University Postgraduate Research Programmes: Digitization(ICT),Innovations and Applications

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UNIVERSITY POSTGRADUATE RESEARCH PROGRAMMES: DIGITIZATION (ICT), INNOVATIONS AND APPLICATIONS

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ABSTRACT

Without advanced educational research, development will not occur and only technologically educated people can command the skills necessary for sustainable growth and development. However, the current generations of university postgraduate students are ushering in a new paradigm for research. Here, collaboration is made much easier, sharing of research knowledge is instant and the resultant synergies yield huge advances in research productivity and innovation. Therefore, this paper argues that ICT integration and digitization process will help university postgraduate (research) programmes to remain the same while at the same time is influencing it, determining and changing it. And giving that technological change is continuous and frequently disruptive, educational (research) policy planning should be dynamic and integrated within the framework of ecosystem innovation hub.

KEY WORDS: Digitization, ICTs, University, Research, Postgraduate-programmes, Innovation, TechHub, Nigeria, Africa, Incubation, Internet, Education, Knowledge, Information Networks, Technology, Infrastructures.

JEL NO: A20, A23, C88, C80 D80, I20, I23, 030, 031, 032, 033.

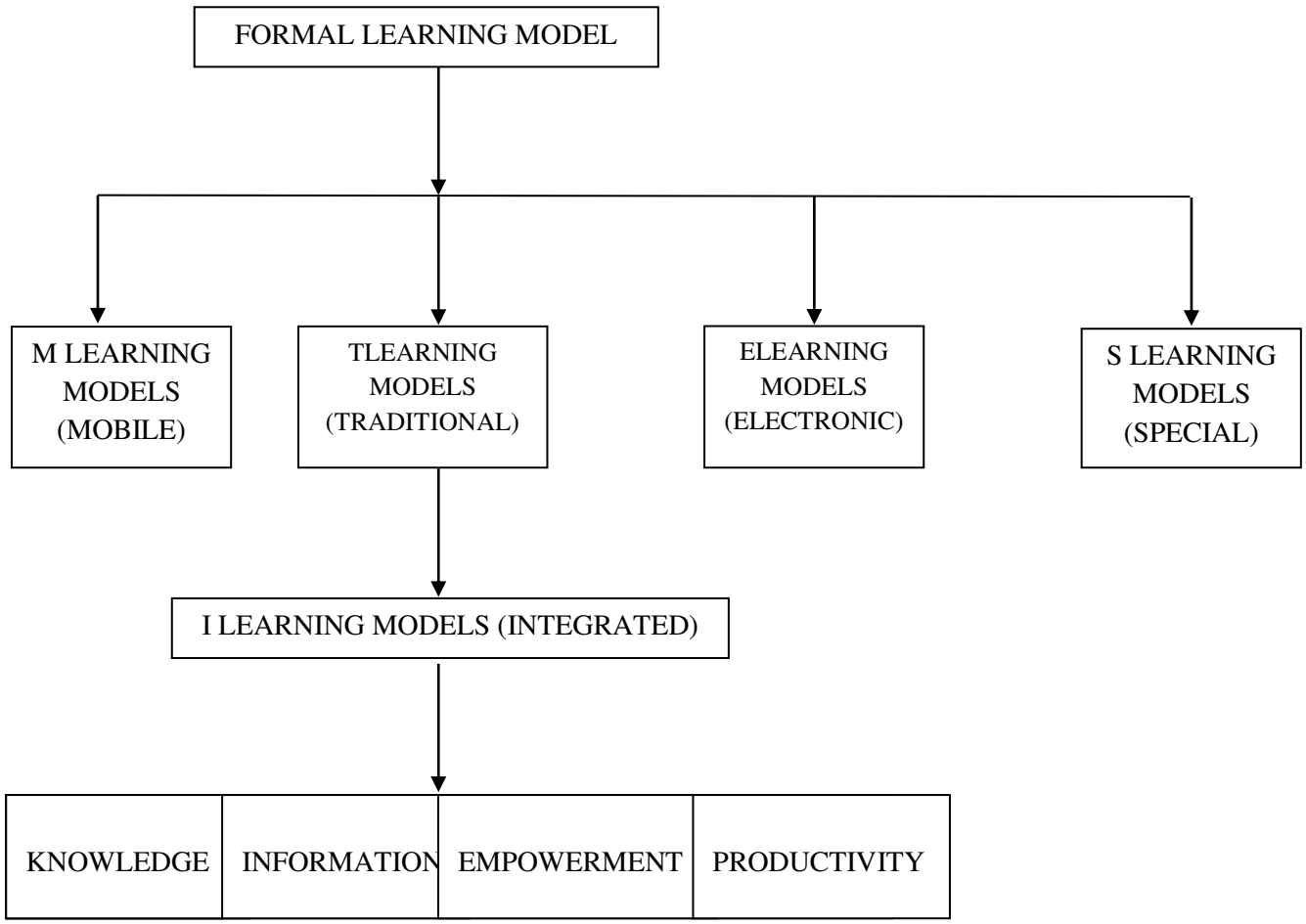
1.0INTRODUCTION

Naturally, learning begins at birth and continues through lifetime. Unlike the informal system of learning (such as trades and crafts learning) that has been on swift decline; formal learning system (such as schools, colleges, universities and established institutions) has been on the increase. Basically, the formal system of learning can take different forms as shown in figure I.I. However, these formal institutions that exist today and even those at planning stages are becoming less relevant to the requirements of emergent knowledge societies (Haddad, 1994; Rotarian, 1996; UNCTD, 1998). Indeed, knowledge is critical for development because everything we do depends on knowledge and hence the need to increase the capacity to use knowledge cannot be overstated (Nwaobi, 1999; Nwaobi, 2000). Thus, countries that postpone these tasks will fall behind those that move faster while unhappy consequences for their development prospects will be hard to remedy (World Bank, 1999). Therefore, the knowledge networks that support science and technological innovation are becoming increasingly international as well involving a growing number of research types and educational institutions. In other words, science and technology research networks are providing the necessary foundations. Hence, academic researchers working independently cannot hope to have the full range of skills, equipment and materials needed to carry out modern scientific research (Hicks, and Katz, 1996). Thus scientists should engage in a continuous learning process involving the recombination of codified information and tacit knowledge to generate new knowledge. Clearly, the observed changes in the research process are enabled by ICT applications in a wide range of fields of expertise which require specific skills in the use and deployment of ICT infrastructures by the University research community.

In fact, to be competitive in the fast-changing world, developing countries must be able to keep up with the pace of innovation using postgraduate education as the driver. Unfortunately, these countries have not sufficiently invested in University education and hence no long-term sustainable innovation is possible without

correcting this course (Choi et.al; 2019). At a time when the developed and emerging countries are rethinking their University education systems; the African region (and Nigeria in particular) must move away from the early independence higher institutions that focused disproportionately on teaching as compared to research and innovations.

FIGURE 1.1 SYSTEMS OF FORMAL LEARNING



With the exception of South Africa (often regarded as the regions technological hub), other African Countries are usually ranked low in terms of the quality of University education, postgraduate research capacity, innovation performance and knowledge production. Consequently, digital technologies have the potential to be an enabler rather than a disrupter in the education sector. In other words, these new technologies have the potential to reinforce learning, increase access to education, offer access to high-quality materials (where there are no teachers with the needed

skills) and deliver high-quality research and learning outcomes in African countries such as Nigeria. Specifically, it is anticipated that adaptive learning software will increasingly replace textbooks and other classroom materials while the future of schools will be an education system that trains students to study and learn on their own (with computer-assisted programs that assist their needs).

However, this entire trend will require the important role of teachers (as technology – saturated teacher workforce) to make it work and productive (Perera and Aboal, 2019). Thus, by giving appropriate ICT skills training to teachers on how to use digital technologies in the delivery of teaching; creating computer-assisted learning platforms for teachers and students as well as addressing logistical and infrastructure constraints; University teachers could assist students in poorly resourced classrooms (Laboratories) to use affordable tablets and computerized learning (research) platforms to learn and perform research activities.

Therefore, this paper argues that creating the desirable research conditions will require critical strategic interventions such as a coherent and pragmatic University ICT policy; building infrastructures that support digital-driven academic (research) programmes and producing a strong pool of University postgraduates (teachers) with strong digital (ICT) skills base. However, the observed crisis in Nigeria postgraduate educational research system requires urgent policy response from various stakeholders. And yet, policy change should not be introduced lightly nor abandoned without careful examination and planning. The rest of this paper is divided into five sections. Section two looks at postgraduate education and research process while section three presents ICT Infrastructure and Framework. The innovation systems and technological hubs are discussed in section four while section five examines research digitization and application. Section six concludes the paper with policy challenges and recommendations.

2.0 POST-GRADUATE EDUCATION AND RESEARCH PROCESS

Indeed, the indigenous Africa education remains an important transmitter of cultural identity from one generation to the next. However, the educational systems inherited by the African nations were quite inadequate to meet the needs of the new countries for rapid economic growth. Yet, the progress achieved in African education has been spectacular while quantitative expansion was very impressive (World Bank, 1988). Specifically African higher education developed relevant curricula and revised its content to reflect African priorities. They also legitimized research, established specialized University research units and promoted vibrant intellectual communities. Unfortunately, these advances are now seriously threatened. In particular, attracting and retaining talented staff has become a serious problem for many African Universities. Again, declining salaries, deteriorating working conditions and increasing number of students (including un-supportive political conditions) have caused many academic staff to seek alternative employment. Consequently, many Universities are left with young (inexperienced and insufficiently trained) staff that lacks the necessary mentors and role models for guidance. Again, research output has lagged behind the training accomplishments of these universities while lack of national investment in research explained the observed weak performance (Nwaobi, 2007).

Subsequently, creating research-driven University postgraduate programmes is like creating a hybrid plant that demands certain environmental conditions for its germination, survival and fruition. Conventionally, postgraduate programmes are housed within Universities which allows them to operate efficiently within a highly specialized sphere by drawing selectively upon the university staff and informational resources. But given the prevalence of senior staff shortages at many African Universities; assembling the qualified staff needed to offer postgraduate programme is likely to include an initial mix of national, regional and international faculty members. Ideally, these human resources should be recruited and retained within the

context of a longer term staff development plan which distinguishes between permanent core positions which might be filled over time with nationals possessing the necessary qualifications. In fact, institutional linkages may offer a useful solution to such needs (Fine, et-al. 1994).

Clearly, in Nigeria, national policy on education identified the goals of tertiary education as need to contribute to national development through high level relevant manpower training; develop and inculcate proper values for the survival of the individual and society; develop the intellectual capability of individuals to understand and appreciate their local and external environments; acquire both physical and intellectual skills which will enable individuals to be self-reliant and useful citizens; promote and encourage scholarship and community service; forge and cement national unity as well as promote national and international understanding and interaction (NERDC, 2014).

Apart from the above national policy provisions, all university education institutions have enabling laws to which their operations are based. However, the past three decades have witnessed significant changes within the Nigerian University system and notable among such changes is the increase in the number of universities and (post-graduate) programmes (Okebukola, 2017). Consequently, the stress put on the universities in terms of limited expansion in physical facilities and academic staff has negatively affected post-graduate research programmes and activities.

However, Nigerian Tertiary Education Trust Fund (TETFund) is an intervention agency set up to provide supplementary support to all level of public tertiary institutions with the main objective of rehabilitation, restoration and consolidation of tertiary education in Nigeria. Specifically, the funds are disbursed for the general improvement of education in federal and state tertiary education for the provision or maintenance of essential physical infrastructure for teaching and learning; institutional material and equipment; research and publications; academic staff training and development as well as any other need that is critical and essential for the improvement and maintenance of higher educational institutions standards.

Thus, as a response, strong opinions for and against the said provision has been argued on three key factors: equity, relevance and historical considerations. And yet, when pooled as public universities, private universities make up to forty-five percent of the total number of universities in the Nigerian universities system (Okebunkola, 2017).

As a major activity of the university post-graduate programme, research inculcates scientific and inductive thinking while promoting the development of logical habits of thinking and organization. In fact, to those students who are to write a Master's or PhD thesis, research may mean a careerism or a way to attain a high position in the social structure while to teachers and intellectuals, research may mean the development of new theories. Therefore, research may be regarded as the fountain of knowledge for the sake of knowledge which is an important source of providing guidelines for solving different business, governmental and social problems. Operationally, whether a given research is simple or complex; sophisticated or primitive; scientific or unscientific; depends on its objectives, its design as well as the skill and integrity with which it is conducted. Again, research makes technological innovations possible while technology provides apparatus to understand social phenomenon better. However, universities postgraduate researchers are constantly facing several problems in the execution of their various research tasks. Hence there is need for developing some mechanisms of a university and industry interaction programme so that academics can get ideas from practitioners on what needs to be researched while practitioners can apply the research done by the academics. Essentially, Nwaobi, (2014) provided the framework design for African Economies.

Consequently, it is critical to incorporate information and communication technology (ICT) in the planning, designing and execution of postgraduate research programmes of the universities.

3.0 ICT INFRASTRUCTURES AND FRAMEWORK

Generally, Information and Communication Technology (ICT) includes the production side (computer hardware and software, telecommunications equipment and microelectronics-based industries) as well as the User-side (in all social, economic and business sectors). In fact, of all the many technologies of our time, progress in ICT has the greatest influence on the global society. In otherwords, ICT makes it possible to collect, process and transmit information at breath taking speed and declining cost while increasing productivity as well as improving quality and efficiency in all kinds of industries or services. Indisputably, ICT is a key technology which relates to various terms that can be used to describe important technologies in recent years such as 'generic', 'strategic', 'critical', 'core', 'enabling' or 'pervasive' technologies (Nwaobi, 1999; Hanna, et.al. 1995). Indeed, there is a consensus that the transition to the twenty-first century will witness a quantum leap in the development and exploitation of information technologies with corresponding ramifications for social and economic organization (Mansell and Wehn, 1998). However, the capacity of a national system of innovation for building the capabilities required to take advantage of ICTs is a reflection of the nature of the 'learning economy' that exists in a given region. Nevertheless, the use of ICT can offer an important complementary component of the national information infrastructure that leads to capability building and enhanced learning in the economy. Yet, there is known perspective that there is no alternative way to become permanently better off apart from putting learning and knowledge creation at the strategic centre.

Furthermore, the knowledge networks that support science and technological innovation are involving a growing number of research types and educational institutions such as universities. Here, scientists are engaged in a continuous learning process involving the recombination of certified information and tacit knowledge to generate new knowledge. Basically, these changes in the research process are

enabled by ICT applications in a wide range of field of expertise. Notably, the range of ICT applications in the education sector that is being developed to tackle problems in the research context is numerous. Specifically, the application of ICT in research has caused significant transformation in various sectors (including educational sector). This is because of the fact that it helps to save time and money (used during and after research) as well as reducing the difficulty in working with big data or information resources that were impossible in the past. Again, ICT in research has significantly reduced the barriers and obstacles in research that is attributable to distance through the use of social networks and web portals such as 'My Net Research' (Anandarajan and Anandarajan, 2010). Similarly, ICT provides members and institutions with support strategies through collaboration, resource sharing, webinars and custom consultations.

Indeed, the application of ICT in research is expected to equip postgraduate researchers in the University with world-class expertise and facilities in the collection and management of research data; modeling, simulation and data processing through high-performance computing; comprehension of big data through visualization and data science techniques; dissemination of research outcomes that includes data and workflows; promotion of collaborative research through virtual Labs and cloud resources as well as the development of customized research software, hardware and services. Clearly, this innovation is to provide applications and services that can assist postgraduate students, faculty and university community in their research endeavors. Consequently, the rates at which ICTs are utilized by African Universities will have positive impact on the level of patronage to electronic materials and application by academic researchers. In otherwords, we can argue that the adoption of ICT in postgraduate research will contribute immensely to the realization of institutional goals through the provision of adequate and effective information to the university community.

Empirically, the use of ICT in research has become an important facility in postgraduate research in terms of getting access to better storage media, improved

data analysis technologies, citation and compiling bibliographies as well as publishing. Thus, academic institutions (Universities) should invest in ICT facilities that are relevant in various postgraduate research works. Furthermore, there should be regular training programs such as seminars and workshops for postgraduate students in the use of ICT applications like OPAC, RESEARCH GATE, NVIVO, INSTITUTIONAL REPOSITORIES (ICT) and VIDEO CONFERENCE. Certainly, this will help the postgraduate programmes adoption of ICT tools as useful and productive (Dutton and Meyer, 2009). In fact, the advent of social networks and web portals have led to the creation of new research networks that dramatically reduces the barriers and obstacles to collaboration by researchers who are geographically, organizationally and disciplinarily distant. Globally, the current millions and eventual billions of researchers who will use research networks are ushering in a new paradigm for research. Clearly, in this emerging paradigm, collaboration is made much easier while sharing of research knowledge is instant and where synergies from routine collaboration will yield huge advances in research productivity and innovation.

Operationally, there should be a need for supply infrastructure and framework that can support the ICT platforms. Thus, university regulation must be conducive to using the new technology while effective policies to promote diffusion must be guided by the use to which ICT is put. Therefore, we can distinguish between three diffusion phases and associated modes of technological usage: SUBSTITUTION, ENHANCEMENT AND TRANSFORMATION. Here, SUBSTITUTION occurs when a new or improved technology merely substitutes for an existing one. Similarly, ENHANCEMENT occurs when the new technology leads to substantial performance enhancement while the third gradation exists where the adoption opens up opportunities for the redefinition of tasks via a wholesale TRANSFORMATION of work practices and organizational structures. Graphically, figure 3.1 sets out the three ICT diffusion phases or levels of ICT use in a University system. Clearly, enhancement is the usual driver for ICT adoption; substitution is frequently the

initial diffusion reality while transformation is the eventual realization of the often unforeseen potential. However, figure 3.2 shows how the adoption stages can apply in each diffusion phase. Thus, the proposed analytical framework characterizes ICT policies along two dimensions. In other words, policies are characterized as either ICT-specific or ICT-related:

(I) ICT-specific policies and programs are intended to further the production and use of ICT goods and services by the university. Some examples of ICT-specific policy measures are research grants for software development, programs for enhancing ICT literacy as well as incentives for adopting such new information technology as computer-aided designing (Digital Structures).

(II) ICT-related policies and programs are not aimed specifically at ICT but nonetheless influence its generation and use.

FIGURE 3.1 ICT DIFFUSION PHASES: UNIVERSITY SYSTEM

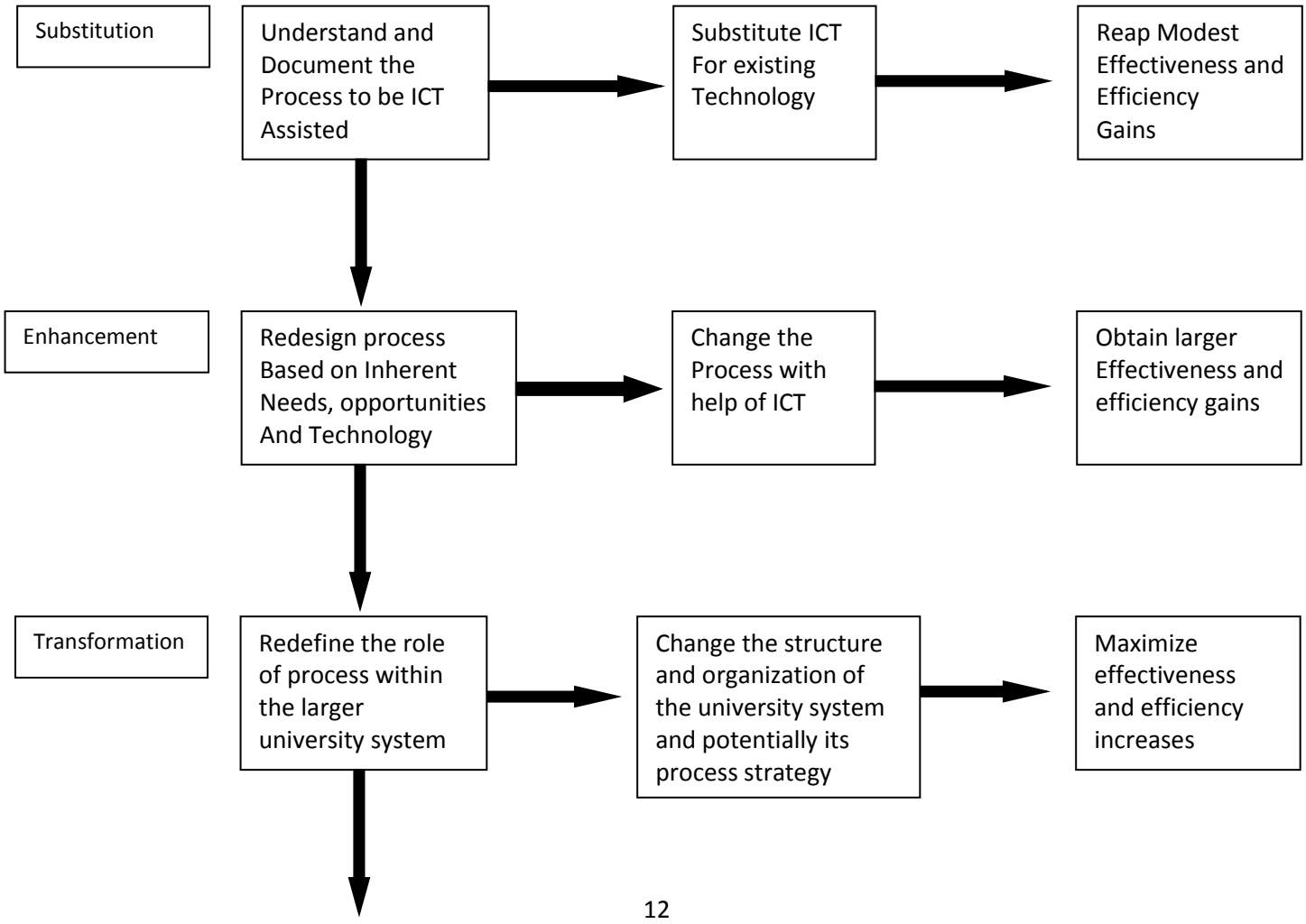
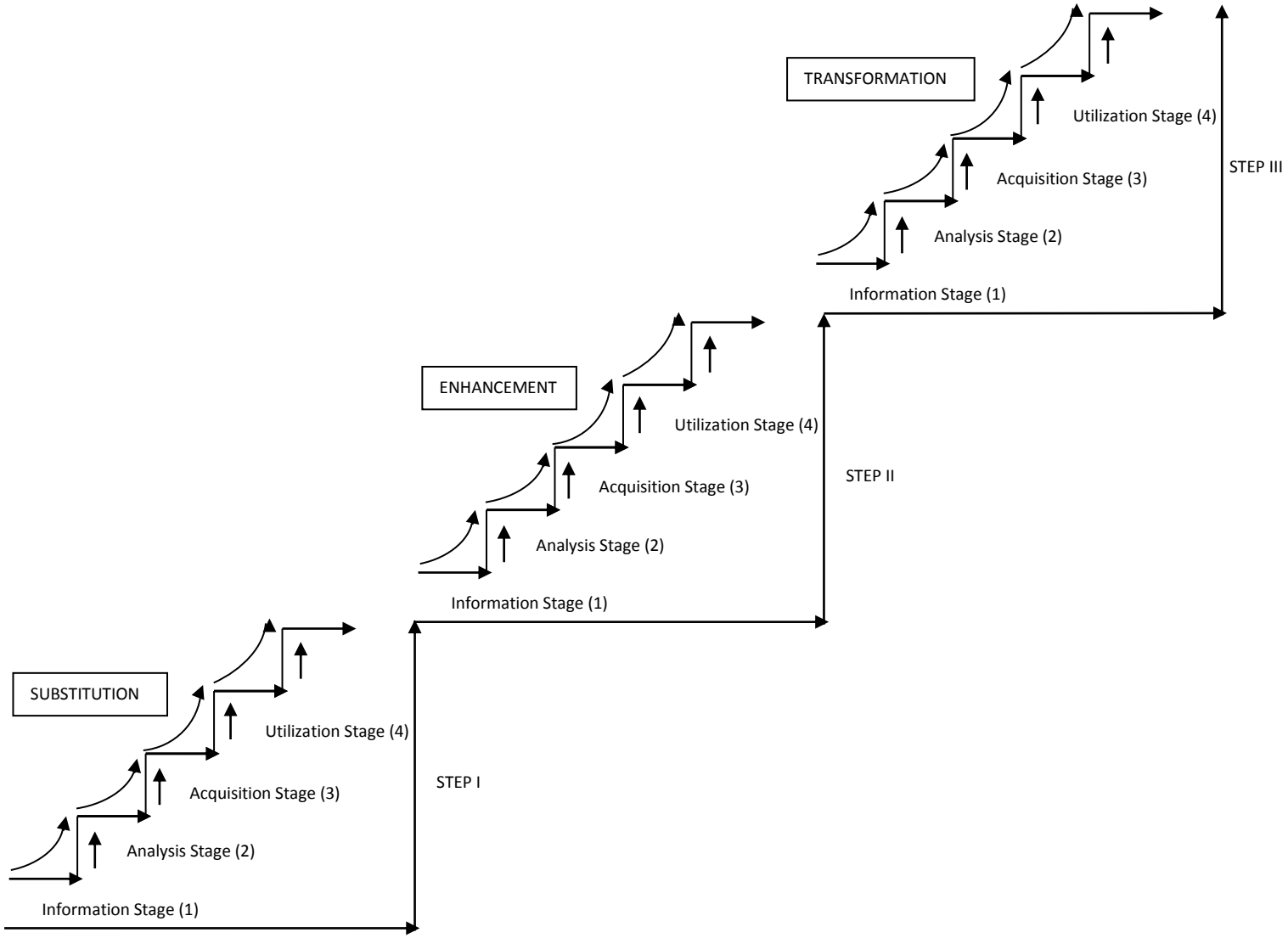


FIGURE 3.2 UNIVERSITY ICT ADOPTION MODES: STEP GUIDE



This includes programs aimed at improving the productivity of the entire university system (Analog Foundations).

Consequently, policies concerning University ICT system should be subdivided according to whether they are intended to augment its production or procurement (ICT generation policies), enhance its use (ICT diffusion policies) or link producers with users (ICT bridging policies). Essentially, ICT generation initiatives are primarily intended to stimulate university technological (research) activities while developing ICT generation capability. On the other hand, ICT diffusion measures

are intended to encourage Universities to acquire and apply new ICT products and services needed for training and research activities. However, bridging actions (attempts to improve cross-cutting policies and infrastructures) should equally be intensified by the University management and stakeholders.

(4.0) INNOVATION SYSTEMS AND TECH HUBS

In today's emerging digital economies, technology is increasing essential for Universities to compete and develop. Thus, digital technologies have evolved into the general purpose technology of our time; given their critical spillovers to other sectors and their role as University wide enabling infrastructure. Therefore, ICT access and usage can be regarded as key enablers of Universities' overall technological readiness. Critically, university systems operation needs to have access to advanced products and blue prints as well as the ability to absorb and use them. In this context, the level of technology available to Universities systems need to be distinguished from the University's ability to conduct research activities and develop new technologies for innovation that expand the frontiers of knowledge (Nwaobi, 2015).

As a fundamental social process, innovations germinate into innovation systems that are made up of private and public organizations and actors that connect in various ways. Again, as a specific feature, an innovation may be created by public or private research and development laboratories or universities in the same country. And to support the various innovation initiatives, business incubator is the most widely used policy instrument. Unlike economic development incubators, the primary goal of technology incubators is to promote the development of technology-based sectors. And usually located at or near universities, science and technology parks, these incubators are characterized by institutionalized links to knowledge source such as universities, technology transfer agencies, research centers, national laboratories as well as skilled-research and development personnel. Specifically, they may target specific industrial clusters and technologies such as software information and communication technologies.

Operationally, innovation is a global phenomenon that represents tremendous opportunities and challenges. However, success in a given sector is a long-term process that requires tremendous learning and discovery. Therefore, success can be achieved by analyzing the underlined key dimensions of the innovation system as shown in figure 4.1 below. And yet, because of the connection between local innovation and success in international markets; localities have a strong rationale for

developing a strategy for increasing innovation in targeted sites: special economic zones, science parks, clusters and even cities with universities as knowledge providers. Generally, innovation involves the introduction and sale of new or

FIGURE 4.1 INNOVATION SYSTEM DIMENSIONS

I.	VISION (LEADERSHIP)	POLITICAL SYSTEM AND STABILITY; STRATEGIC FOCUS
II.	FRAMEWORK CONDITIONS	OVERALL ECONOMIC AND INSTITUTIONS REGIMES; TAXATION AND INCENTIVES COMPETITION
III.	EDUCATION (RESEARCH)	HUMAN RESOURCE CAPACITIES; TRAINING HIGHER EDUCATION INSTITUTIONS
IV.	INFRASTRUCTURE	BUSINESS SUPPORT AND SERVICES FINANCE AND VENTURE CAPITAL INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)
V.	INDUSTRIAL SYSTEM	FIRMS TYPE AND MIX
VI.	INTERMEDIARIES	INFORMATION BROKERS AND DISSEMINATORS RESEARCH INSTITUTIONS
VII.	DEMAND	OPPORTUNITIES AND MARKETS (DIGITAL)

improved products (PRODUCT INNOVATION) and the introduction and use of new methods of production (PROCESS INNOVATION) as well as economic and social dimensions and activities that fall under the general heading of BUSINESS INNOVATION. However; the spine of any educational system in the innovation economy is the quality and reach of its basic education and the competence of its teachers. Truly, this is the basis of subsequent learning that transits to the University postgraduate programmes. To this end, policy needs to promote up to date quality and higher standards in learning, teaching and research.

As an innovation case study, the ambition behind iHub was fueled by the aspiration that Kenya and other African countries (following the arrival of broadband connectivity) could catch up with and become more closely connected to the Global North-West (Graham and Mann, 2013). Here, it is anticipated that through iHub, the technology community, industry, academia, investors and venture capitalists could meet, share ideas and collaborate which can transform ideas into actions. Basically, the iHub brand was meant to provide exposure for innovators by pooling and providing access to opportunities such as jobs, group contracts or training. Here, the hub's community was structured to enable knowledge sharing and mentorship, thereby raising the skill levels of members (such as university graduates and postgraduate student researchers).

Subsequently, the confluence of several events and dynamics allowed the spread across Africa of organizations similar to iHub (resulting in at least partial recognition of hubs as a distinct organizational form). However, some of the national labs latter formed AFRILABS (a network of tech innovation hubs in Africa) with the mission to build the capacity of hubs which support the growth of tech communities

around them. Geographically, hubs were affirmed as an important Africa-wide phenomenon through widely noted stock-taking exercises as shown in table 4.1 below for selected African countries (World Bank, 2016). Traditionally, these hubs have consistently been understood to consist of a Wi-Fi-connected space with hot

TABLE 4.1 AFRI – NATIONAL HUBS: SAMPLE D LOCATIONS

S/N	COUNTRY	HUBS LOCATION	PROTOTYPE
1.	SENEGAL	JOKKOLABS DAKAR	CIVIL SOCIETY LED
		CTIC DAKAR	CIVIL SOCIETY LED
		AFRICA UUNG LAB	ACADEMIC INSTITUTION LED
		MOBILE SENEGAL	HYBRID
		JIGUENE TECH HUB	CIVIL SOCIETY LED
2.	GHANA	MFRIDAY	CIVIL SOCIETY LED
		MELTWATER INCUBATOR	ACADEMIC INSTITUTION LED
		GSPACE	CIVIL SOCIETY LED
		LSPACE	CIVIL SOCIETY LED
		MULTIMEDIA INCUBATOR	GOVERNMENT LED
		MOBILE WEB PAGE	CIVIL SOCIETY LED
		KUMASI INCUBATOR	HYBRID
		OGUAA INCUBATOR	CIVIL SOCIETY LED
		HUB ACCRA	HYBRID
3.	ETHIOPIA	ICEADDIS	ACADEMIC INSTITUTION LED
		XHUB	CIVIL SOCIETY LED
4.	NIGERIA	L5LAB	CIVIL SOCIETY LED
		CO-CREATION HUB	CIVIL SOCIETY LED
		WENNOVATION HUB	CIVIL SOCIETY LED
		TECHNOLOGY INCUBATION CENTRE	GOVERNMENT LED
		MINNA TECH INCUBATION CENTRE	GOVERNMENT LED
		INFORMATION DEVELOPER CENTRE ACCELERATOR	HYBRID
		FOCUS HUB	CIVIL SOCIETY LED
		ENSPIRE INCUBATOR	HYBRID
		CALABAR TECHNOLOGY INCUBATION CENTER	GOVERNMENT LED
		BB MPH (400 N6)	HYBRID
5.	KENYA	IHUB	CIVIL SOCIETY LED
		MLAB	HYBRID
		GROWTH HUB	CIVIL SOCIETY LED
		NAILAB	CIVIL SOCIETY LED
		C40 LAB	ACADEMIC INSTITUTION LED
		AKIROCHIX	CIVIL SOCIETY LED
		LAKE HUB	CIVIL SOCIETY LED
		IBIZ AFRICA	ACADEMIC INSTITUTION LED
		ILAB AFRICA	ACADEMIC INSTITUTION LED
		FAB LAB NAIROBI	ACADEMIC INSTITUTION LED
		88 MPH	HYBRID

desks and meeting rooms allowing for laptop-based work. Here, activities have been described as including events, presentations, small innovation competitions, group meetings on topics of interest, training and mentorship sessions. In contrast to this original ihub conceptualization, two divergent macro-level grand discourses about African hubs (as an organizational form) have developed. Namely, these are Network Infrastructure Expectation and Incubator Expectation. Comparatively, while the network infrastructure expectation assumes that startups are created within wider ‘eco-systems’ (which the hub supports); the incubator expectation assumes direct creation of hubs ventures. Thus, for hubs to lead to better outcomes,

implementers and funders should move beyond the hype (acknowledging the indirect and indeterminate nature of hub outcomes) while working toward a more grounded understanding of what hubs can do for University postgraduate students and researchers.

In the spirit of unlocking technological entrepreneurship in Sub-saharan Africa, there has been significant rise of tech startups, tech hubs and innovation ecosystems in recent times. In fact, Tech hubs in the region have grown by over fifty percent: from 314 in 2016 to 442 in 2018 (Choi et.al, 2019). Again, the technology investment ecosystem across the region is also attracting more capital and expertise. In fact, new ecosystem cities such as Accra and Abidjan have joined traditional frontrunner tech hub and ecosystem cities such as Cape Town, Lagos and Nairobi as internationally attractive technology centers. Notably, the top tier countries remain the premier tech investment destinations on the continent in the year 2018. In the same year, Nigeria surpassed South Africa to emerge as a premier investment destination with 55 Active tech hubs raising a total of US $94.9 million (GSMA, 2018). However, a host of other countries in the region are also showing signs of joining and becoming internationally attractive tech centers. Even in countries where tech hubs where non-existent, can boast of at least one active tech hub. Again, with anticipated government support, and the regions tech ecosystem showing signs of maturity as well as growing synergy between investors, industry and universities; the future looks bright for Africa technology ecosystem. Certainly, it is the right time for University postgraduate programmes to speed up its connectivity to take full advantage of digital technologies.

CASE STUDY: MTN ACADEMIC RESEARCH DEVELOPMENT AND INNOVATION CHALLENGE (MTN ARDIC)
This is an end-to-end support system where selected students would translate their ideas into solutions through a seamless access to applicable tools, data, platform and hands-on-mentoring. As an initiative, MTN will be hosting an exclusive launch of the event to connect with other organizations supporting MTN's mission to become entrepreneurs and foster their journey. Students, entrepreneurs, stakeholders are invited to attend to the three regional pitching events. At the end of the challenge, MTN would provide the top six well motivated researchers who want to translate their research ideas into high-impact enabling platforms, APIs, data, training mentorship and money seed stars to further develop the ideas towards commercialization. As a requirement to be considered for selection in the MTN ARDIC, applicants must be a registered current postgraduate (Masters or Doctorate) studying in Nigerian

University or research institute. The candidate must have received confirmation from faculty and commenced research in the following areas:

* Econometric modeling and Advanced Scenario Analysis for Telco Industry using economic data.
* Media Optimization and Attribution Modeling of Media Advertising.
* Market Footprint Optimization for retail.
* Geo-marketing and Community Chum Modeling.
* Digital Media Optimization and Real-time planning Model.
* Use of GIS/Satellite Data for market sizing and characterization.
* Innovative biometrics for multi-sectoral customer identification.
* Rural Telephone Coverage technology and Strategies.
* High Scalable Impact Research in Block chain for Telco and Fin Tech.
* Use of GIS and Customer migration data for Health/Epidemiological.
* AgriTech with emphasis on use of technology for agricultural yield to preservation.
* Med Tech with emphasis on Malaria prevention tech-solutions; efficient maternal-infant and child mortality reduction.
* Customer complaints modeling using new media and NLP.

As a prize incentive, MTN partnered with seed stars to provide six months virtual accelerator projects pitching at our regional pitching events. As perks and resources, MTN will provide one million naira to the winners as well as enabling platforms, AP mentorship to further develop the ideas towards commercialization. However, the SEEDSTARS INVESTMENT READINESS PROGRAM is a flexible, tech and data centered that supports startups with global expertise and insights.

http://www.mtnonline.com/ardic.

5.0 RESEARCH DIGITIZATION AND APPLICATIONS

Essentially, digital technologies have dramatically expanded the information base; lowered information costs and created information goods. Again, it has facilitated searching, matching and sharing of information which has contributed to greater organization and collaboration among research agents. Technically, it promotes research through the following mechanisms: search and information, automation and coordination as well as scale economies and platforms. Yet, across these domains, the major enablers of digital technologies are digital finance, social media and data revolution (big data vs. open data). Thus, learning capacity is related not only to the sophisticated use of digital process to access global stocks of knowledge; but to the characteristics of the communication process among people

involved in the innovation process. In fact, the application of digitization is leading to more flexible learning environments. In other words, the feasibility of interactive learning (between teachers and students or computer-based software applications and students or among teachers and students themselves) is becoming a reality for university post-graduate programmes. Again, the knowledge networks that support science and technological innovation are becoming increasingly international. Generally, they are involving a growing number of types of research and educational institutions. In other words, science and technology research networks are becoming more popular. Therefore, researchers working independently cannot hope to have the full range of skills, equipment and materials needed to carryout modern scientific research (Hicks and Katz, 1996).

Operationally, LECTORA authoring software provides the simplicity and sophistication to develop professional e-learning courses, presentations, assessments and more that will engage, entertain and educate learners. Similarly, COURSE MIII enables instructors, students and administrators to easily and effectively administer, manage, track and take online courses and curriculum. It also provides student self-enrollment, single click course upload, shopping cart support, wait list functionality, etc. Again, it makes the tracking and reporting of online courses simple and hassle free by enabling users to easily create an unlimited number of reports. Furthermore, it provides MySQL database support, 3rd party content support; classroom based training support for blended learning and much more to provide for a range of uses. Other e-learning networks include GLOBAL DEVELOPMENT LEARNING NETWORK, MINDSET NETWORK, YOUNG DIGITAL PLANET, BLACKBOARD, QUESTION MARK, INMEDIA, TECHSMITH, CABECA (capacity building for electronic communication in Africa), RINAF (Regional Informatics Network for Africa), SSRN (Social Science Research Network), COPINE (Cooperative Information Network linking Scientists, Educators and Professionals in Africa), DIGITAL PUBLISHING, E-LEARNING SOLUTION, GLOBAL LEARNING and AVU (African Virtual University).

Indeed, University postgraduate programmes have changed fundamentally at exactly the same time that it has remained unchanged in many important aspects. Here, the many important aspects of the programmes that remain unchanged include the need for opportunities to learn about core research processes; the ability to design and implement a manageable project having impact and significance as well as the development and utilization of skills to disseminate research outcomes. Apart from the formalities of getting the degree and producing a thesis or dissertation, the dissemination and application of ideas that benefit the wider research community

remains important. Thus, over the past five decades, the evolution of academic practice (including postgraduate research) has been dramatically affected by changes and developments in technologies that govern determine and influence all areas of life. In fact, the ever-present need and desire to improve postgraduate student experience and increase effectiveness and efficiency of research and research processes point to aspirations to improve quality of life for researchers, those learning to be researchers as well as those who benefit from research. Clearly, this need or desire is inherently human and technological.

Like all areas of education, the world of postgraduate programmes is evolving. In fact, what makes one's stand in the research world has always been about having an impact on thought and practice with one indicator of impact being citation levels: the use of online technologies increases the likelihood that research outputs are seen while the impact is acknowledged. And whether limited ability to use online technologies in the form of social media to push out research activity is really an obstacle to success; the place of online facilities to aid dissemination and wider community engagement needs to be understood by postgraduate students. Notably, in using an online educational (research) programme, there is a connection among humans (researchers/teachers/supervisors), tasks and goals to be achieved (studying/learning/teaching/supervising/researching) and technological artifacts (courses/nodes/interaction processes/communication tools). Here, it is expected that each element being integral to the designed technological process, served to solve the educational need to provide a related set of opportunities and experiences for postgraduate research student cohorts. Consequently, under pinning any successful research is well-designed project. Therefore, developing the skills and knowledge to explore and articulate the rationale for research; make explicit the paradigm within which the research is taking place as well as designed and plan the project itself, are some of the essential elements of university postgraduate programs.

Again, enabling learning through information guidance and support are the 'IDEA PUZZLE SOFTWARE' with a structured range of topics and support activities to enhance the postgraduate student experience that is made accessible through institutional-based platforms. Practically, the Idea Puzzle Software focuses sharply on research design: educating the novice researcher about research design through research project design. Although measured in different contexts, the main issue is the development of institutional platforms for broader postgraduate education support. Again, the software offer guidance for research design education, in addition to providing resources to scaffold postgraduate students' learning and studies more broadly. Clearly, these facts illustrate the many factors that must be

taken into account when solving typical problems that postgraduate students encounter during the course of their research study with online information and opportunities to interact, communicate and engage being presented as useful and workable solutions. Critically, the introduction of digitization in the form of platforms and applications can result in qualitatively different levels of engagement among postgraduate students and supervisors as well as new ways of thinking about the research experience that were not possible before.

Yet, drawing on a range of ideas from documented strategies for facilitating and generating discussion forums, there is need for the development of a blended model that suite specific need of their specific context. Essentially, student progress and academic professional development along with administrative requirements are to be tracked during the development of the model. Certainly, this innovation aims to reduce what can be called 'dislocation effect' that postgraduate students often experience in their research process. Similarly, with attention being paid to role in learning played by interaction and engagement, there is also need for an E-MENTORING framework for postgraduate students. Operationally, this framework highlights the advantages of supervising online, mapping the place of the student and supervisor as well as their connections with groups and institution. Thus, in several ways, the supervisor's significant place in postgraduate research remains unchanged. However, consolidating this aspect of postgraduate research processes by casting the supervisor as e-moderator demonstrates how supervision is changing. In other words, the supervisor role is being modified and altered by the facilities that the internet and web-based applications provide currently and in the future.

CASE PROJECT : IDEA PUZZLE GUIDE		
1.	KEY WORDS	THEORETICAL QUESTION: Which are the main key words of your research
2.	STREAMS OF THOUGHT	THEORETICAL QUESTION: Which are the two main streams of thought of your literature review?
3.	RESEARCH GAP	THEORETICAL QUESTION: Which is the main gap that your research addresses
4.	RESEARCH QUESTION OR HYPOTHESIS	THEORETICAL QUESTION: Which is the main question or hypothesis of your research
5.	STATE OF THE SCIENCE	THEORETICAL QUESTION: Which is the current answer to your research question or hypothesis?
6.	PHILOSOPHICAL STANCE	METHODOLOGICAL QUESTION: Which is the philosophical stance of your research?
7.	RESEARCH STRATEGY	METHODOLOGICAL QUESTION: Which is the qualitative, quantitative or mixed method of your research
8.	COLLECTION TECHNIQUES	METHODOLOGICAL QUESTION: Which are the data

		collection techniques of your research?
9.	ANALYSIS TECHNIQUE	METHODOLOGICAL QUESTION: Which are the data analysis techniques of your research?
10.	QUALITY DATA	METHODOLOGICAL QUESTION: Which are the tactics of your research to ensure scientific quality criteria
11.	UNIT OF ANALYSIS	EMPIRICAL QUESTION: Which is the unit of analysis of your research?
12.	LEVEL OF ANALYSIS	EMPIRICAL QUESTION: Which is the level of analysis of your research?
13.	NATURE OF DATA	EMPIRICAL QUESTION: Which is the nature of the data of your research
14.	ORIGIN OF DATA	EMPIRICAL QUESTION: Which is the origin of the data of your research
15.	SAMPLE	EMPIRICAL QUESTION: Which is the sample of your research?
16.	PATHOS	RHETORICAL QUESTION: Which are the positive and negative emotions of your research?
17.	LOGOS	RHETORICAL QUESTION: Which is the scientific logic of your research?
18.	ETHOS	RHETORICAL QUESTION: Which are the limitations of your research?
19.	WISDOM	AUTHORIAL QUESTION: Which is your education and experience related with your research?
20.	TRUST	AUTHORIAL QUESTION: Who are the partners of your research?
21.	TIME / RESOURCES	AUTHORIAL QUESTION: Which is your availability of time and resources for your research

GENERAL FOCUS: STUDENT RESEARCHERS
(I) To establish relationship between epistemology, methodology, ontology and axiology.
(II) To establish coherence between theory, method, data, rhetoric and authorship.

6.0 CONCLUSION, CHALLENGES AND RECOMMENDATIONS

Generally, knowledge production (its theories, modes, methods and techniques) has spread from academic to many different types of institutions. However knowledge accumulation and the accumulation of skills for digitization (ICT) will occur increasingly outside the traditional institutions of formal education: Yet, these institutions of formal education such as university education will continue to play a leading role in the society. Consequently, this paper has explored purposeful technological activities aimed to create systems that enhance the quality of research and learning for postgraduate students. Clearly, the reported projects involved the use of knowledge and skills; judgments and decisions about ICT policy design development and implementation. However, the key to making good use of ICTs within and for postgraduate research programmes involves balancing needs,

resources, expectations and usability to achieve aims of solving problems as well as capitalizing on opportunities. Therefore, pressures on those who become users of resultant digital technologies must bring together their current and developing knowledge of postgraduate research with their current and developing knowledge of the online communities.

As ICT users, Nigeria Universities must determine a feasible rate of adoption of the new technology that is consistent with their development and technological capabilities. However, these universities face structural constraints that reflect their institutional, technological and infrastructure development. Although market failures and limited absorptive capacity are severe and pervasive; these universities are poor in infrastructures that are relevant to ICT diffusion or digital adoption. In fact, the development of specialized electronic networks is constrained by the unreliability and inflexibility of the telecommunications infrastructure; poor regulatory framework as well as lack of standardization and co-ordination. Also, as a major cost of ICT use, is the unreliable power supply system. Similarly, these innovation-driven industries (such as software development, information services and other ICT-related support services) are typically small scale, undercapitalized and operating under severe short-term horizons. Thus, without sophisticated financial institutions and markets (FINTECH), University ICT adopters find it difficult to borrow against potential benefits from intangible investments in information and communication systems.

Again, there is little credible data related to the costs of using ICTs to support university postgraduate research programmes in developing countries such as Nigeria. Even where cost studies exist, there is a greater focus on initial costs of introducing ICTs than on real costs of implementing and maintaining ICTs over time. Thus, the development of models and case studies on successful strategies for using ICTs to change postgraduate research practices would be useful. Similarly, a database of existing policies related to ICTs applications in postgraduate programmes should be developed and analyzed which could serve as a resource for University management, donor staff and personal interested in developing such policies as appropriate. In other words, case studies on uses/misuses/costs of ICTs in facilitating the process research in the postgraduate programmes could be a valuable tool to assist universities planning for similar processes. Furthermore, case studies of a variety of strategies explored by public-private partnership to deliver ICT based research software and content; maintenance and training ways to share costs should also be explored.

Perhaps, the most serious challenge facing postgraduate research at the ICT level is the need for the integration of new knowledge into academic courses and programmes. In particular, there are areas of concern that should be addressed urgently: the regard of knowledge as static canon as well as outdated educational research practices. Critically, these challenges must be faced and resolved if the plan to establish ICT driven postgraduate (research) programmes is to succeed. However, international development assistance will certainly play a prominent role in efforts to stabilize and revitalize the university postgraduate research programmes. This is because of the fact that severe financial constraints at the national level have (in many cases) reduced government funding for university education to salary support and operating costs (without private universities allocation). Therefore, funding for new initiatives, pilot projects and special investments (in ICT infrastructures) is most likely to come from outside sources.

But donor policies must be modified if their assistance is to be effectively applied in support of Nigerian postgraduate research programmes renewal. Specifically, donors are urged to support institutional strategic planning exercises in response to the University research initiatives. Clearly, these exercises should seek to develop mission statement for the university (which responds to present and future research circumstances) and to support appropriate cost projections. However, flexible funding requires that donors allow universities greater management initiatives in the use of such funds. Yet it necessitates agreement on appropriates mechanisms of accountability (technological work plans/annual reports/periodic audits) to address donors stewardship obligations in the disbursement of public funds. However, in the long run, Nigerian universities (public and private) must strive to reduce their dependence on international development assistance and to cultivate local donors within their own regions. Essentially, these local donors include alumni, businesses, professional associations and policy makers with ties to the university.

Indisputably, government is the central actor in the university educational system. It finances the lion's share of university programmes (mainly for public universities), set access policies, appoints key officials and ensures that standards are maintained through accreditation or other control mechanisms. Therefore, the way in which government relates to the university education sector in carrying out their responsibilities will very much condition the possibilities and pace for post-graduate (research) programmes reform. Thus, greater understanding of university educational research issues is needed to formulate appropriate institutional plans and policy guidance. In fact, without an adequate information base and the capacity to

document post-graduate research performance regularly; the government will have difficulty in operationally defining and tracking critical policy variables for the university system (in general).

Finally, a digital technology is reshaping the skills needed for work. While the demand for less-advanced skills is declining, it is rising for advanced cognitive, socio-behavioral and adaptable skills. In other words, new jobs are replacing old jobs while some existing jobs increasingly require a different skill set. Consequently, the changing nature of work (in the context of digital technologies and other global trends) should be high on the agenda of Nigerian universities and post-graduate researchers alike.

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APPENDIX

ACADEMIC INNOVATION HUB DESIGN: VERITAS MODEL PROPOSAL

In recent times, the global economy has witnessed remarkable private sector driven growth. This has propelled the need for African nations to close the observed digital gap between the developing and developed nations. Consequently, this gap has led to a substantial demand for highly skilled human resources capable of managing and supplying various ICT infrastructure systems and networks deployed in the African landscape. Therefore, as technology keeps advancing rapidly, there is urgent need for sustained training and research programmes (projects). Clearly, ICT has opened opportunities and new ways of doing business. As at today, a sizeable portion of businesses are globally transacted with various mobile platforms and online payment systems. Specifically, in Nigeria, the Central Bank of Nigeria cashless policy was aimed at encouraging more electronic-based transactions. Again, businesses and transactions are finalized without physical contact between the manufacturer and final consumer while using electronic marketing platforms. Thus, the increasing numbers of business transactions that are consummated over digital platforms show that digitization is the future of business transactions. Hence, there is

need to provide the critical combination of infrastructure, services and training that is required to realize the power of emerging technologies for human capacity building and graduate empowerment.

Consequently, thriving new hubs of innovation are emerging in cities across various nations with universities often expected to lead the way. Here, entrepreneurs, researchers, students and established professionals mingle and collaborate in lively districts with state of art facilities. Yet, whether an institution is in a dense urban center or a small town; an innovation center can provide a valuable gate way between university talent and resources as well as private sector. In fact, with careful planning, one can bring together students, researchers administrators, facilities, equipment and others to commercialize new technologies and breakthrough ideas emerging from the campus community. Yet, these ambitions may encompass job creations and economic resuscitation. However, for the newest generation of scientists and innovators, a live-work-learn-play environment is what inspires collaboration and creativity.

After innovation hub launching to fully realize the project ambition, the university will need a thoughtful and empowered governance team that includes key stakeholders and fulltime leader or team. Here, as new participants join the innovation hub, a strong governance structure will help keep the vision and goals in the forefront. However, the university should serve as the team leader bringing various parties together while managing the long-term programming of the innovation hub. Again, since innovation center is a future economic engine, the school can ask for the public funding it deserves. This is in addition to integrating public-private partnerships for development know-how. Yet, as you consider potential tenants, don't overlook the smallest start-ups. Here, co working spaces can help create collaborations and bring in potential growth companies to invigorate larger innovation center. Finally, one cannot predict the future and hence the need to plan for flexibility. While it is important to start with a vision and master plan; it is also important to remain open to changes in the execution. That is, research priorities and industries may change direction as new technologies enter the market place. In fact, the most successful innovation centers begin with a strong foundation and a smart strategy toward their goals.

VERITA INNOVATION ECO.SYSTEM WALL (VIEW-HUB) ABUJA, NIGERIA, WEST AFRICA

Essentially, the proposed project is to ensure that VERITAS postgraduate students are equipped to succeed in this new era of digital revolution. As a 21st Century

University, a networked environment that emphasized a culture of innovation, collaboration across disciplines and visionary leadership for the information age should be guaranteed. Structurally, the VIEW-HUB will offer a space that gives open access collaborations in an environment that fosters innovation. In other words, it is anticipated to yield creativity sought by a community of inquisitive people to facilitate cross-disciplinary communication and problem-solving. Consequently, the objective of VIEW-HUB is to best expose VERITAS postgraduate research students and university community members to the global resources and possibilities. Specifically, VIEW-HUB is expected to connect students, faculty, college units and community members to the existing spaces, market spaces and resource laboratories across the university. Basically, this connection will improve innovation at the intersections between disciplines and increase awareness and access to the broad range of university design, technology and resource laboratories.

In other words, the proposed VERITAS learning innovation initiative serves to discover, implement and support academic technology that increases college efficiency and enhances student access and engagement. VIEW-HUB will work with faculty or college (both on campus and online) to create an environment where innovative pedagogy can flourish; wise experimentation is supported while all researchers will receive robust practical experience. Physically, the proposed VIEW-HUB will be a technology rich-hub building that will provide robust systems and flexible infrastructure to accommodate the rapid pace of technology changes. Here, the structural design should be able to accommodate the following parts:

(A) LECTURE HALL
(B) FLEXIBLE CLASSROOMS
(C) ACTIVE LEARNING CLASSROOMS
(D) STUDENT SKILLS STUDIO
(E)DIGITAL LIBRARY
(F)INFORMATION COUNTER
(G) FACULTY INNOVATION STUDIO
(H) FEATURE WALLS
(I) CREATIVE CORRIDOR QUARTERS
(J) DESIGN STUDIO
(K) MEDIA DEVELOPMENT
(L)LAB SPACE
(M)COLLABORATION ROOM
(N) STUDENT SHOW CASE
(O) HUDDLE STATIONS

(P)CHAPEL STATION
(Q) DIGITAL SIGNAGE
(R) TENANTS SPACES
(S)ETC.

NOTE: PEDAGOGY + RESEARCH + TECHNOLOGY = INNOVATIONS

TRIPLE HELIX INNOVATION MODEL: ACADEMIA, INDUSTRY AND GOVERNMENT