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ASSESSMENT OF UNIVERSITY AND INNOVATION IN NIGERIA: A STUDY OF AHMADU BELLO UNIVERSITY ZARIA

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Abstract

The study explores the critical role of universities in fostering innovation using Ahmadu Bello University (ABU) Zaria, Kaduna state as a unit of analysis. The study used Quintuple Innovation Model as theoretical framework of analysis. The study was conceptual in nature using ABU data such as bulletin, online publication as well as periodic reports, the findings were arranged as themes for easy analysis. The findings show that Ahmadu Bello university scored big in AI—winning "Best AI-related Programme for its B.Eng Computer Engineering (AI Option) and landing second place for AI policy impact. ABU's engineers and scientists patented two COVID-era inventions: the 4-In-One Hand Sanitizing Machine (_ABUSANIT-20_) and an ICU ventilator (_ABUVENT-20_).The ABU staff publish research findings in academic journals, disseminate knowledge through conferences, and contribute to the public domain.Also, Ahmadu Bello University contributes to energy innovation, in order to create sustainable solution to energy shortage in the campuses.Also, in an attempt to foster innovation, the university has trained several staff in the academics and non academics in the areas of sciences, social sciences, arts, law and engineering. Other areas that Ahmadu Bello University contributes to innovation is in the area of commercialization of some the research findings to the industries and public. The result further demonstrated that Ahmadu Bello University foster culture of innovation through entrepreneurship education, students were trained in skill acquisition in order for them to be self reliant in areas such as Soap making, Cream and other aspects of human endeavor. There was collaboration with best universities in the world to foster innovation such as China Central South University. Though the university is facing problems that affects it innovative capacities such as inadequate funding, limited human resources, brain drain, poor collaboration with the industries as well as regulatory challenges. The study recommends commitment to collaboration with the industry to foster innovation, therefore, future researchers should concentrate on Training and Innovation in ABU Zaria.

Key words: *Commercialization, innovation, industry, private sector & university*

1.1 Introduction

Global universities share a common commitment to advancing education, research, and service for the betterment of society. Studies such as Clarivate (2024) shows that universities are driven global innovation, most of the universities that made it to the top are the innovative institution. A report from the institute for Scientific Information(2025) stated that Groundbreaking ideas driving the world's most innovative companies often originate from academic research. These ideas fuel technological advancements and contribute to solutions for societal challenges – spanning healthcare, sustainability, economic development and more.

Table 1.1 : Universities powering global innovation

University	**Country**	**Ranking**
Harvard University	USA	1
Stanford University	USA	2
Massachusetts Institute of Technology MIT	USA	3
University of California, Berkeley	USA	4
Universite Paris Cite	France	5
University of Cambridge	UK	6
University of Washington Seattle	USA	7
University of San Diego	USA	8
University of Michigan	USA	9
University of Toronto	Canada	10

Clarivate (2024)

The table 1.1 above shows the most innovative universities globally, Harvard University ranked first in term of innovation, followed by Stanford University and Massachusetts Institute of Technology came third, University of California, Berkeley ranked forth etc. While in Africa, South Africa and Egypt universities led in innovation, the most innovative universities are as follows:-

Table 1.2 : University Innovation Ranking Africa 2025

University	**Country**	**Ranking**
University of Cape Town	South Africa	1

Cairo University	Egypt	2
Witwater University	South Africa	3
University of Pretoria	South Africa	4
University of Kwazulu Natal	South Africa	5
Stellenbosch University	South Africa	6
University of Johannesburg	South Africa	7
Ain Shams University	Egypt	8
Alexandria University	Egypt	9
Mansoura University	Egypt	10

Source: SCImago Institution Ranking (2024)

The table 1.2 above shows University Innovation Ranking Africa 2025, South African universities are leading followed by Egypt universities. University of Cape Town ranked first, followed by Cairo University with second position, Witwater University came third, University of Pretoria ranked forth and University of Kwazulu Natal ranked fifth.

The aim of this paper therefore is to analyse University and Innovation in Nigeria using Ahmadu Bello University Zaria as a unit of analysis. Though, there are many studies on problems of universities in Nigeria, little studies were documented on university and innovation in Nigeria that is why the study intends to cover the gap.

2.0 Review of related theories

2.1 Triple Helix Theory

The Triple Helix theory, developed by Etzkowitz and Leydesdorff (1995), assumes that innovation and economic growth are driven by the interaction and collaboration between three key actors:

i. University: Provides knowledge, research, and talent.
ii. Industry: Offers resources, expertise, and market access.
iii. Government: Creates policies, regulations, and funding opportunities.

Assumptions of the theory

Collaboration: The three actors collaborate and interact to drive innovation and economic growth.

Knowledge-based innovation: Innovation is driven by the creation and application of knowledge.

Triple helix model: The three actors are interdependent and influence each other.

Dynamic relationships: The relationships between the actors are dynamic and evolving.

Innovation ecosystem: The triple helix model creates an innovation ecosystem that fosters entrepreneurship, creativity, and economic growth.

Importance of the theory

Increased innovation: Collaboration between the three actors leads to increased innovation and economic growth.

Improved knowledge transfer: The triple helix model facilitates knowledge transfer between academia, industry, and government.

Enhanced entrepreneurship: The model supports entrepreneurship and start-up development.

Better policy-making: Government policies and regulations are informed by industry and academia, leading to more effective policy-making.

The Triple Helix theory highlights the importance of collaboration and knowledge-sharing between different actors in driving innovation and economic growth.

2.2 Quadruple Helix Model

The theory was developed by Carayannis & Campbell (2021). The Quadruple Helix model builds upon the Triple Helix model by adding a fourth helix:

i. University: Provides knowledge, research, and talent.
ii. Industry: Offers resources, expertise, and market access.
iii. Government: Creates policies, regulations, and funding opportunities.
iv. Civil Society: Includes users, consumers, media, and other stakeholders who provide feedback, validation, and support.

Assumptions of the theory

User-centric innovation: Civil society plays a crucial role in driving innovation by providing user feedback and validation.

Co-creation: The four helices collaborate to co-create innovative solutions that meet user needs.

Open innovation: The Quadruple Helix model promotes open innovation, where knowledge and ideas are shared across boundaries.

Social innovation: The model recognizes the importance of social innovation and the role of civil society in driving positive social change.

Sustainability: The Quadruple Helix model aims to create sustainable innovation ecosystems that benefit society as a whole.

2.3 Importance of Quadruple Helix model

More inclusive innovation: The Quadruple Helix model ensures that innovation is more inclusive and responsive to user needs.

Improved social impact: The model recognizes the importance of social impact and aims to create innovative solutions that benefit society.

Increased legitimacy: The involvement of civil society increases the legitimacy and acceptance of innovative solutions.

Better policy-making: The Quadruple Helix model informs policy-making with user needs and feedback, leading to more effective policies.

The Quadruple Helix model provides a more comprehensive understanding of the innovation ecosystem by incorporating the role of civil society and users in driving innovation .

2.4 The theoretical framework

Quintuple Helix Model

Carayannis & Campbell (2021) also proposed the Quintuple Helix by adding a fifth helix—the natural environments of society. The Quintuple Helix addresses the socio-ecological transition of society and economy in the twenty-first century, bringing an ecologically sensitive perspective to the discussion of innovation and knowledge production.

The Quintuple Innovation Helix Framework assumes that innovation and economic growth are driven by the interaction and collaboration between five key actors.

i. University: Provides knowledge, research, and talent. The university has contributed to innovation ecosystem through collaboration as well as conducting research and commercialization of findings.
ii. Industry: Offers resources, expertise, and market access. The industries also provide funds for research and also interact with university to purchase innovation and discoveries from universities.
iii. Government: Creates policies, regulations, and funding opportunities. Most of the funding of researches for innovation were carried out by government, therefore government play an important role by providing support to the universities.
iv. Civil Society (Public): Includes users, consumers, media, and other stakeholders who provide feedback, validation, and support.
v. Environment (Nature): Recognizes the importance of environmental sustainability and the need to address global challenges like climate change.

Application of the theory to the study

The Ahmadu Bello University collaborate with industry, government, civil societies to nurture innovation. Since the time of creation of ABU, the university engage in collaboration with many companies both in Nigeria and abroad for training and funding of its important projects such as with Dangote foundation, billion of naira was injected in building ultra modern hostels for the students, the Ahmadu Bello University was able to collaborate with the Central Bank of Nigeria, fund was secured which resulted in building of CBN center of excellence. The university was able to trained it personnel through linkage with government institutions such as Federal Ministry of Education of Nigeria as well as Tertiary Education Fund (TETFUND) that provide scholarship to the staff of the institution for training in both local and international. The Evidence shows that Ahmadu Bello University conduct research for innovation and discovery of new ideas, industry also sponsor some of the research conducted by the university, government also provide support to the university as well as civil societies also plays important role as agent of innovation.

Ahmadu Bello University also serves as the laboratory for research, innovation as well as talent factory. For instance, For instance Ahmadu Bello University is developing solar-powered to cope with the problem of electricity facing the institution. The Ahmadu Bello University is also in collaboration with major industrial firms in Nigeria for support as well as research collaboration. The Institute of Agricultural Research is also collaborating with farmers producing seeds, such as Maize, Cowpea, Beans and Groundnut. MTN and Dangote are partnering with universities to train data scientists and logistics engineers.

Relevance of the theory

Collaboration: The five actors collaborate and interact to drive innovation and economic growth.

Knowledge-based innovation: Innovation is driven by the creation and application of knowledge.

Sustainability: The model aims to create sustainable innovation ecosystems that benefit society and the environment.

Social innovation: The Quintuple Helix model recognizes the importance of social innovation and the role of civil society in driving positive social change.

Interconnectedness: The model highlights the interconnectedness of the five helices and the need for a holistic approach to innovation.

3.1 Methods of Data Collection

The study was conceptual in nature using data, the data were gathered from the publications of Ahmadu Bello University such as Bulletin, online publication, committees reports as well as periodic reports etc.The data was analyzed thematically using themes. The study used the processes of thematic analysis such as familiarization with the data, developing initial code, searching for the themes, reviewing the theme as well as write up.

4.1 Role of Ahmadu Bello University in Innovation

ABU Zaria is a center of innovation in sub-Sahara Africa, it has many innovation such as ABU-NITDA IT Hub innovation at the Zaria Digital Empowerment Summit, covering everything from AI-driven learning platforms to smart waste-sorting bots and IoT fish-pond monitors. These ventures got mentorship, funding and a spot in the university's incubation program.The above support the quintuple innovation theory that stipulated that government and industries fund university in order to embrace culture of innovation Carayannis & Campbell (2021). The implication is that Ahmadu Bello University rely on funding innovation ecosystem from government and little support from the industries.

The university also scored big in AI—winning "Best AI-related Programme for its B.Eng Computer Engineering (AI Option) and landing second place for AI policy impact. Plus, it's now part of the iDICE program, a national initiative to build digital innovation hubs across Nigerian universities, with experts from archaeology to theatre collaborating on tech projects.This also rhyme with the quintuple innovation theory which says that collaboration foster innovation Carayannis & Campbell (2021). The implication is that, through interdisciplinary collaboration, Ahmadu Bello University Zaria was able to produced many innovation such as Solar energy, new varieties of crops such as Maize, Guinea corn and Groundnut.

On the research side, ABU's engineers and scientists patented two COVID-era inventions: the 4-In-One Hand Sanitizing Machine (_ABUSANIT-20_) and an ICU ventilator (_ABUVENT-20_)—both recognized by the Federal Government for public benefit. And the Faculty of Engineering just launched the ABU Energy Innovation Challenge to tackle campus power woes with homegrown renewable solutions.

1. **Knowledge Creation and Dissemination:**

Ahmadu Bello University is a centre for basic and applied research, leading to the creation of new knowledge and technologies. The staff of Ahmadu Bello University publish research findings in academic journals, disseminate knowledge through conferences, and contribute to the public domain. This knowledge creation forms the foundation for future innovation in various fields in Ahmadu Bello University. The above also is inline with quintuple innovation theory, that the philosophy behind creation of ABU is to foster research as well as teaching and learning, also collaboration and community service Carayannis & Campbell (2021). The implication is that ABU Zaria has succeeded in conducting researches in all spheres of life ranging from arts, sciences, social sciences and engineering.

2. **Energy innovation**

Energy innovation is another area that Ahmadu Bello University has played important role, due to power shortage in the university that is electricity, energy innovation create sustainable solution to energy shortage in the campuses. This is also in consonance with the quintuple innovation theory that the essence of collaboration between government, university, industry and civil society is to enhance innovation, Carayannis & Campbell (2021). The implication is that through such collaboration ABU Zaria was able to came out with many innovation such as energy innovation.

3. **Utilization of Human Resources to provide solutions to ABU challenges**

The Human Resource is very important to the development of any organization, like wise in Ahmadu Bello University Zaria, Kaduna state, the university is utilizing it manpower in areas of arts, social sciences, engineering as well as medicine in providing problems facing the institution.

4. **Human Capital Development:**

Ahmadu Bello University also train it staff both locally and international with the support of tertiary education fund, for the past yesteryears, the university was able to sent it staff to some of the best universities in the world for training such as Harvard and Standford Universities, the university also create avenue for collaboration and staff exchange. train the next generation of scientists, engineers, and entrepreneurs who will drive innovation. They equip individuals with the skills and knowledge necessary to develop and implement new ideas.This skilled workforce is essential for translating research into practical applications and fostering a culture of innovation. This is also in consonance with the quintuple innovation theory that states that through collaboration innovation is achieved, Carayannis & Campbell (2021). The implication is that ABU for instance was able to established linkages with China university such as exchange of staff for innovation, TETFUND also provide support for training.

5. **Technology Transfer and Commercialization:**

Ahmadu Bello University also facilitate the transfer of technology and knowledge to businesses and other organizations. This can involve licensing technologies, creating spin-off companies, and engaging in collaborative research projects. Technology transfer offices and other intermediaries play a vital role in connecting universities with external partners.

6. **Regional Development:**

Ahmadu Bello University contribute to regional innovation and economic development by attracting talent, fostering collaboration, and driving the growth of local industries. Ahmadu Bello University partner with regional governments to develop innovation strategies and support local businesses. By contributing to the creation of new jobs, businesses, and technologies, universities play a key role in regional prosperity.

7. **Fostering a Culture of Innovation:**

Ahmadu Bello University promote a culture of innovation through entrepreneurship education, support for start-ups, and engagement with the wider community. Ahmadu Bello University encourage students and faculty to think creatively, take risks, and pursue new ideas. By fostering a dynamic and innovative environment, the university inspire the next generation of innovators. In essence, Ahmadu Bello University is not just places of learning, but also engines of innovation, driving economic growth, and contributing to societal progress.

4.2 Areas of collaboration between universities and industries in Nigeria include

Research and Development: Ahmadu Bello University collaborate on research projects to develop new products, processes, and services. For example, Ahmadu Bello University partnered with the International Crops Research Institute for Semi-Arid Tropics (ICRISAT) to develop improved sorghum seed varieties.

Student Internships and Practical Training: Industries provide students with hands-on experience and practical training to enhance their skills and employability. This benefits industries by giving them access to talented students who can contribute to their organizations.

Staff Exchanges and Capacity Building: Ahmadu Bello University also participate in exchange staff to enhance knowledge sharing, capacity building, and skills development.A good example of it is recent double degree exchange programme between Ahmadu Bello University and China Central South University.

Entrepreneurship Development: Ahmadu Bello University offer entrepreneurship programs, and industries provide mentorship, funding, and networking opportunities to support start-ups and small businesses. The University has Institute for Entrepreneurship and Innovation.

Product Development and Innovation: Industries collaborate with Ahmadu Bello University to develop innovative products and services, leveraging the universities' research capabilities and expertise.

Knowledge Sharing and Technology Transfer: Ahmadu Bello University and industries share knowledge, expertise, and resources to drive innovation and technological advancement.

Business Incubators and Accelerators: Ahmadu Bello University and industries partner to establish business incubators and accelerators, providing start-ups with resources, mentorship, and support (Falaiye,2025).

4.3 Problems of University Innovation in Ahmadu Bello University

University innovation in Nigeria faces several challenges, including:

Inadequate Funding: Ahmadu Bello University faces problem of insufficient funding for research and development which hinders innovation (Ariemu,2025).

Limited Resources: Ahmadu Bello University often lack necessary resources, such as modern equipment and technology.

Brain Drain: Many talented researchers and innovators in Ahmadu Bello University leave Nigeria for better opportunities abroad.

Poor Industry-Academia Collaboration: Limited collaboration between Ahmadu Bello University and industries restricts practical application of research.

Regulatory Challenges: Complex regulations and bureaucracy can hinder innovation and entrepreneurship in Ahmadu Bello University.

Inadequate Infrastructure: Ahmadu Bello University often lack necessary infrastructure, such as research facilities and incubators.

Limited Access to Markets: Innovators may struggle to access markets and commercialize their innovations.

Insufficient Training and Capacity Building: Ahmadu Bello University is facing limited opportunities for training and capacity building hinder the development of innovation skills.

Corruption and Inefficiency: Ahmadu Bello University is also bedeviled with problems of corruption and inefficiency which hinder innovation and entrepreneurship. That is why Ahmadu Bello University could not access TETFUND for the past yesteryears

Limited Focus on Practical Applications: The research at Ahmadu Bello University often focuses on theoretical aspects rather than practical applications.

Weak commercialization pathways leave many research projects without structured routes to industry application, while fragmentation and the absence of a centralised platform result in uncoordinated efforts and missed opportunities.

Limited private-sector engagement driven by poor intellectual property protection and unclear commercialization guidelines deters potential investors.

5.1 Conclusion

The Ahmadu Bello university is fostering innovation such as knowledge creation and dissemination, investment on staff human capital development, Ahmadu Bello University was able to train many staff in various disciplines such as arts, humanities, sciences, social sciences and engineering, technology transfer and commercialization, regional development and fostering a culture of innovation. There are many problems affecting innovation in the Ahmadu Bello University such as inadequate capital, limited human resources, brain drain, poor industry-academia collaboration, regulatory challenges, inadequate infrastructure, limited access to markets, insufficient training and capacity building, corruption and inefficiency, limited focus on practical applications, weak commercialization and limited private sector engagement.

5.2 Recommendations

The following are the areas of improvement in order to facilitate innovation in Universities in Nigeria.

i. The finding shows that universities are not adequately funded in Nigeria, therefore stakeholders such as government, private sector, civil societies should support universities with funding in order to facilitate research and development as well as innovation.
ii. Secondly, Universities often lack necessary resources, such as modern equipment and technology. For innovation to occur, there is need for adequate provision of latest technology to facilitate innovation.

iii. There is need for motivation of university staff with a better package because many talented researchers and innovators leave Nigeria for better opportunities abroad. Their salary should be harmonize up to the international standard.

iv. The university should also facilitate collaboration with stakeholders such as government, private sector, civil society and even international development partners.

v. The finding also revealed weak commercialization of university research, therefore, commercialization of research output should be enhance in universities in Nigeria.

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