

EXTENDED UNIFIED THEORY OF ACCEPTANCE AND USE OF
TECHNOLOGY: THE INFLUENCE OF BEHAVIORAL INTENTION ON BIG
DATA MANAGEMENT ADOPTION BY MALAYSIAN PUBLIC RESEARCH
UNIVERSITIES

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DEDICATION

To my parents and family who inspired and gave me support to complete this research successfully.



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PERPUSTAKAAN UNIVERSITI TUN HUSSEIN ONN MALAYSIA

ABSTRACT

The higher education environment has been experiencing a record of challenges such as declines in students' enrolment, retention rates, and graduation rates. Combined with cuts in institutional funding, executive leaders in higher education institutions (HEIs) in Malaysia and internationally have found it challenging to address these challenges effectively due to the dynamic and highly competitive education landscape. However, HEIs, like many organizations, are rapidly changing because of advancements in technology. The application of big data management (BDM) has been acknowledged as a potential solution to difficulties experienced in HEIs. So far, its adoption is relatively new, as there are currently numerous unknowns regarding its use. The focus of this study is to provide both institutional executive decision-makers and strategic managers with insight into factors related to the behavioral intention for the adoption of BDM in Malaysian public research universities. The contribution of this study is to bridge the gap in existing research on the behavioral intention for the adoption of BDM. Venkatesh's Unified Theory of Acceptance and Use of Technology model was used to determine if the independent variables: performance expectancy, effort expectancy, social influence and facilitating conditions are predictors of the dependent variable; the behavioral intention with moderating variable of transformational leadership (TL) for adoption of BDM by both institutional executive decision-makers and strategic managers whose universities are considering using BDM in their operations. The findings of the study based on a total of 171 valid survey collected showed that social influence and facilitating conditions have significant effects on behavioral intention for BDM adoption. Worth noting is the fact that TL this study's results found no impact on the relationship between performance expectancy, effort expectancy, social influence variables and the behavioral intention. The sector is at the initial phase of adopting BDM technology, and the main challenge of adopting BDM use is transforming the processes, culture, and people in the institutions. The need for further research into the behavioral intention factors and leadership may in turn universities in being better prepared for the implementation and the costs of the technology.

ABSTRAK

Persekitaran Pendidikan Tinggi sedang mengalami cabaran seperti penurunan rekod pendaftaran pelajar, kadar pengekalan, dan kadar tamat pengajian. Dikombinasikan pula dengan pemotongan dana institusi, Pimpinan eksekutif di Institusi Pendidikan Tinggi (IPT) di Malaysia dan Antarabangsa merasa agak sukar untuk menangani cabaran ini dengan berkesan kerana lanskap pendidikan yang dinamik dan sangat kompetitif. Namun, seperti kebanyakan organisasi, IPT juga membangun dengan pesat kerana kemajuan teknologi. Penerapan Pengurusan Data Besar telah diakui sebagai satu solusi yang berpotensi bagi menangani kesulitan yang dialami di IPT. Setakat ini, penggunaannya agak baru, kerana masih banyak yang tidak diketahui mengenai penggunaannya. Fokus kajian ini adalah untuk memberi pandangan kepada kedua pembuat keputusan, eksekutif institusi dan pengurus strategik mengenai faktor-faktor yang berkaitan dengan niat tingkah laku untuk penerimaan pengurusan data besar di universiti penyelidikan awam Malaysia. Sumbangan kajian ini adalah untuk merapatkan jurang dalam penyelidikan, mengenai niat tingkah laku untuk mengadaptasi pengurusan data besar (BDM). Model Terapi Penerimaan dan Penggunaan Teknologi Venkatesh digunakan untuk menentukan sama ada pemboleh ubah bebas: jangkaan prestasi, jangkaan usaha, pengaruh sosial dan keadaan pemudahcara adalah peramal pemboleh ubah bersandar; niat tingkah laku dengan pemboleh ubah moderasi kepemimpinan transformasional (TL) bagi mengadaptasi pengurusan data besar (BDM) untuk kedua pembuat keputusan eksekutif institusi dan pengurus strategik, bagi Universiti yang ingin mempertimbangkan penggunaan BDM dalam operasi mereka. Penemuan kajian berdasarkan sejumlah 171 tinjauan yang dikumpulkan menunjukkan bahawa, pengaruh sosial dan keadaan pemudahcara mempunyai kesan yang signifikan terhadap niat tingkah laku bagi mengadaptasi pengurusan data besar (BDM). Perlu diperhatikan adalah fakta bahawa hasil kajian TL ini tidak memberi kesan terhadap hubungan antara jangkaan prestasi, harapan usaha, pemboleh ubah pengaruh sosial dan niat tingkah laku. Sektor ini pada tahap awal mengadopsi teknologi pengurusan data besar (BDM), dan cabaran utama penggunaan BDM adalah untuk mengubah proses, budaya, dan orang di institusi. Keperluan bagi penyelidikan lebih lanjut mengenai faktor niat tingkah laku dan kepemimpinan, seterusnya, membolehkan universiti lebih bersedia bagi pelaksanaan dan kos teknologi.

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LIST OF SYMBOLS AND ABBREVIATIONS

BHV	Behavioral Intention
BD	Big Data
BDM	Big Data Management
COPPA	Codes of Practice for Programme Accreditation
COPIA	Code of Practice for Institutional Audit
C-TAM-TPB	Combined TAM and TPB
DTPB	Decomposed Theory of Planned Behavior
EFF	Effort expectancy
EQA	External Quality Assurance
FAC	Facilitating conditions
HEIs	Higher Education Institutions
HEP	Higher Education Provider
IDT	Innovation of Diffusion Theory
IS/IT	Information Systems/Information Technology
LAN	Lembaga Akreditasi Negara
MHES	Malaysian Higher Education Sector
MoE	Ministry of Education
MQA	Malaysian Qualification Agency
MQAA	Malaysian Qualification Act
MQF	Malaysian Qualification Framework
MQR	Malaysian Qualifications Register
MPCU	Model of Personal Computer Utilization
MM	Motivational Model
NIST	National Institute of Standards and Technology

PER	Performance expectancy
SAS	Statistical Analysis System
SCT	Self-Efficacy and Computing
SOC	Social influence
QAD	Quality Assurance Division
TAM	Technology Acceptance Theory
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UMS	Universiti Malaysia Sarawak
UKM	Universiti Kebangsaan Malaysia
UM	Universiti Malaya
UMT	Universiti Malaysia Terengganu
UPM	Universiti Putra Malaysia
USM	Universiti Sains Malaysia
UTM	Universiti Teknologi Malaysia
UUM	Universiti Utara Malaysia
UTAUT	Unified Theory of Acceptance and Use of Technology



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CHAPTER 1

INTRODUCTION

1.1 Introduction

Data exist in every field and work in the global economy. Public and private sector organizations have been under pressure to integrate massive volumes of data, called Big Data (BD), through technology (Hood-Clark, 2016a). The use of BD is still very new yet has become the cornerstone of corporate development and competition and has become a vital way for leading organizations to sustain competitive advantage (McGuire, Manyika, & Chui, 2012). BD is pushing structural improvements in all sectors. With a dynamic and innovative approach in today's market, the integration of Big Data Management (BDM) has given rise to a sense of urgency in the corporate decision-making process (Hood-Clark, 2016b). However, the employment of new technologies in an organization poses difficulties in integration and usage (Subashini & Kavitha, 2011).

Senior executives understand and are mindful of the need to make data-driven decisions and require information that offers direction and guidelines on the best action for insights (Janssen, van der Voort, & Wahyudi, 2017). BD computational analysis, which involves a huge volume of data, provides for this purpose by revealing trends, patterns and connections that are essential in providing relevant information useful for informed decision-making. However, the applications of BD are relatively recent, and especially in Higher Education Institutions (HEIs). Therefore, there is much more uncertainty with BD and its usage (Esteves & Curto, 2013).

Furthermore, the evaluation of variables that enable decision-makers involved in the intention and actual use of information technology (IT) to make informed

decisions that affect the successful organization's adoption of IT has become a primary guideline for studies (Viswanath Venkatesh & Bala, 2008). Business operational needs are expected by leaders and decision-makers and a variety of resources are offered through the policies and culture of the organization. The organization's top executives promote the use of emerging technologies to managers as well as decision-makers, but its adoption into everyday use requires cooperative effort (Triana, Miller, & Trzebiatowski, 2014).

Therefore, this chapter starts with the research background, discussing the significance of BD and the intention adoption of BD in higher education institutions (HEIs). Afterward, the problem statement is grounded on reality, ideal, and consequence in Malaysia. Also, the problem statement highlights the existing theoretical gap in the literature on the intention of BDM use. Then, the research questions are stated, and research objectives are outlined. The scope of the study describes the boundaries of the research and then the significance of the study, highlighting the importance of the research and, finally, the summary of the chapter.

1.2 Research background

As reported by Hassani & Silva (2015), BD is the knowledge that needs new methods of processing data to allow improved decision-making, innovative insights, and optimization of processes. Data generated from social media interactions, e-commerce, and business processes produce BD. BD could offer insights and innovative ideas that can encourage competition and creativity (Esteves & Curto, 2013). Numerous technologies and tools used to process BD include NoSQL databases, the Hadoop Distributed File System, and MapReduce (Al-Sai & Abdullah, 2019). Organizations could realize cost savings and changes in the time taken to deliver a new system by implementing frameworks that allow for the application of BDM. Similarly, noted by Wamba *et al.* (2017), the capability to efficiently use BDM often offers financial advantages and facilitates internal strategic decisions and goals. Organizations who intend in adopting BDM need to also take note of the associated risks. Risks exist such as misunderstanding of data, stolen or mismanagement in an unethical trend (Rahman & Aldhaban, 2015; Davenport & Dyché, 2013). Hence, corporate, legal and social accountability must be taken into consideration by organizations regarding the

management and use of data (Waterman & Bruening, 2014). Despite the advantages of incorporating BD, the lack of support from strategic management and decision-makers would hinder the adoption and use of BDM. For example, in a survey by the International Data Corporation (IDC) in 2011, it was found that 47% of the 502 organizations surveyed thought their organization does not need BDM (Esteves & Curto, 2013a). The importance or value of BDM was not seen by 25% of the organizations surveyed. 33% of the organizations with BD initiatives have not met the standards in terms of cost and efficiency (Esteves & Curto, 2013a). Likewise, based on the surveyed by the MIT Sloan Management Review and IBM in 2011, the main barriers to the successful acceptance and adoption of BDM faced by many organizations is prominently the support of leaders and managers (LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011). Moreover, 33% of the participants of the survey suggested absence effort and support from the management as one of the challenges to the acceptance of the application of BDM (LaValle *et al.*, 2011). Therefore, the introduction of transformational leadership as a moderator factor in this study to investigate the behavioral intention for the adoption of BDM.

Existing literature on BD focuses mainly on the value generated from BD use and the use of big data analytics for the organizations. While with limited studies on its acceptance and implementation, particularly on the organizational leaders to promote or support its acceptance and use. The purpose of this study is to fill the gap in the literature regarding a topic related to the behavioral intention with transformational leadership perception for the adoption of BDM. A study about transformational leadership acceptance or adoption of BDM is crucial because organizations sustained substantial costs incorporating BDM into their existing system's framework. Therefore, understanding the behavioral intention factors of BDM will help organizations become better prepared for the adoption of the technology.

Globally, education is seen as a critical driver to increase the wealth of the economy, wellbeing of society and as well as for individuals. Education is the stepping stone that develops human attitudes and abilities. However, the higher education sector has been experiencing rapid change due to unprecedented challenges, which include a decline in student enrollment, retention and graduation rate (Ghasemy *et al.*, 2018; Chaurasia, 2017). The quality of Education in this 21st century is not only just for career-oriented but also being able to develop individually uniquely. With such

challenges and expansion, Malaysia is also facing similar problems as the Malaysian public universities are facing the challenge of decrease the number of students' enrollment (Tasmin *et al.*, 2020). For example, according to the World Bank's development indicators compiled from officially recognized sources, tertiary enrolment in Malaysia was 45.13 percent as reported in 2018, which is declining compared to 2016, as shown in figure 1. Malaysia – School enrollment, tertiary (percent gross) – on August 2020 the World Bank generated real values, historical data, forecasts and projections (Trading Economic Forecast, 2020). The gross registration ratio, irrespective of age, is the ratio of the total registration to the population of the age group that officially represents the amount of education shown. Tertiary education, whether or not for the advanced qualification in the study, usually includes satisfactory completion in high school education as a minimum prerequisite of admission (Forecast, 2020). Moreover, there is also a decrease in retention rate due to cuts in funding and a decrease in the graduation of students (Anis & Islam, 2019; Salleh *et al.*, 2019; Tan & Goh, 2014). Similarly, there is a challenge in the increase in unemployed graduates from the higher education system (Ghasemy 2018; Azziaty *et al.*, 2017). Similarly, some of the challenges include insufficient quality assurance and academic issues (Azziaty *et al.*, 2017 & Grapragasem, 2014).

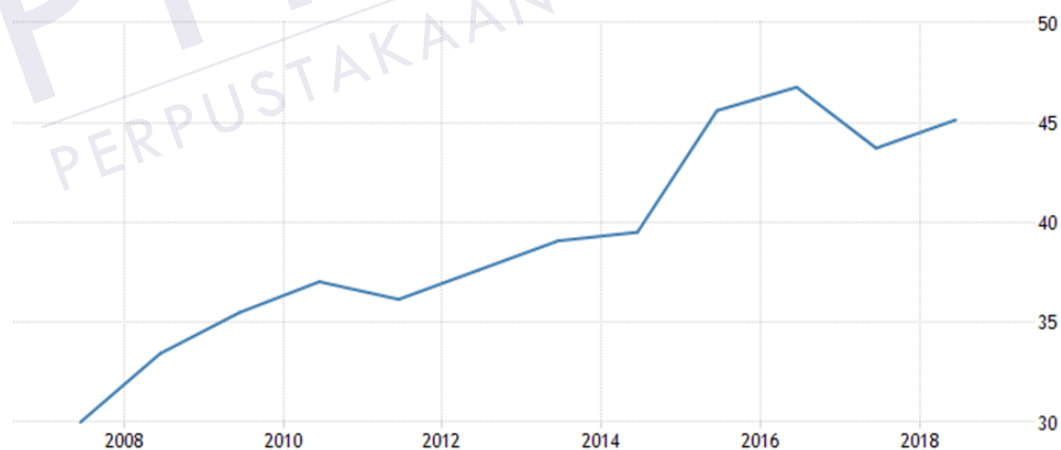


Figure 1.1: Malaysian HEIs students' enrolment.

With regard to these sets of challenges and increases demands on the growing market of the sector that the Ministry of Higher Education (MOHE) Malaysia has set in strategic goals for the transformation of HEIs in the country (Zain *et al.*, 2014). More so, the Malaysian higher education system has experienced numerous

restructures over time. It has been reshaped by the development aspiration of the governmental socioeconomic (Tan & Goh, 2014; Malakolunthu & Rengasamy, 2012). Currently, the primary trend in Malaysian HEIs includes globalization, teaching and learning, innovation, governance, and knowledge-based society to sustain competition regionally, nationally and as well as globally. Likewise, HEIs are at the point of unprecedented uncertainty and change, thus leading to much external pressure (Shacklock, 2016). However, the evolving nature of technology and innovative orientations are changing the ways of doing things in more agile and effective practices.

Technology makes new ways of doing things, often unpredicted. Technological progress like electronic communications, personal device, and tools for collaboration which allows local and international networks to be built for both individuals and organizations (Mohamad *et al.*, 2018). These networks allow the exchange of data, social communications and highlight the significance of human capital as change drivers. According to Davenport, (2014); Spijker, (2014) and Mui & Carroll, (2013), mobility, IoT and connectivity are popular and significant drifts behind the origination of data. For decades, Information technology (IT) has made it possible for businesses and people to interact. As a result, it was profoundly influenced by the advent of the Internet and personal devices such as smartphones. Organizations share with others their systems. For example, many enterprises with their suppliers have produced unified logistics procedures (Houshangi *et al.*, 2016). However, the misuse of various social media platforms is a new trend. These help individuals to communicate with others easily, build informal networks that go far beyond organizational boundaries. Spijker (2014), emphasizes that this modifies the interactions of employees as well as communications with customers. These innovative techniques of communication shape organizations. Therefore, these interactions simultaneously generate vast amounts of data.

Over the years, it was observed by Shacklock, (2016), that data had been anticipated as a crucial asset in all decision-making policy. And today, it is considered an economic and policy strength. The concept of BD is a new trend in the real world today; BD is described as the exponential growth and availability of both structured and unstructured data (Yu, Liu, Dou, Liu, & Zhou, 2017). BDM is referred to as the process of capturing, storing, evaluating, and sharing data to gain insight and act from

the information that devices and as well as humans produce and distribute by using computer-based networks and technologies (Herschel & Miori, 2017).

In the BD era, Chang *et al.* (2014) stated that a major paradigm change in information management and analytics towards an inter-disciplinary social science research agenda. Throughout the past decade, tools and techniques have been developed for the management of large datasets. Currently, data generation and acquisition have more than quadrupled (Aye & Thein, 2015). According to Abbasi *et al.* (2016), BD is presenting a new outline of data in organizations. Thus, these evolving data sources, processes for decision-making, and IT objects introduce an opportunity to review subjects related to constructs, such as leadership, capacity, skill, decision-making and effort. In this study, the researcher seeks to evaluate how Performance expectancy, effort expectancy, social influence and facilitating conditions impact the behavioral intention for the adoption of BDM and how transformational leadership (TL) existence impact the relationship between these four dimensions (i.e. Performance expectancy, effort expectancy, social influence and facilitating conditions) and Behavioral Intentions. Therefore, BDM research could yield new perceptions and understandings based on the current IS constructs (Attaran, Stark, & Stotler, 2018).

Consequently, Abbasi (2016) reasons that conventional IS structures should be revisited. This perspective is driven and underlined by organizations increasing in the adoption of BDM. In the same way, Gartner reports three-quarters of companies have an interest in investing or are expecting to spend in BD annually (Kart & Heudecker, 2015). The value put and increased ventures by various organizations in BD is, therefore, a good indicator of its advantage. Advances in BD innovations like Deep Learning are incorporated knowledge systems that are capable of automating intellectual tasks (Al-Rahmi *et al.*, 2019). The growth of BD and related technologies are shifting organizations' knowledge chains of value.

For this reason, Abbasi (2016) noted that there should be a re-examination of the conventional IS constructs. Innovative IS theories such as the Unified Technology Acceptance and Use of Technology Model (UTAUT) can shed new knowledge and understanding in the behavioral intention for BDM adoption in any field. Hence, an increase in the technology of BDM adoption will provide an exciting chance to study existing IS perceptions. In an editorial paper regarding BD, Abbasi (2016) call for an investigative study concept of factors influencing behavioral intentions to use BDA in

HEIs. The factors influencing the intended behavior to adopt BDM are essential for institutions, so that it may take appropriate measures to encourage its use.

The endless value-driven search has, therefore, encouraged organizations to turn to big business and external data repositories in order to discover new patterns, statistical platforms and other workable apps to support the development, growth and management of their data use. In addition, these platforms have aided leading executives and technologists to build and popularize BD with their associated policies, analytics and tools. This is as a result that, organizations collect and store data in variation which could either be structured, semi-structured, or/and unstructured data and tend to require a wide range of management and storage conditions known as BDM. BDM is the process of organizing, administering, and regulating large volumes of data (both structured and unstructured data). The idea of managing data in an organization is to get sufficient insight from the data (Hashem *et al.*, 2015).

Organizations must, therefore, capitalize on exploration and take-out thorough and appropriate choosing of framework and approach for the successful execution of their business plan, which is not different from an educational setting. Furthermore, BDM aims to certify the high level of data quality as well as the accessibility of data value for BD applications. Organizations, government agencies, corporations, and other areas of business enterprises can use BDM strategies to help fast grow their industries (Mo & Li, 2015), and so is the education sector. Hence, the study is focused on the higher education sector.

The quality of education is a critical and vital aspect for HEIs as they are responsible for numerous stakeholders, which include students, staff, and the society as a whole (Papanthymou & Darra, 2017). With a well-planned and carefully designed education system, the quality of the education processes produces a quality human capacity (Fallis, 2013). Therefore, improving understanding, knowledge, culture, values, skills and managing the institutional data are key factors and are the objectives of sustainability of any educational system. Despite the growing changes happening in the environment of HEIs, the role of data in serving to address current challenges are often overlooked. Siemens, Dawson, & Lynch (2013) argue that as learning technologies continue to penetrate all sides of higher education, a surplus of valuable 'data traces' is generated, thereby changing the concept and environment of the institutions. Simultaneously, these global changes are cumulative on HEIs; innovation

continues to have a significant impact on academic careers as research and teaching become more needful in these systems (Anshari, Alas, & Guan, 2016).

The increase in business and academic partnerships will open new research areas that can be explored to supplement our understanding of the role of BD in HEIs (Sin & Muthu, 2015). Data can be utilized to inform HEIs to adopt better techniques regarding changes happening within and outside their environments. However, despite the growing changes occurring in the context of HEIs, making use of the large chunk of available data in addressing current challenges is often ignored (Chaurasia, 2017). The use of BD is relatively new in the HEIs. Nevertheless, in most developed countries such as the UK, USA, and Australia, the use of BD has started gaining impact, and some are already implementing it in their institutions. For instance, the University of Bolton UK is presently using Big Data Analytics (BDA) to improve their institution budget and workload planning by initiating a project that defines, captures and reuses BD to support better operational priorities and strategic decision-making (V. K. Ong, 2016). The University of Wisconsin USA has commenced small projects on BDA. One of which is learning analytics within the system to help improve the overall quality and effectiveness of the university. Also, learning analytic tools and processes are being used to help contextualize data to target learners at risk better and personalize learning to give students greater control of their learning process (Siemens *et al.*, 2013).

Also, in Australia, the University of Queensland Australia which is an intensive research university recently launch a BD approach developed at the institutional level that observes to assess and integrate learning data into a programmatically accessible academic warehouse, by classifying the institutional data into two categories; (i) describing data relevant to the individual learner and (ii) reflecting institutional data on program and curriculum performance. The learner data is subdivided into a set focused on research on learning and a set relevant to real-time actionable data for learner decision-making. The approach is intended to provide visually informative actionable views of student behaviour to support informed decision-making. While the other part is organizational work to build an academic data repository that will provide the basis for an enterprise-wide change management framework, bringing data to life by visualization, predictive modeling, and learner-shaped recommendations (Siemens *et al.*, 2013). On the contrary, in Malaysia, only a few HEIs have shown interest in the use of BD. The first phase of BD centers was launched and supported by the Ministry

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Conferences and Publications:***Published Research***

1. Sustainable Competitive Advantage of Big Data Analytics in Higher Education Sector: An Overview, paper presented at 1st International Conference on Computing Information Science and Engineering (ICISE 2020) held in Kelantan, Malaysia January 29–30, 2020, Journal of Physics: Conference Series, IOP Publishing, doi:10.1088/1742-6596/1529/4/042100. Scopus-indexed conference.
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3. Integrated QR Code-Based Approach to University e-Class System for Managing Student Attendance. Advances in Computer, Communication and Computational Sciences, Advances in Intelligent Systems and Computing 1158. Springer Nature Singapore. doi.org/10.1007/981-15-4409-5_34.
4. Big Data in Education Sector: An Overview, published in Path of Science, 2019. Vol. 5. No 6, DOI: 10.22178/pos.47-6.
5. Innovative Approach to Big Data Analytics Usability. Proceedings of the 5th NA International conference on Industrial Engineering and Operations Management Detroit, Michigan, USA, August 10-14, 2020. Scopus-indexed conference.
6. Assessment of Big Data Analytics Maturity Models: An Overview. Proceedings of the 5th NA International conference on Industrial Engineering and Operations Management Detroit, Michigan, USA, August 10-14, 2020. Scopus-indexed conference.
7. Factors Influencing Big Data Management Intentions in Higher Education Sector: A Perspective of Public Research Universities in Malaysia: Pilot Study Result. 36th IBIMA International Conference, Granada, Spain. Conference proceedings: ISBN: 978-0-9998551-5-7 (Pending)

Conferences Attended

1. 1st International Conference on Computing Information Science and Engineering (ICISE 2020) held in Kelantan, Malaysia January 29–30, 2020, Journal of Physics: Conference Series, IOP Publishing, doi:10.1088/1742-6596/1529/4/042100.
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PTTA UTHM
PERPUSTAKAAN TUNKU TUN AMINAH

VITA

The author was born on January 09, 1985, in Minna, Niger State - Nigeria. She started her secondary education journey in Hassan Ibrahim Gwarzo Secondary School Kano, Kano State-Nigeria where the senior secondary school certificate was obtained. In pursuit of a degree programme, she proceeded to the Federal University of Technology, Minna (FUTMinna) and graduated with Bachelor of Technology (B.TECH.) in Mathematics & Computer Science in 2010. After graduation, she worked as a Trainee in Nigerian National Communication Commission (NCC) between 2010 to 2011. Subsequently in January 2012 she joined the Midland School of Business and Finance Abuja as a Research Assistant. To enhance her educational capabilities, she enrolled for Msc. Information Technology in National Open University of Nigeria (NOUN) in 2013, where she was awarded Msc. Information Technology in 2017. Consequently, she sought and gained admission for the Doctor of Philosophy in Technology Management at Universiti Tun Hussein Onn, Malaysia in 2018.