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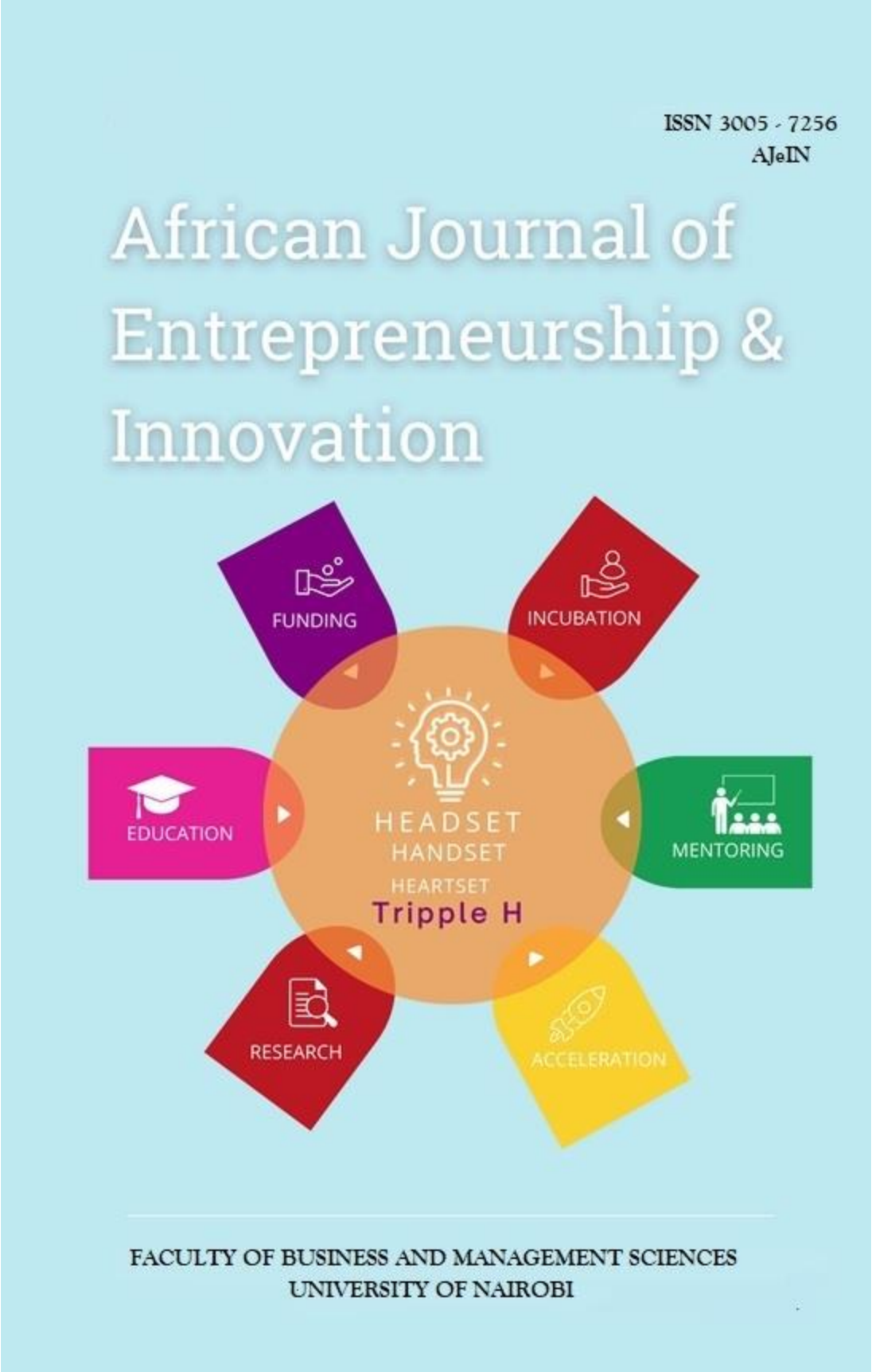

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Research Collaborations in an Academic Entrepreneurial Ecosystem: Insights from a Nigerian University

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Abstract

This study utilizes a developed framework for research collaborations to identify the types of collaborations occurring within a university's entrepreneurial ecosystem with 17 faculties, schools, institutes, a Centre for entrepreneurship development, a directorate of Innovation and Technology, and 9 financial institutions, which include conventional and microfinance banks. The sample consisted of 151 published articles from the proceedings of the 3rd University of Benin Annual Research Conference. Out of the 151 articles, 14 were authored by individuals, 77 were written by authors from the same department, 22 by authors from different departments within the same faculty, 7 articles were produced by authors from different disciplines, 18 articles involved authors from different universities, , 7 articles stemmed from collaborations between university and industry, 4 articles from university-government collaboration and 2 articles from international collaboration. The findings reveal a low level of interdisciplinary and inter-institutional research collaborations. Given the promising nature of the university's entrepreneurial ecosystem, it is recommended that scholars at UNIBEN increase their engagement in interdisciplinary and cross-institutional research collaborations. This approach could enhance the university's innovative capacity and its ranking in research and development.

Key Words: *Interdisciplinary Research collaborations, Entrepreneurial Ecosystem, Innovation*

1. Introduction

Entrepreneurship is about identifying opportunities, harnessing creativity, and driving innovation, usually through research, to create valuable products and services that can solve real-world problems and satisfy human needs and wants. According to Shane and Venkataraman (2000), entrepreneurship is the activity that involves the discovery, evaluation, and exploitation of opportunities to introduce new goods and services that previously did not exist. In the same vein, Kuratko and Hodgetts (2004) defined entrepreneurship as a dynamic process of vision, change, and innovation, which requires an application of energy and passion towards the creation and implementation of new ideas and creative solutions. In the face of the complexity and enormity of meeting global needs and challenges in various aspects of life, Van de Ven (1993), observed that individual entrepreneurs cannot command all the resources, institutions, markets, and business functions that are required to develop and commercialize their entrepreneurial ventures; hence the integration of the relevant resources into an efficient and effective system known as an entrepreneurial ecosystem.

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Entrepreneurship has been globally embraced as the backbone of national development and a key factor in solving a myriad of socio-economic problems, such as unemployment, low human capital, poverty, and low gross domestic product (GDP). While Nigeria has embraced the concept of entrepreneurship and made entrepreneurship development a compulsory item in the curricula of all federal universities, the desired outcomes of improved technological development, increased business startups, low level of unemployment, reduced poverty level and enhanced national development are yet to fully materialize, thus creating a big gap between theory and practice (Uwumbanwen & Obeki, 2019). This gap has been attributed to a lack of systematic integration of the relevant entrepreneurial resources to form a practical and functional entrepreneurial ecosystem, from which high-utility, high-technological and commercial sable products can be created, as is the case with Stanford University's Silicon Valley, which is the global epicentre of technological advancement (Stam and Van de Ven, 2021).

Entrepreneurial ecosystems, according to Isenberg (2010), "are interactive networks of knowledge-based, creative, and business-oriented actors and factors that influence and complement each other to create innovative products and services.' In other words, Stam (2015) posited that an entrepreneurial ecosystem is a set of interdependent actors and factors that lead to productive and innovative entrepreneurial activities in a particular region. Universities, being research and knowledge-based institutions, have been known to play significant roles in creating, enhancing, and driving entrepreneurial ecosystems within their environments or locality (Van de Ven, 1993; Stam, 2015). According to Stam and Van de Ven (2021), entrepreneurship is a collective achievement that requires the participation of other entrepreneurs, policy makers, knowledge-based institutions, commercial institutions, and investors in both the public and private sectors to create an entrepreneurial ecosystem that facilitates creativity, innovation and business startups.

1.1 Academic Entrepreneurship Ecosystems (AEE)

An academic entrepreneurial ecosystem (AEE) is an entrepreneurship ecosystem that is centered within an academic institution and involves research and various entrepreneurial activities that affect its staff, students, and the surrounding community. This concept promotes collaboration among different faculties, departments, and units within the institution to integrate entrepreneurship. By doing so, it fosters innovation, encourages breakthroughs, drives economic growth, creates jobs, and generates a positive impact on society. Etzkowitz (2003) defines AEE as an interconnected web of

relationships among universities, research institutions, industry partners, government agencies, and entrepreneurial support organizations that facilitate the creation, growth, and success of entrepreneurial ventures"(Etzkowitz, 2003, p. 296).

In 2007, Rothaermel et al. further expanded the definition as a complex system that comprises various actors, including universities, research centers, incubators, accelerators, and industry partners, which interact and collaborate to facilitate the creation and growth of entrepreneurial ventures (Rothaermel, Agung, & Jiang, 2007).

However, Wright, Piva, Mosey, and Lockett (2017), further defined AEE as a network of interconnected components, including universities, research institutions, industry partners, government agencies, and entrepreneurial support organizations, that work together to foster entrepreneurship, innovation, and economic development.

From the definitions above, the key elements of AEE are (1) to drive and support academic research that can bring about innovative and impactful findings that can be translated into entrepreneurial ventures or commercial sable products, (2) to provide resources, funding, and mentorship to academic researchers and entrepreneurs, (3) to facilitate industry-academia collaborations and knowledge transfer, and (4) to drive economic growth, job creation, and societal impact.

Furthermore, Etzkowitz (2003), Grimaldi, Kenney, Siegel, and Wright (2011), and Wright et al. (2017), revealed the key components of an Academic Entrepreneurial Ecosystem to include (1) Academic Institutions: Universities, research centers, and colleges that provide the foundation for research, innovation, and entrepreneurship, (2) Research and Innovation: The generation of new ideas, technologies, and products that can be translated into entrepreneurial ventures, (3) Entrepreneurial Support Organizations: Incubators, accelerators, coworking spaces, and other organizations that provide resources, funding, and mentorship to academic entrepreneurs, (4) Industry Partners: Companies that collaborate with academic institutions provide funding, and offer expertise to support the development of entrepreneurial ventures, (5) Government Agencies: Organizations that provide funding, policies, and regulations that support the development of AEEs, and (6) Mentorship and Networking: Opportunities for academic entrepreneurs to connect with experienced entrepreneurs, investors, and industry experts.

1.2 Conceptual Framework

The general system theory by Ludwig von Bertalanffy (1968, cited in Froehlich,2019) is adopted as the conceptual framework of this study based on the principle that a system works better when its parts are identified, understood and integrated in the context of the relationships with each other and with other systems, rather than in isolation (Froehlich, 2019). An entrepreneurial ecosystem, like any other system, will be studied under the Systems theory, which asserts that every system has causal boundaries, is influenced by its context, defined by its structure, function and role, and expressed through its relations with other systems, and noted that a system is "more than the sum of its parts" by expressing synergy or emergent behaviour (Bertalanffy (1968, cited in Froehlich, 2019).

2. Literature Review

2.1. Entrepreneurial Ecosystems

The entrepreneurial ecosystem as an idea emerged in the 1980s in the realization of the complementary nature of entrepreneurship infrastructures and resources, thereby moving entrepreneurship away from its hitherto narrow individualistic model to a broader group or community-based model for a better outcome (Aldrich 1990; Nijkamp 2003). This idea is rapidly growing and producing huge results across the developed world, but this seems not to be the case in the developing world, including Nigeria.

Factors that shape entrepreneurial ecosystems include universities, industry clusters, and government policies. Universities contribute by fostering entrepreneurship education and technology transfer. Using the Silicon Valley innovation ecosystem where UC Berkeley, Stanford, and UC San Francisco universities helped in creating the highly successful Silicon Valley innovation business hub, universities, as a research hub, have been shown to play a crucial and unique role in entrepreneurship ecosystems (Spigel & Harrison, 2018). For maximum efficiency and functionality, Spigel and Harrison (2018) proposed that an entrepreneurial ecosystem should be located within a specific boundary where the actors and factors can be easily identified and coordinated.

Although work on entrepreneurial ecosystems is still developing, there are already empirical studies showing how university–related, or university-based entrepreneurial ecosystems have enabled high-growth entrepreneurship development and significant value creation at campus, regional and national levels. For example, Spigel and Harrison's (2018) study of entrepreneurial ecosystems in Waterloo

and Calgary, Canada, discovers that while ecosystems' structures and origins are different based on the product, service, or region they intend to serve, their success lies in their ability to create a cohesive social and economic system that supports the creation and growth of new ventures. Similarly, study of such highly developed economic regions as the Silicon Valley in Northern California, USA, that serves as a global centre for high technology and innovation and Route 128, a region in Massachusetts in Arizona USA that is notable for startups specialising in defense and high technology products, revealed that these regions leveraged their popularity and success on the research from the regions' higher education system such as the Stanford University and the Massachusetts' Institute of Technology, respectively (World Economic Forum, 2013). In the same vein, Stam (2015) explored the entrepreneurial successes in Phoenix, Arizona, and discovered a strong link between a strong entrepreneurial ecosystem, a strong entrepreneurial culture, supportive public policies, and strong institutional engagement.

Drawing from the thriving entrepreneurial ecosystems' stories of Stanford University and the Silicon Valley project in Arizona, USA (Stam & Van de Ven, 2018), it became evident that universities, being centres of knowledge, creativity, and infrastructure, have a lot to do with creating and promoting entrepreneurial ecosystems through research collaborations both internally and externally. Therefore, this study aims to gain insight from a Nigerian university on the entrepreneurial ecosystem, collaborative research and innovation capacity.

2.2 Research Collaborations

Research is defined as the systematic investigation into the study of materials and sources to establish facts and reach new conclusions (Oxford Dictionary, 2024) and can be classified into basic academic research and professional research. While basic academic research seeks to expand knowledge, professional research aims to address real-world challenges (Boell, 2013; Creswell, 2014). Both play crucial roles in advancing our understanding and improving practices, and both types of research are carried out within an entrepreneurial ecosystem. However, this study sought to ascertain the most relevant type of research that will enhance the functionality of an entrepreneurial ecosystem, and which should attract the most collaboration and funding.

Al Masud (2024) defined collaborative research as a partnership between two or more parties who work together to achieve common goals. The COVID-19 pandemic, HIV/AIDS and other previous

pandemics have made research collaborations more critical and imperative, especially in solving complex problems that evolve every day globally (Hays, 2005; Envuladu, Miner & Agho, 2022). Collaboration enables researchers from different backgrounds, such as industry and academia, to come together to address a problem, usually of multidimensional significance (Wuchty et al., 2007).

According to Al Masud (2024), while research is the foundation for forming knowledge, collaboration is a strategy to deal with situations that seem challenging to solve individually and for developing solutions that can have a significant impact on society. For example, a business or government might partner with a university to research nuclear power or cancer treatment. In this case, the business organization or government can provide the finances and resources for research, while the university can provide the academic knowledge, theories, and expertise needed to analyze the data and draw meaningful conclusions that will enable an innovative solution to be obtained.

Therefore, this study aims to identify, categorize and discuss the different types of research in a Nigerian university entrepreneurial ecosystem to ascertain their innovation potential, as the main goal of every entrepreneurial ecosystem is innovation.

2.3 Types of Research Collaborations

Different scholars have identified different types of research collaborations. However, understanding the different types of collaborative research and how they can contribute to advancing knowledge in various fields will help to appreciate the value of collaborative research and its potential for creating positive, innovative changes in the world (Al Masud, 2024).

Al Masud (2024) identified two broad types of collaborative research, namely homogenous and heterogeneous collaborations. Homogeneous research involves individuals or groups that share similar backgrounds or perspectives, while heterogeneous research involves individuals or groups with diverse backgrounds and perspectives. A collaborative research team is considered homogenous when the research team members are similar in terms of their backgrounds, expertise, and research interests. This type of collaborative research can be beneficial because team members may share similar perspectives and approaches to research, which can lead to more efficient and effective collaboration (Al Masud, 2024).

On the other hand, heterogeneous collaboration involves team members with diverse backgrounds, expertise, and research interests. While this type of collaboration can be more challenging, it can also lead to more innovative and creative research outcomes. Heterogeneous teams can bring different perspectives and ideas to the table, which can lead to new insights and approaches that might not have been possible with a more homogeneous team (Al Masud, 2024).

However, Springer Nature (2023), identified five types of research collaboration, which are (1) Collaboration within an academic institution: This type involves various configurations of faculty, staff, administrators, and students working together on research projects within the same institution. This setup allows for easy communication and face-to-face meetings, facilitating progress and adjustments. (2) Collaboration with other academic institutions: This type involves researchers from different institutions working together on a project, often with a primary investigator inviting junior researchers to collaborate. This collaboration promotes mutual benefits, such as sharing resources and expertise. (3) Collaboration with a government entity: This type involves policymakers and researchers working together to address common concerns or questions. Government agencies may provide funding or resources, while researchers offer expertise to inform policy decisions. (4) Collaboration with private industry: This type involves researchers partnering with private companies to develop new products, technologies, or services. This collaboration promotes innovation and can lead to groundbreaking discoveries. (5) Collaboration with international researchers: This type involves researchers from different countries working together on a project, often facilitated by global conferences, study abroad programs, or online platforms. International collaboration broadens cultural perspectives, increases the pool of research data, and fosters global solutions.

2.4 Research Collaboration and Entrepreneurship Ecosystem

Etzkowitz (2003), Bercovitz and Feldman (2006) observed that research collaboration in a university's entrepreneurial ecosystem with diverse faculties and resources can significantly impact innovation in several ways by combining expertise from various fields to promote innovation, facilitate the exchange of ideas, and resources, and instil an entrepreneurial mindset among researchers to think creatively and develop innovative solutions. In the same vein, Leydesdorff and Etzokowitz (1996), Siegel and Wright (2015) noted that research collaboration provides opportunities for researchers to connect with potential partners, investors, and mentors, expanding their professional networks and developing innovative products. They also submitted that interdisciplinary collaboration could facilitate the

identification and solving of complex problems, leading to innovative solutions, and accelerate the development of prototypes, testing, and validation, reducing the time-to-market for innovative products and services.

Etzkowitz (2003), in his triple helix model of university – industry - government entrepreneurial ecosystem, noted the university's role to include the provision of infrastructure, resources, and facilities to support research collaboration and innovation, the development of programs, courses, and workshops to teach entrepreneurship skills, supporting researchers in commercializing their innovations, and promote collaborative academic research that could produce breakthroughs and contribute to knowledge in different areas of human endeavour.

2.5 Empirical Review

Several studies have been conducted on entrepreneurial ecosystems and research collaborations globally. However, for this study, whose focus is on entrepreneurial ecosystem and research collaborations in a Nigerian university, we have limited our empirical review to studies conducted in Nigeria by Nigerian academics, and four of such studies were reviewed as follows:

Oyelaran-Oyeyinka and Adebowale (2012) conducted a study on university-industry collaboration as a determinant of innovation in Nigeria. Using notable research institutes and selected universities in Nigeria, they examined the types, intensity, and impact of collaboration and learning between universities and research institutes. The findings, which were arrived at through descriptive statistics and Probit regression analysis, revealed that the size of the research institute, its available infrastructure and human capability through the availability of grants and knowledge base, influence the types and intensity of collaboration and the resulting level of innovation. The study encourages university-industry research collaboration. However, the study did not examine the level of collaboration between the academic entities within the university's entrepreneurial ecosystem.

Ogunsola (2011) investigated the impact of research collaboration on academic productivity in Nigerian universities. Using a survey of 150 academics from five Nigerian universities, the results showed that research collaboration had a significant positive impact on academic productivity, measured by the number of publications, citations, and research grants. The study also found that the frequency and quality of research collaboration were significant predictors of academic productivity.

While this finding is true, however, identifying the factors that promote or retard research collaborations within a university would provide a better insight into the challenges facing academic productivity.

Adelowo, Ilevbare, and Morufu (2022) researched collaboration, networking and research productivity in Nigeria's research institutes. The study utilised a cross-sectional survey with data collected from a total of 1611 senior researchers, scientists and engineers in seventeen research agencies/institutes in Nigeria. The results showed that internal collaborations among researchers and scientists were high, and the purpose of collaboration included research engagement, grantsmanship writing and journal publications. The findings also revealed that most researchers engaged in external collaboration, particularly with other research institutes, Universities and Polytechnics, with a significantly positive effect of collaboration on research productivity.

Obeki and Oshio (2025) developed a categorisation framework for research collaborations in Nigerian universities and used the framework to assess the innovative potential of the universities. In the study, a total of 1946 articles that were published in 139 Nigerian journals from the 274 universities in Nigeria (Statista, 2024) were assessed, categorised into 8 groups of research collaborations, labelled C1 to C8, as shown below:

C1 Collaboration: Single authorship (No collaboration. Research carried out by a single author in a department)

C2 Collaboration: Intra-departmental Collaboration (Research collaboration between two or more authors in the same department).

C3 Collaboration: Inter-departmental collaboration (Research collaboration between two or more authors from different departments within the same faculty)

C4 Collaboration: Inter-faculty/inter-disciplinary collaboration (Research collaboration between two or more authors from different faculties/disciplines, e.g., Law and Medicine)

C5 Collaboration: Inter-university collaboration (Research Collaboration between authors from two or more different universities or tertiary institutions)

C6 Collaboration: University-industry collaboration (Research collaboration between a university/tertiary institution and a private/public company)

C7 Collaboration: University-government collaboration (Research collaboration between a university and a government agency/research institute).

C8 Collaboration: International collaborations: Research collaboration between scholars/organisations from Nigerian universities and foreign universities.

Underlying Assumptions: The study based its findings on underlying assumptions from empirical evidence provided by several authors (Etzkowitz, 2003; Isenberg, 2010; Stem & Van de Ven, 2021; Springer Nature, 2023; Al Masud, 2024):

(a) A higher frequency of C1 and C2 collaborations often results in more localized research outcomes, limiting the prospects for obtaining resources necessary for innovation and impactful advancements.

(b) Increased interdisciplinary (C4) collaborations lead to greater access to cross-disciplinary knowledge and resources, fostering impactful results and driving innovation.

(c) Collaborations at the inter-university (C5), university-industry (C6), university-government (C7), and international levels (C8) enhance the potential for securing resources, gaining interdisciplinary insights, and achieving economic, technological, and innovative growth for the involved institutions and nations.

(d) Greater engagement in C4 through C8 collaborations leads to more impactful research outputs, higher publication rates in renowned journals, and improved university rankings in research, development, and innovation.

2.6 Research Questions

This study used the C1-C8 groupings to categorize the collaborative research in the University of Benin entrepreneurial ecosystem and used the above-listed underlying assumptions to answer the following research questions:

(a) What are the characteristics of research collaborations in the university entrepreneurial ecosystem, and how can they be categorized into the C1–C8 groups?

(b) Which research collaboration group (C1–C8) is the most prevalent within the university entrepreneurial ecosystem?

2.7 Hypotheses

From the two research questions above, only one is hypothesis-driven, while the other one is more exploratory and can be answered through the frequency distribution. Therefore, the following overarching null hypothesis was formulated and tested concerning the research questions:

The level of research collaboration within the university's entrepreneurial ecosystem is not significant

3. Research Methodology

3.1 The research station: The University of Benin, Nigeria

The University of Benin, Benin City, Nigeria, where the two authors work as academic staff, was chosen as the research station for its entrepreneurial ecosystem. The University of Benin was founded on Saturday, 23rd November 1970, to be a model of higher learning in the area of academic and research excellence. Today, the University has produced over 350,000 graduates and boasts 17 faculties, schools, and institutes with 130 academic disciplines, ranging from Agriculture, Engineering, Medicine, Arts, and Management Science to Education (UNIBEN Convocation Brochure, 2023). The University is surrounded by other universities, colleges of education, polytechnics and industrial organisations that form a veritable structure for inter- and multi-disciplinary research collaborations. In addition, the University of Benin is a prominent beneficiary of the Tetfund grants (both Institution based and national research funds) (TETFUND, 2024).

3.2 Population

The population consisted of all the 151 published research articles in the Book of Proceedings of the University of Benin Annual Research Conference. The University of Benin Annual Research Conference promotes and showcases the research efforts and outputs of the university's academics and allows all academic staff of the University to participate in the conference.

3.3 Sample size

The University of Benin Annual Research Day (UBARD, 2018) Conference is an event that allows all academic staff of the University to participate and publish their research findings. We randomly selected one out of the three books of proceedings of the UBARD conferences, and we picked the 3rd UBARD Conference proceedings, held in 2018 for this study. The book contained 151 published articles by UNIBEN academics, which formed the sample size for this study.

3.4 The Research Instrument

This is desk research, or documentary research as it relied on the data that has already been published in the Book of Proceedings of the 3rd edition of the University of Benin Annual Research Day Conference.

4. Results and Discussions

4.1 Type and Frequency of Collaborations

Using the categorization framework created by Obeki and Oshio (2025), the type and frequency of research collaborations in the 151 articles assessed for this study are presented in Table 1 below:

Table 1: Type and Frequency of Collaborations

Type of Research Collaboration	Frequency	Percentage
C1(Single authorship)	14	9.3
C2 (Intra-Departmental)	77	51.0
C3 (Inter-departmental)	22	14.6
C4 (Interdisciplinary/faculty)	7	4.6
C5 (Inter-University)	18	12.0
C6 (University-Industry)	7	4.6
C7 (University-Government)	4	2.6
C8 (International)	2	1.3
TOTAL	**151**	**100 %**

Source: Authors' Fieldwork (2025).

4.1.1. Discussion

The Table 1 below categorizes research collaborations within the University of Benin's entrepreneurial ecosystem into eight types (C1- C8), highlighting their frequency and percentage:

Table 1: Frequency Table

Type of Research Collaboration	Frequency	Percentage
C1(Single authorship)	14	9.3
C2 (Intra-Departmental)	77	51.0
C3 (Inter-departmental)	22	14.6
C4 (Interdisciplinary/faculty)	7	4.6
C5 (Inter-University)	18	12.0
C6 (University-Industry)	7	4.6
C7 (University-Government)	4	2.6
C8 (International)	2	1.3
TOTAL	**151**	**100 %**

Source: Authors' Fieldwork, 2025

From Table 1 above, the following research collaborations were observed:

(i). C1: Single Authorship (No Collaboration) - Independent research within a department. Frequency: 14 (9.3%).

(ii). C2: Intra-departmental collaboration - Research among authors from the same department. Frequency: 77 (51.0%).

(iii). C3: Inter-departmental collaboration - Collaboration between departments within the same faculty. Frequency: 22 (14.6%).

(iv). C4: Interdisciplinary/Inter-Faculty Collaboration - Cross-faculty or cross-discipline research. Frequency: 7 (4.6%).

(v). C5: Inter-University Collaboration - Research between authors from different universities. Frequency: 18 (12.0%).

(vi). C6: University-Industry Collaboration - Partnerships with private organisations. Frequency: 7 (4.6%).

(vii). C7: University-Government Collaboration - Collaborative research with government agencies. Frequency: 4 (2.6%).

(viii). C8: International Collaboration - Research with entities in different countries. Frequency: 2 (1.3%).

4.2. Analysis

Research Question 1: Characteristics and Categorization of Research Collaborations:

The research collaborations are categorized into eight types (C1-C8), ranging from single authorship (C1) to international collaborations (C8). Each type represents a different level of collaboration, from intra-departmental to interdisciplinary and international partnerships.

Research Question 2: Most Prevalent Research Collaboration Group:

According to Table 1, the most prevalent research collaboration group is C2 (Intra-Departmental Collaboration), with a frequency of 77 and a percentage of 51.0%.

The underlying assumptions suggest that higher frequencies of C1 and C2 collaborations often result in more localized research outcomes, limiting the prospects for obtaining resources necessary for innovation and impactful advancements. Therefore, while C2 is the most prevalent, its innovative potential may be limited compared to other types of collaborations like C4 (Interdisciplinary) and C5-C8 (Inter-University, University-Industry, University-Government, and International) which are associated with greater access to resources and interdisciplinary insights.

4.3. Research Hypotheses:

4.3.1. Hypothesis One: The level of research collaboration within the university's entrepreneurial ecosystem is not significant:

Table 2. Chi-Square Table

Option	**O**	**E**	**O – E**	**$(O - E)^2$**	$\frac{(0 - E)^2}{E}$
C1(Single authorship)	14	18.9	-4.9	24.01	1.27
C2 (Intra-Departmental)	77	18.9	58.1	3,375.61	178.6
C3 (Inter-departmental)	22	18.9	3.1	9.61	0.50
C4 (Interdisciplinary/faculty)	7	18.9	-11.9	141.61	7.49
C5 (Inter-University)	18	18.9	-0.9	0.81	0.04
C6 (University-Industry)	7	18.9	-11.9	141.61	7.65
C7 (University-Government)	4	18.9	-14.9	222.01	11.74
C8 (International)	2	18.9	-16.9	285.61	15.11
TOTAL	151				$\sum X^2 = 222.4$

Source: Computed from Field Survey, 2025

X^2 calculated value = 222.4

Table value = 9.49

When X^2 Calculated < X^2 table value, reject H_1

Level of significance = 0.05 or 5%

Df = degree of freedom 8 – 1 = 7

X^2 = 14.1 (value on the table)

Since the calculated X2 (222.4) is higher than the table value or critical value at df = 7 and a 0.05 level of significance, we reject the null hypothesis that the level of research collaboration within the university's entrepreneurial ecosystem is not significant. Furthermore, the data in Table 3 shows a total of 151 collaborations, with a significant number being intra-departmental (C2) and inter-departmental (C3) collaborations. This indicates a moderate level of collaboration within the university's entrepreneurial ecosystem, suggesting that the hypothesis may not hold true.

5. Conclusion and Recommendations

5.1. Conclusion

The study reveals a preponderance of C1 and C2 (Single authorship and Intra-Departmental Collaborations) with limited innovative potential in the University, which is partly due to the need to publish to meet the criteria for promotion. However, this has several implications for the university's entrepreneurial ecosystem as follows: (1) Higher frequencies of C1 and C2 collaborations often result in more localized research outcomes. This means that the research conducted within the same department may not have the broader impact or reach that interdisciplinary or international collaborations might achieve. (2) The limited innovative potential in C2 collaborations restricts the prospects for obtaining resources necessary for innovation and impactful advancements. This can hinder the ability to secure funding, access cutting-edge technology, and attract top-tier talent. (3) Intra-departmental collaborations may lack the interdisciplinary insights that come from collaborations involving different faculties or disciplines. This can limit the scope of research and the ability to address complex, multifaceted problems.

On the other hand, greater engagement in interdisciplinary (C4) and inter-university (C5- C8) collaborations lead to more impactful research outputs, higher publication rates in renowned journals, and improved university rankings in research, development, and innovation. Indeed, collaborations at the inter-university (C5), university-industry (C6), university-government (C7), and international levels (C8) have been shown to enhance the potential for achieving economic, technological, and innovative growth for the involved institutions and nations, and should be encouraged and duly supported in the University.

5.2 Recommendations

Entrepreneurial ecosystems fired by interdisciplinary and cross-institutional collaborations are the basic ingredients in the 21st-century innovative products and services, which every university, including the University of Benin, should imbibe. Therefore, to enhance the quality, relevance, and impact of research in the University of Benin, and by implication, any other university in Nigeria, we strongly recommend that university academics prioritise interdisciplinary research collaborations over single authorship and intra-departmental research. This approach will facilitate the integration of diverse perspectives, methods, and expertise, leading to more comprehensive and innovative solutions to complex problems.

Indeed, the rationale for interdisciplinary research collaboration becomes more compelling given the complexity of real-world problems such as climate change, pandemics, economic inequality, new strains of disease-causing bacteria and viruses, etc., which require broad perspectives, specialized technology and methodological expertise to deal with. Collaborative research across disciplines can foster Innovative solutions through the integration of diverse perspectives and methods, enhance research quality through rigorous peer review and critique, increase research impact through the development of practical, applicable solutions, and improve research funding opportunities through the demonstration of interdisciplinary collaboration.

To achieve the benefits of collaborative research in the university's entrepreneurial ecosystem, we recommend that the University of Benin do the following:

1. Incentivise researchers to collaborate across departments and disciplines by providing resources and support for joint research projects and giving articles arising from collaborative research more points than those from single authorships
2. Establish programs that bring together researchers from diverse disciplines to tackle complex problems, providing a framework for collaboration and knowledge sharing.
3. Offer training and development programs that help researchers develop the skills and competencies necessary for effective interdisciplinary collaboration.
4. Develop funding schemes that prioritise interdisciplinary research collaborations, providing financial support for joint research projects.
5. By prioritising interdisciplinary research collaborations, the University of Benin can develop more innovative, comprehensive, and impactful solutions to complex problems, ultimately enhancing the quality and relevance of its rich entrepreneurial ecosystem.

5.3 Acknowledgements

We sincerely acknowledge the Editorial Board of the 3rd University of Benin Annual Research Day publication, which formed the key secondary data for this study.

5.4 Recommendations for Future Research

Utilizing data from UBARD 2018 is now historical, as the recent UBARD 2024 edition has taken place. Therefore, we recommend conducting a study on the types of research collaborations present in UBARD 2024, allowing for a comparison with the 2018 findings. This comparison will offer

valuable insights into the progress made by the University of Benin in research collaborations over the past seven years.

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