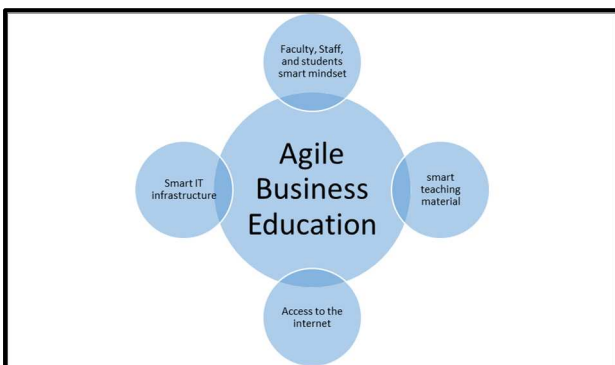

Fig. 1. Domains of agile business education

III. INCORPORATING THE IoT INTO BUSINESS EDUCATION

Universities in general, and business schools in particular, can benefit from the potential offered by the IoT to achieve an agile educational system. The pandemic situation remains uncertain and this has triggered education institutions to explore the power of technologies and to be agile and adaptable. Risk management plans should consider the utilization of new technologies and invest in IT infrastructure as well as training faculty and staff to be constantly prepared for the need to work online. It is important to emphasize that technology will not replace human resources within organizations, but given the current trend, it is becoming evident that technology will replace HR forces that are not technology ready. Several studies have been conducted to link e-learning with the IoT. Widespread access to the internet has reshaped the education systems in higher education institutions in different parts of the world. Moreover, [12] stated that new systems need to be active in an 'electronically' served manner; e-learning can thus be referred to as the modified version of learning. Students as well as teachers benefit from any kind of technique that enhances the procedure of e-learning. E-learning initiates a level of efficiency that becomes productive and fruitful for them. More stimulating learning activities can be conducted through e-learning where the students as well as the teachers can interact in an efficient manner. The process of e-learning will be more productive if it is carried out via the IoT. Animations, online tutorials, study materials via virtual classrooms, video lectures, and so on can all be utilized as an e-learning procedure. The efficient use of the IoT can be achieved in physical or virtual classrooms that provide greater convenience and accessibility through e-learning.

IV. NEW OPPORTUNITIES USING THE IoT

IoT serves as an agent of change by providing opportunities to improve the education infrastructure and teaching methodologies. The IoT comprises a network of electronic devices, software components, and different forms of network connectivity to exchange and aggregate different types of information [12]. The digital campus encompasses an IT Service Delivery Platform infrastructure that provides network security, mobility, and connectivity for all services and applications. In addition, it includes a multitude of applications functioning across the platform to facilitate learning and teaching activities and enhance the experiences of students, which supports the professional objectives of the university [13].

IoT provides the infrastructure to engage students in the learning process and enables them to perceive and learn using all their senses [14]. Students are connected to the learning environment through smart devices. The smart tools allow personalized and human oriented training. Students can communicate and interact with each other and their surroundings to achieve full involvement and participation in all activities and in collaborative research. In real time, students can access unlimited resources of information and knowledge [14]. On the digital campus, the use of technology can increase security lower operational costs and provide useful tools for students, researchers, and academics. Such advantages are immensely valuable in enhancing the student experience, the learning outcomes of researchers, and the development and daily operations of universities [13].

V. Security Implications

The IoT system will help enhance the safety of students as well as the institution by providing fire security, tracking forbidden entry, monitoring the entry of external individuals, and tracking the limited movements of students. Wireless devices will facilitate detailed surveillance in the campus as well as outdoor and out of campus security [15]. The smart learning environment permits control over the flow of information such that it is received and used on a timely basis [14].

Authentication protocol, trust, and the detection of Rogue Nodes are among the most relevant security issues [16]. Other security challenges that might arise are key management, data aggregation, and verifiable computing [16].

VI. CONCLUSION

It is undoubtedly the case that the IoT will dramatically transform the landscape of higher education. Nevertheless, the agility of education systems remains an unfulfilled aim. Given the recent changes in the operations of educational institutions, the radical transformation of traditional teaching and learning processes is inevitable. However, it is becoming clear that having the most advanced technologies in the traditional classroom will not change how instructors interact with students unless there are also changes in pedagogical approaches to knowledge sharing, interaction, and assessment methods. In this regard, agility in higher education should be accompanied by a transformation of traditional teaching approaches, typically based on evolutionary methodologies, to an agile mindset characterized by holistic and systemic approaches where simultaneous, iterative tasks are undertaken. It is evident that creative teaching approaches will ultimately surpass traditional classroom instruction. The IoT can therefore be viewed as the inevitable future of higher education institutions. Incorporating the IoT into existing business education systems is increasingly considered convenient, time efficient, cost efficient, and user friendly for all key participants in the learning process. Furthermore, the incorporation of IoT into business education enhances connectivity and interaction. Business schools can utilize IoT in the delivery of classes to promote, maintain, and enhance soft skills, lifelong learning skills, critical thinking, problem solving, and analytical skills. In addition, it can overcome barriers related to geographical distance, big class sizes, and potential emergency lockdowns.

For future universities to compete they need to have the vision, flexibility, platforms, and proper leadership in place to ensure they can innovate and react to marketplace conditions [13]. Further research is recommended to elicit the perceptions and attitudes of key participants in higher education institutions toward incorporating IoT into business education. Practical case studies designed to ascertain the applicability and impact of this change can be conducted to determine the overall impact on the learning outcomes of business education. In addition, future studies are needed on how to modernize existing traditional business education programs to become more agile IoT smart enabled educational systems.

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