AFRICALICS

THE AFRICAN NETWORK FOR ECONOMICS OF LEARNING, INNOVATION, AND COMPETENCE BUILDING SYSTEMS

BIBLIOMETRIC ANALYSIS OF SCHOLARLY OUTPUTS AND COLLABORATIONS FROM THE AFRICALICS *PHD ACADEMY PROGRAMME* (2015–2024) REPORT

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AfricaLics PhD Academy Programme

1. Background and Rationale

The AfricaLics PhD Academy Programme is an initiative under the AfricaLics (African Network for Economics of Learning, Innovation and Competence Building Systems) umbrella, designed to support the training of African doctoral students engaged in the emerging field of Innovation and Development. This multidisciplinary social science research area intersects innovation studies and development studies and remains underrepresented within the African higher education and research landscape. As such, the PhD Academy serves a strategic purpose in nurturing the next generation of African scholars equipped to interrogate and advance context-sensitive approaches to innovation, policy, and sustainable development.

Since its inception in 2012, the AfricaLics PhD Academies have sought to address capacity constraints in African innovation scholarship by creating an intellectually rich environment that bridges global expertise and local relevance. The Academies are held face-to-face or virtually, depending on the availability of funds. Academies are hosted in or by different African countries/organisations working closely with AfricaLics, and they adopt a competitive, merit-based selection process to identify early-career researchers working on innovation-related issues from across the continent. In face-to-face PhD academies, the selected participants receive intensive training through a two-week residential programme that blends lectures, paper presentations, peer discussions, and site visits to innovation hubs or enterprises. The virtual PhD academies have been of shorter duration (3 – 5 days) but have still provided the students with lectures on I&D issues as well as possibilities to present their own work and get feedback from senior I&D scholars. An overview of all AfricaLics PhD academies conducted during the period covered by this report is included as Annex 1.

A key feature of the PhD Academies is their emphasis on research mentorship, enabling PhD students to present their work and receive detailed, structured feedback from internationally renowned and African-based scholars. This process not only enhances the academic quality of participants' doctoral research but also helps to embed their work within broader theoretical and policy discourses. The inclusion of advanced research methods training and innovation policy seminars further strengthens the participants' conceptual and analytical capacities. Given the growing demand for evidence-based assessments of capacity-building interventions, a systematic evaluation of the academic outputs of AfricaLics PhD Academy alumni is both timely and essential.

This report presents a bibliometric analysis of the publication outputs and research collaborations of AfricaLics PhD Academy participants between 2012 and 2024. The aim is to assess how the programme has influenced the scholarly productivity, intellectual development, and collaborative networks of its alumni, with particular attention to their contributions to the field of innovation and development from an African perspective.

1.1 Objectives of the Study

This report forms part of a broader bibliometric exercise covering results obtained through the AfricaLics Research Capacity Building (RCB) Programme from 2012 to 2024. It focuses specifically on the AfricaLics PhD Academies.

The primary objectives of this bibliometric analysis are:

1. To assess the scholarly productivity of AfricaLics PhD Academy alumni, with a focus on peer-reviewed journal articles, book chapters, and other academic outputs published between 2012 and 2024.
2. To analyse the thematic orientation of Academy alumni publications, with particular attention to how their research aligns with the innovation and development agenda in Africa.
3. To evaluate the academic influence of AfricaLics PhD academy alumni's research through citation metrics and patterns of scholarly dissemination.

2. Methodology

This study employed a mixed-methods approach to assess the scholarly productivity, collaborative patterns, and academic development of **participants in the AfricaLics PhD Academy Programme between 2012 and 2024.** The methodology integrated both quantitative and qualitative techniques to provide a comprehensive evaluation of how the Academy has contributed to research capacity building within the African innovation and development studies community.

The quantitative component of the analysis focused primarily on bibliometric techniques. A bibliometric analysis was conducted to map and evaluate the peer-reviewed publication outputs of former PhD Academy fellows. This involved identifying the number, types, and thematic focus of academic publications authored or co-authored by alumni, with an emphasis on journal articles, and book chapters. A total of 171 articles were identified, of which 91% were based on presentations made during the AfricaLics PhD Academies. Citation analysis was also undertaken to assess the academic impact of these publications, using indicators such as citation counts.**Co-occurrence analysis**

Co-occurrence analysis was also employed to examine the frequency and patterns of author keywords appearing together across the publications by AfricaLics PhD Academy fellows included in the analysis. This method helps to identify thematic relationships and research

clusters within the body of scholarly output. Using bibliometric software, the co-occurrence of keywords was mapped to visualize intellectual linkages and emerging research trends. The resulting clusters reflect shared conceptual focus areas, enabling a deeper understanding of the thematic orientation and evolution of research interests among fellows. This approach provides insights into the collective knowledge structure and highlights dominant and emerging themes in the AfricaLics research ecosystem.

Co-authorship analysis

Co-authorship analysis was employed to explore patterns of academic collaboration among AfricaLics PhD Academy fellows. This method involves mapping and visualizing relationships between authors based on their shared publications most especially that which came directly from the presentations made during the AfricaLics PhD Academies, providing insights into the structure and intensity of research networks within and beyond the AfricaLics community. By identifying clusters of co-authored works, the analysis reveals key collaborative groups, the extent of intra- and inter-country partnerships, and the thematic focus areas around which these partnerships have formed.

2.1 Data Sources

To further contextualise and enrich the quantitative findings, a structured online survey was administered to former AfricaLics PhD Academy participants. The survey aimed to capture data on the number and type of peer-reviewed publications produced by each respondent, specifically those resulting from their participation in AfricaLics PhD academies. To maximise the response rate and ensure diverse representation across different Academy cohorts, follow-up reminders were sent via email to all alumni. Responses from the survey were analysed using descriptive and non-parametric statistics, enabling the integration of both numerical and narrative insights into the report.

The analysis drew on multiple data sources to ensure robustness and triangulation. nternal records provided by the AfricaLics Secretariat, including participant lists and contact information, were used to identify and verify alumni to be contacted for the survey. To complement survey responses, an extensive bibliometric search was then conducted across several academic databases, including Google Scholar, Scopus, ResearchGate, and African Journals Online (AJOL). These platforms were selected to ensure a wide coverage of both international and regionally published academic outputs, particularly those that may be underrepresented in global indexing services. Manual verification was undertaken to confirm authorship, affiliation, and publication accuracy, and to avoid duplication or erroneous attributions.

Taken together, this mixed-methods design provided a rich dataset for understanding the scholarly contributions and academic pathways of AfricaLics PhD Academy alumni. It also offered a basis for assessing how the programme has fostered research aligned with African innovation and development priorities, while strengthening intellectual networks across the continent and beyond.

2.2 Data Analysis

The data analysis phase of the study involved systematic cleaning and organization of publication records collected through bibliometric searches and survey responses. Duplicate entries were carefully identified and removed, and all publication data were formatted to ensure consistency across sources and cohorts. This clean data set formed the basis for subsequent quantitative and qualitative analyses.

To examine publication performance, descriptive statistical measures were applied. These included calculations of the total number of publications per fellow, average number of articles produced per cohort, and citation counts. The dataset was further disaggregated by gender, institutional affiliation, and geographical region to explore trends and identify variations in scholarly output across different categories of participants. This disaggregation helped to surface patterns related to inclusion, representation, and regional diversity within the AfricaLics PhD Academy alumni network.

In order to assess the thematic breadth and focus of fellows' research, each identified publication was reviewed and classified into key domains within the broader field of innovation and development studies. These thematic categories included agricultural innovation, low-carbon development pathways, sustainable energy transitions, science, technology and innovation (STI) policy and governance, gender and innovation, and the integration of indigenous knowledge systems. This classification enabled the study to reflect critically on the extent to which the PhD Academy programme has supported research that is aligned with inclusive and transformative innovation agendas across Africa.

2.3 Co-authorship Analysis

The co-authorship analysis was employed to examine the patterns of research collaboration among fellows and their networks. This approach involved mapping close 170 co-authored publications of fellows to understand the extent, diversity, and nature of academic partnerships developed during or after their engagement with the Academy. By analyzing co-authorship, we identified cross-country and cross-institutional collaborations, including partnerships between fellows and senior researchers or mentors, many of whom are part of the AfricaLics network. This method helps to assess the Academies role in fostering South-South and South-North research linkages, promoting knowledge exchange, and building enduring research communities

that align with AfricaLics' objective of strengthening innovation and development-oriented scholarship in Africa.

2.4 Co-occurrence Analysis

To explore the thematic focus and intellectual structure of research emerging from the AfricaLics PhD Academy, a co-occurrence analysis of keywords was conducted. This method identifies and visualizes the frequency and patterns with which key terms appear together across a set of publications, revealing dominant research themes, areas of convergence, and emerging topics.

Using bibliometric tools, keywords were extracted from the titles of identified peer-reviewed articles authored by AfricaLics fellows. The analysis enabled the mapping of clusters that reflect shared research interests, such as innovation systems, sustainable development, technological learning, and inclusive innovation. These clusters provide insight into how AfricaLics-supported research aligns with the network's strategic agenda of strengthening capacity in science, technology, and innovation (STI) policy studies in Africa. The co-occurrence analysis thus serves as both a diagnostic and reflective tool, highlighting the coherence of the Academy's research output while also identifying knowledge gaps and opportunities for future scholarly collaboration.

2.5 Citation Analysis

As part of this study, citation analysis was conducted to evaluate the scholarly impact of research produced by fellows of the AfricaLics PhD Academy. Citation counts were used as a proxy for academic influence and knowledge dissemination, helping to identify which publications have gained significant recognition within the global scholarly community. This approach provides insight into the visibility and relevance of the fellows' work in addressing innovation and development challenges in Africa. The analysis focused on peer-reviewed journal articles authored by AfricaLics PhD Academy participants, capturing citation data from publicly available databases such as Google Scholar. By linking citation metrics with thematic relevance and geographical focus, the analysis helps assess how well AfricaLics is achieving its objective of building research capacity that contributes meaningfully to innovation systems and policy development in Africa. Citation analysis was conducted using data primarily sourced from Google Scholar, ResearchGate and Scopus. Both total citation counts and average citations per publication were used as proxies for scholarly visibility and academic influence.

2.6 Limitations of the Study

While the report offers important insights into the academic outputs of AfricaLics PhD Academy alumni, several limitations should be considered when interpreting the findings.

Firstly, the survey did not receive responses from all former participants in AfricaLics PhD Academies. Although a majority participated, some, particularly from more recent cohorts, did not respond, often due to delays in publishing or ongoing doctoral work. This incomplete response coverage means the results may not fully represent the entire population of Academy participants.

Secondly, there is a possibility of underreporting of publications in the survey data. Some respondents may have inadvertently omitted relevant outputs or failed to attribute them to their participation in the PhD Academy, either due to memory limitations or uncertainty about the connection between their work and the programme.

Thirdly, the citation data used in the analysis were drawn mainly from Google Scholar, which, although widely accessible and inclusive, may overestimate scholarly impact by capturing duplicate entries. This introduces some variation when compared to more selective databases like Scopus or Web of Science.

To address these limitations, the study employed a triangulation approach, cross-verifying self-reported publications with records from the AfricaLics Secretariat and conducting extensive bibliometric searches using multiple academic databases. This strategy helped improve data reliability and reduce the potential bias introduced by survey non-responses and citation inconsistencies. Nonetheless, some degree of underrepresentation and variability remains, which should be taken into account when interpreting the results.

3 Results and Discussions

3.1 Publication Outputs by AfricaLics PhD Academy participants (2012–2024)

Since its inception in 2012, the AfricaLics PhD Academy has served as a vital platform for nurturing innovation scholars across Africa[1]. Table 1 below presents a quantitative summary of the publication outcomes of Academy participants between 2012 and 2024, offering insight into how the programme has influenced scholarly productivity and research engagement across different cohorts.

Across the ten cohorts hosted in various African countries, a total of 255 early-career researchers were selected through a competitive process to participate in the Academies. As of 2024, these participants have collectively produced 171 peer-reviewed journal articles, of which 91% were based on the papers presented during PhD academies, suggesting that the

[1] Most of the academies were conducted in anglophone countries, but three were conducted in francophone African countries. Translation from French to English and the other way round was provided in most of the academies (subject to funding availability).

programme has had a significant impact on strengthening research capacity and scholarly output in innovation and development studies on the continent.

The data show considerable variation across cohorts in terms of both the number of fellows and their subsequent publication rates. This is shown in Table 1. Notably, the 2015 cohort, hosted in Mombasa, Kenya by Moi University, stands out with the highest number of articles published (39) and a high article-to-fellow ratio of 1.26, contributing 22.8% of the total publications. This exceptional outcome may reflect the benefits of early program structure, strong mentorship, and post-Academy engagement.

Similarly, the 2016 (Tunis) and 2018 (Marrakech) cohorts recorded strong outputs with 21 and 23 articles respectively, also maintaining above-average publication rates. The 2017 (Ile Ife) academy cohort recorded a total of 19 articles produced by 31 participants (average 0.61 article-by-fellow), while the 2022 academy (JOOUST/Kenya) had an average of 0.67 article-by-fellow (14 articles produced by 21 participants). These results reinforce the value of AfricaLics' mentoring model, which enables participants to refine their research ideas and situate them within broader scholarly and policy discourses.

In contrast, the more recent cohorts (2023 and 2024) have lower publication numbers, which is expected due to a) the fact that these academies were shorter and virtual events, and b) the shorter time span available for research dissemination after the PhD academy took place. Nevertheless, early signs of publishing activities by these cohorts suggest that the training is influencing the intellectual trajectories of newer participants.

Average articles per fellow and percentage of total articles, further illuminate trends in research productivity across cohorts. While some cohorts produced more articles overall, others had higher per capita outputs, indicating the variable but meaningful nature of impact across different years and settings.

This bibliometric evidence confirms that the AfricaLics PhD Academy has contributed meaningfully to building a new generation of African scholars capable of engaging with global innovation debates while grounded in local realities. With an average of 0.67 articles per fellow**,** the Academy is not only expanding the volume of academic publications but also promoting the development of collaborative networks and intellectually grounded scholarship on the continent. The data also highlights the importance of time in translating training into tangible research outputs, and the value of continued mentorship and engagement beyond the two-week academy.

Table 1: Publication Output by the AfricaLics PhD Academy alumni (2012–2024)

Cohort	Host Institution	Location	Fellows	Articles Published	Avg Articles per Fellow	% of Total Articles

2012	ACTS and Moi University	Nairobi, Kenya	30	19	0.63	11.1
2013	ISGP	Algiers, Algeria	19	11	0.58	6.4
2015	Moi University	Mombasa, Kenya	31	39	1.26	22.8
2016	ESC Tunis & Univ. of Manouba	Tunis, Tunisia	34	21	0.62	12.3
2017	NACETEM, OAU	Ile Ife, Nigeria	31	19	0.61	11.1
2018	Université Cadi Ayyad	Marrakech, Morocco	32	23	0.72	13.5
2021	University of Gondar	Gondar, Ethiopia	19	12	0.63	7.0
2022	JOOUST	Nairobi, Kenya	21	14	0.67	8.2
2023	University of Johannesburg*	Johannesburg, South Africa	21	9	0.43	5.3
2024	UJ & University of Thomas Sankara*	South Africa & Burkina Faso	17	4	0.24	2.3
Total			**255**	**171**	**0.67 (avg)**	**100**

* = virtual, short-term PhD academies

3.2 Country Representation by Income Group in the AfricaLics PhD Academy

The AfricaLics PhD Academy has consistently emphasized its goal of addressing the capacity constraints in African innovation scholarship by prioritizing fellows from low- and middle-income countries (LMICs). This selection strategy is reflected in the distribution of participants by country income level, based on the World Bank's 2024 income classification.

3.2.1 Strong Representation of Lower-Middle-Income Countries

A large proportion of participants, approximately 65%, come from lower-middle-income countries (see Table 2). This is not surprising, as many of these countries, such as Nigeria, Kenya, and Ghana, have sizeable research communities but still face significant structural challenges in their innovation systems. Nigeria, with 60 fellows, stands out as the most represented country. Its large population, numerous higher education institutions, and active involvement in regional research initiatives contribute to this strong showing. Kenya follows closely with 40 fellows, underscoring its position as a regional research hub in East Africa and a host of previous AfricaLics events. Other countries in this group, such as Cameroon, Côte d'Ivoire, Senegal, and Tanzania, also reflect a growing interest in innovation studies within Francophone and Anglophone African systems.

3.2.2 Strategic Inclusion of Low-Income Countries

Low-income countries account for about 24% of the total representation, led notably by Ethiopia, with 43 fellows. Ethiopia's high number reflects close links between AfricaLics and various universities and individuals in Ethiopia since the inception of AfricaLics. As such it reflects interest in AfricaLics from (senior) scholars in Ethiopia who have encouraged their students to attend

AfricaLics PhD academies, a thematic relevance of what the PhD students are doing as well as intentional efforts to support academic researchers in Ethiopia despite limited national resources. The strong Ethiopian presence illustrates the potential of strategic partnerships and donor support in overcoming resource constraints. Other countries in this group, including Uganda, Burkina Faso, Zimbabwe, and Rwanda, represent diverse regional contexts where doctoral researchers often face severe barriers to training, supervision, and research exposure. The AfricaLics Academy offers a critical lifeline for scholars in these settings, providing access to mentorship, peer networks, and global discourse that they might otherwise be excluded from.

3.2.3 Substantial Engagement with Upper-middle-income Countries

Upper-middle-income countries, though better resourced, make up just under 9% of the fellows. South Africa, with 12 participants, is the most notable here. As a regional leader in science and technology, South Africa's inclusion in AfricaLics helps bridge more advanced research systems with emerging ones. Other participants from Morocco, Libya, and Namibia bring additional geographic and cultural diversity to the Academy, enriching discussions with perspectives from North and Southern Africa. The fact that funding for participation in the AfricaLics PhD academies has been mainly targeting applicants from low and lower-middle-income countries largely explains the more limited participation of students from the upper-middle-income countries. With time, the impact of AfricaLics PhD academies could be increased if additional funding becomes available for young scholars from this category of African countries becomes available e.g., through national science grant councils or other mechanisms.

3.2.4 Limited but Valuable Representation from High-Income Countries

Finally, high-income countries are minimally represented, accounting for just over 2% of fellows originating from France, Portugal, Oman, Taiwan, and Dominica. Their inclusion is likely due to diaspora scholars, researchers studying African innovation systems abroad, or partnerships that support global South–North academic exchange. While they are not the primary focus of AfricaLics, their participation signals the Academy's openness to comparative learning and global dialogue. Increased participation of students from high-income countries could help foster future collaboration between young African I&D scholars and young scholars from high-income countries but would require additional funding from sources such as e.g. the EU-African partnership programmes.

In all, the distribution of fellows highlights AfricaLics' strong orientation towards empowering scholars from countries where innovation research capacity is most limited. By centering its training around low- and lower-middle-income countries, the Academy plays a vital role in democratizing access to high-level research mentorship and fostering the next generation of innovation scholars deeply rooted in African development realities.

Table 2: AfricaLics PhD Academy Fellows by Country Income Group

Income Group	Number of Countries	% share of Countries	Example Countries
Low-Income	9	30.00	Ethiopia, Uganda, Burkina Faso, Eritrea, CAR
Lower-Middle-Income	11	36.67	Nigeria, Kenya, Ghana, Cameroon, Côte d'Ivoire
Upper-Middle-Income	5	16.67	South Africa, Morocco, Namibia, Libya, Iran
High-Income	5	16.67	France, Germany, Portugal, Oman, Taiwan
Total	30	100	–

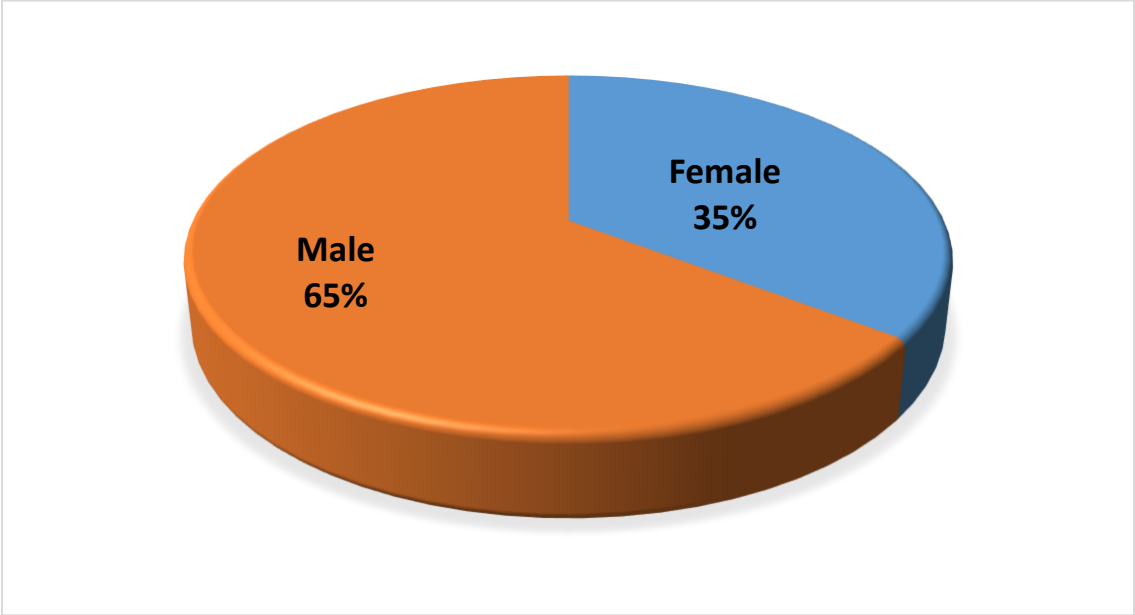
3.3 Gender Representation in AfricaLics PhD Academies

The gender distribution of participants in the AfricaLics PhD Academies reveals important insights about gender inclusivity in African innovation research capacity building. According to the data, 100 out of 282 participants (35.5%) have been female, while 182 (64.5%) have been male (see Figure 1). This reflects a persistent gender imbalance, though not unusual in science, technology, and innovation (STI) fields across many low- and middle-income countries.

Despite the disparity, the participation of 100 female doctoral researchers is significant and demonstrates progress toward greater gender equity in the STI research ecosystem. The AfricaLics PhD Academy, which aims to strengthen the intellectual and professional development of early-career scholars from the Global South, particularly Africa, has evidently contributed to creating pathways for women to engage in high-level innovation studies and global academic networks.

It is important to recognize that systemic and structural barriers, such as limited access to funding, fewer female mentors in STI fields, cultural expectations, and institutional biases, continue to hinder many women from pursuing or completing doctoral studies. The AfricaLics platform thus plays a critical role not only in building research capacity but also in promoting more inclusive participation in innovation and development scholarship.

Figure 1: Gender distribution of the PhD Academy fellows 2012-2024



3.4 Trends in Innovation and Development Research among AfricaLics PhD Fellows

Between 2012 and 2024, the AfricaLics PhD Academy hosted ten cohorts of doctoral fellows from across Africa, each selected for their research potential in the broad field of innovation and development. All research topics presented by these fellows over the twelve-year period were systematically reviewed and organized into six thematic clusters. These clusters represent major knowledge domains within the innovation and development studies landscape: innovation systems and policy, technological learning and industrial development, inclusive and sustainable innovation, science, education and capacity building, digital and frontier technologies, and sector-specific innovation. In total, 250 research topics were analyzed and compared with the topics in the field of innovation and development. Results of the analysis are shown in Table 3.

3.4.1 Innovation Systems and Policy

The innovation systems and policy cluster emerged as the most dominant, comprising over a quarter of all topics (27.2%). This information is illustrated in Table 3. Within this cluster, doctoral fellows demonstrated strong interest in national and regional innovation systems, STI policy, and monitoring and evaluation frameworks, underscoring AfricaLics' foundational mission to strengthen innovation policy capacity on the continent. Sub-themes such as intellectual property, knowledge governance, and foresight further revealed an academic orientation toward understanding how innovation systems are structured, governed, and made responsive to development needs.

3.4.2 Inclusive and Sustainable Innovation

Closely following this, the inclusive and sustainable innovation cluster accounted for 21.6% of the total topics. Research here was strongly aligned with development imperatives such as poverty reduction, sustainability, and equity. Fellows explored innovation for inclusive development, green and clean innovation, as well as grassroots and frugal innovations that reflect the realities of resource-constrained environments. The presence of research on gender and innovation, though smaller in volume, signals growing attention to equity considerations in innovation studies.

3.4.3 Technological Learning and Industrial Development

The technological learning and industrial development cluster (19.2%) highlighted efforts to understand how firms, industries, and countries acquire and build technological capabilities. Notably, topics on technological learning and capability building, innovation and industrial policy, and the dynamics of SMEs, startups, and informal sector innovation collectively underscored a strong orientation toward endogenous industrial development pathways for Africa. These topics reflect the continent's broader interest in leveraging innovation for structural transformation and economic competitiveness.

3.4.4 Sector-Specific Innovation

The cluster on sector-specific innovation, also constituting 19.2% of total topics, indicates that many doctoral fellows have grounded their research in practical, sectoral challenges. This includes agricultural innovation and food security, health systems innovation, and energy access. These themes reflect the strategic alignment of AfricaLics-supported research with Sustainable Development Goals (SDGs) and national development agendas, addressing pressing issues such as food systems resilience, healthcare delivery, and clean energy transitions.

3.4.5 Science, Education, and Capacity Building

Research related to science, education, and capacity building formed 13.2% of the total, reflecting interest in how institutions and human capital contribute to innovation systems. Key areas include university–industry–government linkages and STEM education, technical training, and skills development. These topics are consistent with AfricaLics' long-term goal of nurturing an innovation-aware academic community across African universities.

3.4.6 Digital and Frontier Technologies

Finally, although smaller in size, the digital and frontier technologies cluster (9.6%) captured a growing interest in emerging technologies and their applications to development. ICT for development was the most prominent sub-theme, while artificial intelligence, big data,

blockchain, and e-governance appeared as emerging frontiers of research, particularly among more recent cohorts.

The analysis of all research topics paints a comprehensive picture of the evolving innovation and development research landscape in Africa. The clustering exercise reveals a dynamic community of early-career researchers who are not only addressing foundational issues in innovation systems and industrial development but are also responding to contemporary challenges such as digital transformation, climate change, and social inclusion. These findings affirm the AfricaLics Academy's vital role in fostering a new generation of African scholars who are equipped to shape policy, generate context-relevant knowledge, and contribute meaningfully to global debates on innovation for development.

Table 3: Research Fields in Innovation and Development Studies covered by AfricaLics PhD Academy alumni (2012-2024).

Cluster	% of Topics	Key Insights
Innovation Systems & Policy	27.2%	Strong focus on policy and governance of innovation
Inclusive & Sustainable Innovation	21.6%	Deep concern with equity, environment, and development relevance
Technological Learning & Industrial Dev.	19.2%	Emphasis on learning, industrial upgrading, and firm dynamics
Sector-Specific Innovation	19.2%	Practical, sector-based problem-solving (agriculture, energy, health)
Science, Education & Capacity	13.2%	Building skills and institutional linkages for innovation systems
Digital & Frontier Tech	9.6%	Emerging interest in ICT, AI, and data-driven innovation

3.5 Co-Occurrence Analysis of Fellow's Research Areas

The co-occurrence analysis of authors' keywords from research produced by fellows of the AfricaLics PhD Academies reveals three distinct yet interconnected thematic clusters. Each cluster reflects a particular research trajectory, yet all coalesce around Africa as the central rallying point for scholarly inquiry. This is shown in Figure 2. This illustrates that regardless of disciplinary focus, geographic specificity, or methodological approach, the research consistently orients toward addressing innovation and development challenges on the African continent, a testament to the mission of the AfricaLics PhD Academy.

3.5.1 Cluster 1: Analytical and Methodological Foundations for Innovation Research

Keywords: *Bibliometric analysis, Systematic review, STI measurement, STI, Building low-carbon learning, Developing countries, Small hydropower, Nigeria*

This cluster underscores the increasing application of bibliometric and systematic review methods to analyze innovation dynamics in developing countries. Fellows are engaging in rigorous literature mapping and synthesis to identify research gaps and frame future inquiries. Topics like *building low-carbon learning systems*, *small hydropower in Nigeria*, and *STI (Science, Technology, and Innovation) indicators measurement* reflect an orientation towards using evidence-based methods (quantitative and qualitative) to support policy decisions in energy, environment, and innovation.

These research outputs contribute significantly to building foundational knowledge on how low- and middle-income countries can navigate complex innovation challenges. The emphasis on methodological clarity, including through bibliometric and systematic reviews, indicates the Academy's success in cultivating analytical skills and promoting quality scholarship.

3.5.2 Cluster 2: Innovation and Learning in the Informal and Microenterprise Contexts

Keywords: *Innovation, Micro and Medium Scale Enterprises (MMEs), Capacity building, Informal economy, Learning, Work organization, Micro and Small Agribusiness Enterprises (MSES)*

The second cluster focuses on inclusive and grassroots innovation**,** with a specific interest in the informal sector, agribusinesses, and small-scale enterprises. Research in this cluster explores how innovation emerges and is sustained in low-resource settings, particularly where formal institutions are weak or absent. It also highlights issues such as *capacity building*, *learning mechanisms*, and *work organization*, which are central to improving productivity and livelihoods among micro and small businesses in Africa.

The prominence of this cluster shows how the AfricaLics PhD Academies have fostered a strong focus on bottom-up innovation and entrepreneurship, aligning with AfricaLics' mission of building context-relevant knowledge systems. Fellows working in this area are helping to shift the policy narrative from top-down industrial policy to people-centered innovation strategies.

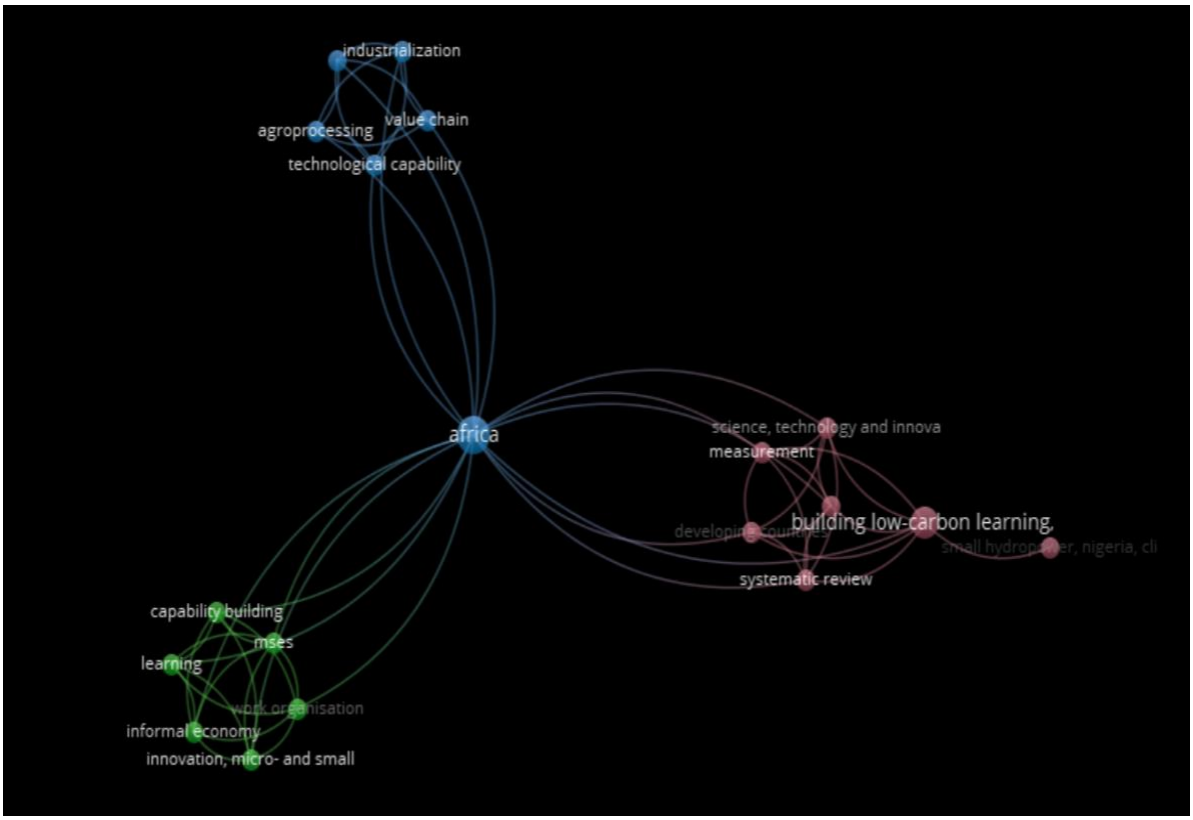
3.5.3 Cluster 3: Industrialization, Agroprocessing, and Technological Capability in Africa

Keywords: *Africa, Agroprocessing, Industrialization, Local production technological capability, Value chain*

The third cluster captures a growing research focus on African industrial development and technological upgrading. Fellows are investigating the role of local technological capabilities, agroprocessing, and value chain integration in driving structural transformation. This includes both sectoral studies (e.g., agroprocessing) and broader policy-oriented work on how innovation systems can support industrialization efforts in the African context.

This cluster signals the PhD Academy's strategic contribution to national development agendas by equipping scholars with the tools to assess and inform policy on industrial development and value chain performance. The strong geographical reference to "Africa" as a keyword also suggests a continental focus, with implications for comparative and regional research collaborations.

Figure 2: Analysis of Co-occurrence analysis of PhD Academy fellows' research areas (2012-2024).



3.6 Co-authorship Clusters and Patterns of Academic Collaboration in the AfricaLics PhD Academy

The co-authorship analysis of AfricaLics PhD Academy fellows revealed eight distinct clusters of collaborative scholarship, reflecting varying degrees of academic partnership, disciplinary focus, and regional engagement. These clusters highlight how fellows have formed scholarly networks both within the AfricaLics community and with external collaborators, particularly in addressing pressing socio-economic and innovation-related challenges across Africa.

The eight distinct research clusters, each reflect shared academic interests, regional collaboration patterns, and disciplinary orientations within the broader field of innovation and development studies (see Figure 3). These clusters provide a compelling picture of how the Academy is nurturing scholarly networks and driving thematic convergence among early-career researchers across the African continent.

Red Cluster, the most cohesive and prolific, revolves around agricultural innovation and entrepreneurship in Ghana. Led predominantly by J.A. Onumah (PhD academy and VFP alumnae) and colleagues, this cluster demonstrates strong national-level collaboration, with multiple co-authored publications addressing innovation systems among cocoa farmers and micro-agribusinesses. The sustained output from this group suggests the benefits of long-term institutional partnerships and fellow-mentor synergies in boosting research productivity.

Green Cluster represents a continent-wide collaboration on micro and small enterprise innovation, led by Musambya (PhD academy alumnus) who collaborated with established AfricaLics scholars such as Lorenz, Erika Kraemer-Mbula, Garba Its cross-country perspective highlights the role of coordinated, multi-country research in tackling structural issues in African innovation systems. Similarly, Deep b**lue Cluster**, led by Kingstone Mujeyi (PhD academy alumnus) focusing on informal innovation and agricultural mechanization in Zimbabwe, provides an example of national-level research that bridges informal sector activity with technological advancement, underscoring the importance of context-specific knowledge production.

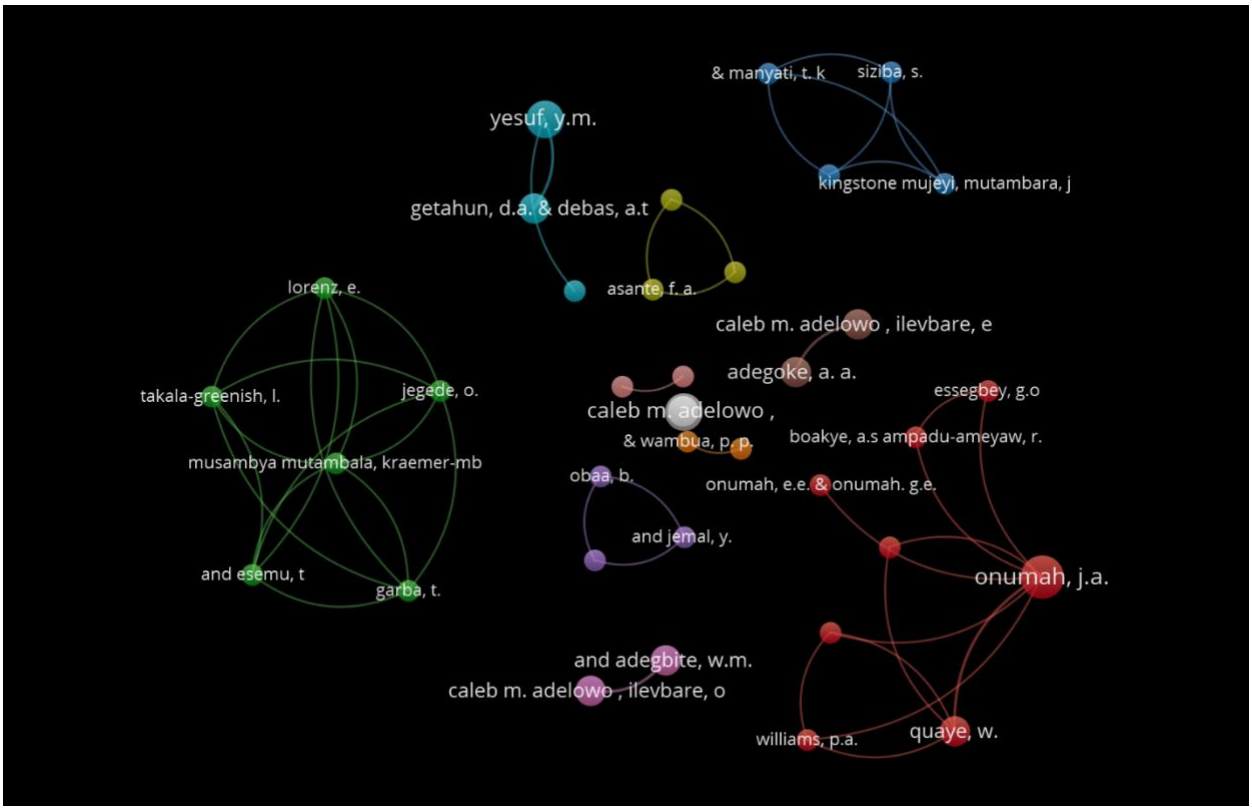
Yellow Cluster is closely related to Cluster 1 but with a sharper focus on institutional arrangements such as innovation platforms. This cluster feature J.A. Onumah (PhD and VFP academy alumnae) and others. It illustrates how thematic sub-streams can evolve within larger research programmes, leading to more specialized insights. In contrast, Deep purple **Cluster** brings attention to the role of Indigenous knowledge and social capital in rural Ethiopia, showing the Academy's support for integrating traditional systems into innovation discourses. This cluster showcased collaboration of Getachew Shambel (PhD academy and VFP alumnus), with other scholars.

Light blue Cluster contributes an organizational and psychosocial perspective by investigating how work environment and family dynamics influence creativity in Ethiopian public research institutions. The collaborative efforts of Yesuf (PhD alumnus) with other scholars is very evident in this cluster. The unique approach of the research expands the Academy's reach beyond traditional innovation topics, reflecting interdisciplinary engagement. Orange **Cluster**, from Kenya, further strengthens this theme by analyzing talent retention and organizational performance in the public sector, emphasizing policy-relevant research outputs as demonstrated by the work of Ruth Wambui, PhD academy alumna.

Finally, light **Cluster**, led by Caleb M. Adelowo (academy and VFP alumnus), showcases a broad interdisciplinary agenda, combining technological learning, public health, and psychology. The diversity of research within this cluster illustrates the Academy's openness to boundary-crossing scholarship and its potential to inform real-world policy and social interventions.

Overall, the clustering pattern suggests that AfricaLics PhD Academy has successfully fostered both national and cross-national research communities. While some clusters remain country-specific, others show potential for cross-border collaboration. The emergence of interdisciplinary themes and the presence of policy-relevant research outputs indicate that the Academy is not only supporting academic growth but also enhancing the societal relevance of innovation research in Africa. Encouraging greater inter-cluster engagement and more cross-country comparative studies could further amplify the impact of the Academy's collaborative research model.

Figure 3: Co-authorship Clusters and Patterns of Academic Collaboration among AfricaLics PhD Academy Fellows



3.7 Publication Outlets Trends among AfricaLics PhD Academy Fellows

The publication patterns of AfricaLics PhD fellows show a strong preference for journals focused on innovation and development, particularly those related to Africa. The *African Journal of Science, Technology, Innovation and Development* (AJSTID) and the journal *Innovation and Development* are the most popular journals, accounting for 30% of publications, which reflects their strong alignment with AfricaLics' focus on innovation systems in Africa. This is shown in Figure 4. *Technological Forecasting* and *Social Change* is also prominent (5% of the publications), suggesting a preference for high-impact journals in innovation studies. High-impact factor journals (IF > 5.0) such as *Technological Forecasting and Social Change* and *Energy Research & Social Science* are used, but less frequently, accounting for approximately 7% of publications.

Mid-tier journals (IF 2.0–4.0), including *Sustainability* and *Journal of Innovation and Entrepreneurship*, represent about 10% of the publications (see Table 4).

A significant portion (around 30%) is published in lower-IF or non-indexed journals, possibly due to regional relevance or open access preferences.

Approximately 61% of the papers strongly align with innovation, technology, and development themes. Moderate alignment (around 30%) is seen in journals covering agriculture, energy, and entrepreneurship, while weak alignment (around 20%) is observed in general business/economics or hyper-specialized fields. Hybrid journals like *AJSTID* and *Innovation and Development* are dominant, but fully open access journals such as *Heliyon* and *Sustainability* are gaining traction. About 40% of the papers are in non-OA or paywalled journals, which may indicate funding constraints or prestige considerations.

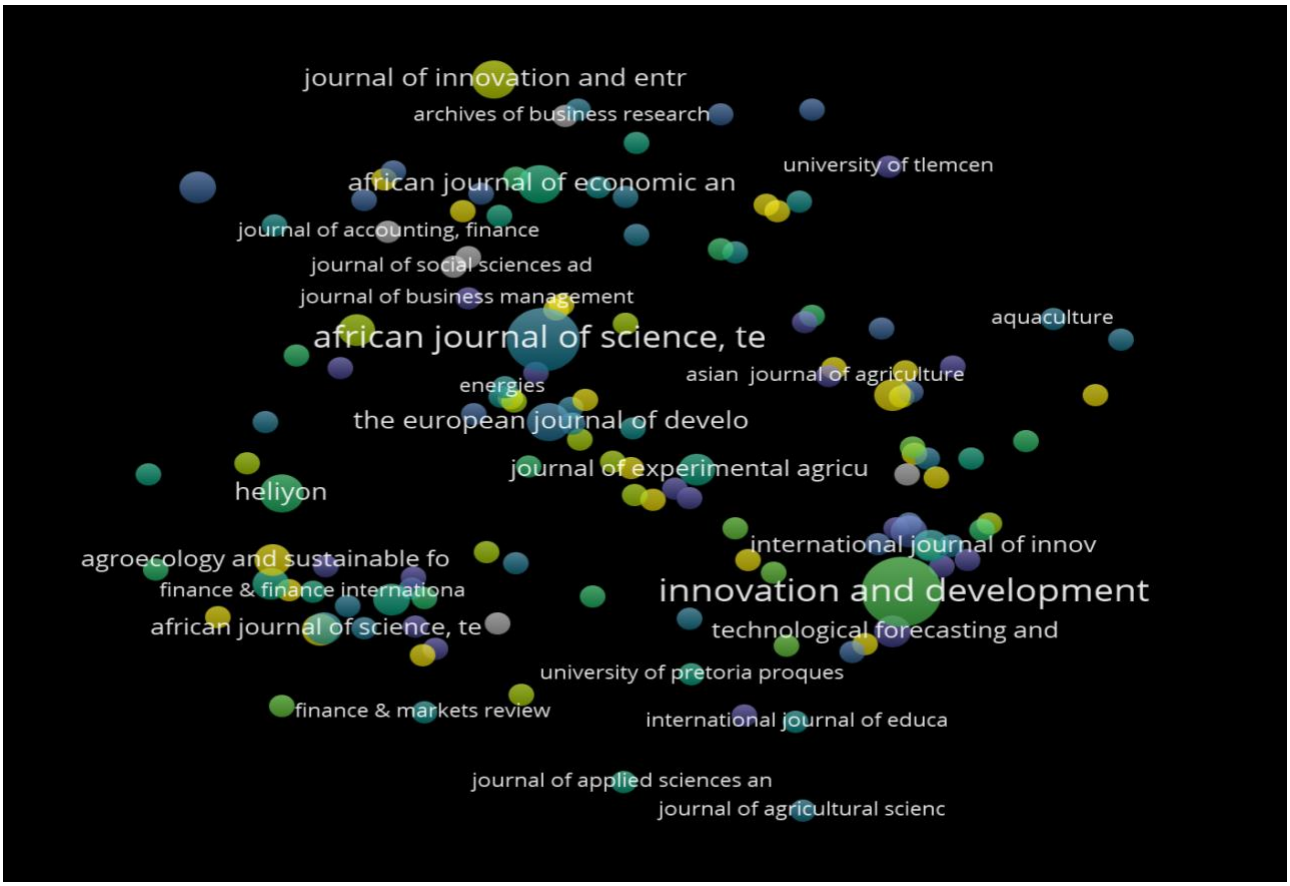
Many publications appear in Africa-based journals, highlighting a focus on local impact, while some fellows aim for global journals for broader reach. Overall, AfricaLics fellows strategically select journals to maximize both academic impact and developmental relevance, though funding for open access and high-IF publishing remains a challenge.

Table 4: Analysis of Journals Where AfricaLics PhD Academy Participants Published

Journal Name	Impact Factor (IF)	Theme Alignment to Innovation & Development	Open Access (Yes/No)	% of Papers Published
African Journal of Science, Technology,	~1.5 (Scopus)	High (Focus on STI in Africa)	Hybrid	30%

Innovation and Development				
Technological Forecasting and Social Change	~8.593 (JCR)	Very High (Tech innovation, societal impact)	Hybrid	5%
Innovation and Development	~1.8 (Scopus)	Very High (Innovation systems, global South)	Hybrid	10%
Sustainability	~3.9 (JCR)	High (Sustainable development, green innovation)	Yes	4%
Journal of Innovation and Entrepreneurship	~2.9 (Scopus)	High (Entrepreneurship, innovation ecosystems)	Yes	4%
Heliyon	~4.0 (JCR)	Moderate (Multidisciplinary, some innovation studies)	Yes	3%
Energy Research & Social Science	~8.5 (JCR)	High (Energy transitions, socio-technical systems)	Hybrid	2%
Agroecology and Sustainable Food Systems	~2.5 (Scopus)	Moderate-High (Agricultural innovation)	Hybrid	2%
European Journal of Development Research	~1.8 (Scopus)	High (Development economics, policy)	Hybrid	2%
Journal of Small Business and Enterprise Development	~3.0 (Scopus)	Moderate-High (SMEs, entrepreneurship)	Hybrid	2%
Knowledge Management for Development Journal	Not indexed (Scopus)	High (Knowledge for development)	Yes	2%
Other journals (e.g., regional, low IF, or niche fields)	<1.5 or not indexed	Variable (Some aligned, others less so)	Mixed	~30%

Figure 4: Distribution of Publication Outlets used by AfricaLics PhD Academy Fellows



3.8 Research Productivity and Scholarly Impact of AfricaLics PhD Academy Fellows

The data presented in Table 5 offers a longitudinal perspective on the research productivity and scholarly impact of AfricaLics PhD Academy fellows. The AfricaLics PhD Academy appears to have made significant contributions to the careers of young PhD scholars in Africa, as reflected in the number of publications and citations generated by its fellows over the years.

Cohorts from the earlier years, particularly those of 2012 and 2015, demonstrate the highest levels of productivity and impact. The 2015 cohort stands out as the most prolific, with 39

articles published by its 31 fellows and a total of 654 citations, translating to an average of 16.77 citations per publication. Studies have shown that publications by academics in Sub-Saharan Africa average 3.8 citations per publication (Mitchell, et. al. 2020). Even more striking is the 2012 cohort, which, although smaller in terms of number of publications (19 articles), recorded the highest average citations per publication at 21.32. This suggests that the research outputs from this cohort have not only been productive but also influential, likely benefiting from both longer citation windows and successful placement in reputable journals.

The data also reflects a typical time-lag effect inherent in academic publishing and citation accumulation. More recent cohorts (2021–2024) naturally report lower figures, as their research is either in progress, recently published, or yet to become more widely cited. For example, the 2024 cohort, with only four articles and one citation so far, is still at the early stages of the publication and impact cycle. This trend is consistent across the 2021–2023 cohorts, all of which show relatively low citation numbers, not necessarily indicating poor performance but rather the need for more time to observe their long-term impact.

Looking at the data holistically, these figures illustrate the value of the AfricaLics PhD Academy in nurturing scholarly engagement among African PhD students. The consistent production of academic outputs over more than a decade signals the Academy's success in equipping fellows with the skills and motivation necessary to contribute meaningfully to the field of innovation and development. However, the downward trend in publication and citation numbers among the more recent cohorts may also suggest a need for more sustained post-Academy support and mentoring, reinvigoration of the physical PhD academies of two weeks duration, and better institutional backing. All such efforts will help ensure that fellows can translate their training into published research and broaden their academic influence.

Table 5: Research Output and Impact by AfricaLics PhD Academy Cohort

Cohort	Number of Fellows	Articles Published	Total Citations	Average Citations per Publication
2012	30	19	405	21.32
2013	19	11	90	8.18
2015	31	39	654	16.77
2016	34	21	373	17.76
2017	31	19	199	10.47
2018	32	23	274	11.91
2021	19	12	33	2.75
2022	21	14	75	5.36
2023	21	9	41	4.56
2024	17	4	1	0.25
Total	**255**	**171**	**2,145**	**12.54** (overall average)

3.9 Scholarly Impact of AfricaLics PhD Academy Fellows

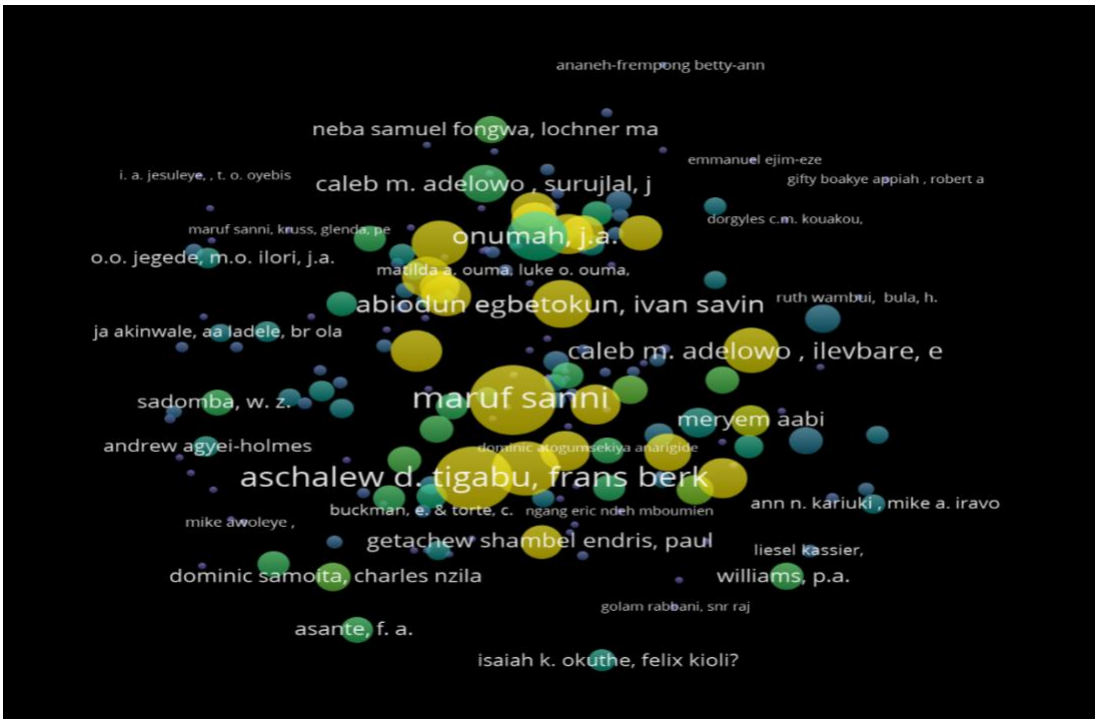
The scholarly output of AfricaLics PhD Academy fellows reflects the programme's significant contribution to building research capacity in Africa and enhancing academic visibility on issues of innovation and development. A review of selected peer-reviewed journal articles authored by fellows reveals a pattern of impactful, context-relevant, and widely cited publications. These works span critical themes such as eco-innovation, technology diffusion, institutional entrepreneurship, inclusive development, agricultural efficiency, and foreign direct investment spillovers, all central to the AfricaLics research agenda.

Notably, some publications have garnered high citation counts, such as the article from 2018 article by Maruf Sanni (PhD academy and VFP alumni) on eco-innovation in Nigeria and the 2015 paper by Aschalew D. Tigabu (PhD academy alumi) and colleagues on technology adoption in Rwanda, both published in the reputable journal *Technological Forecasting and Social Change*. Their high citations (171 and 149 respectively) highlight the global relevance and academic recognition of some of the research emerging from the Academy. Other PhD alumni whose work has achieved notable recognition through high citation counts include Egbetokun Abiodun, Caleb Adelowo, Justina Onumah, Getachew Shambel, among others. Their citation impact underscores the global relevance and significance of their research contributions.

In addition to global academic impact, the research is geographically grounded, with case studies from countries like Nigeria, Kenya, Rwanda, Ghana, and South Africa. This local anchoring supports AfricaLics' aim to generate knowledge that is not only academically rigorous but also context and policy relevant. The breadth of topics also reveals a multidisciplinary orientation, with contributions to innovation studies, development economics, agronomy, and social policy.

Furthermore, the inclusion of gender, poverty, and sustainability themes in several studies underscores the Academy's commitment to inclusive development. The prominence of AfricaLics fellows in co-authored publications with international and African scholars also speaks to the collaborative ethos and growing networks fostered through the Academy.

Figure 5: Citation Impact of Selected Journal Articles by AfricaLics PhD Academy Fellows



4. Conclusion and Policy Recommendations

4.1 Conclusion

The AfricaLics PhD Academy, launched in 2012, has demonstrated substantial and measurable impact in strengthening research capacity and fostering innovation scholarship across the African continent. Over 12 years, the Academy has trained over 255 early-career researchers from 30 countries, with fellows collectively producing 171 peer-reviewed publications. Over 60% of these are highly aligned to I&D studies research, reflecting a growing intellectual engagement with themes related to innovation and development, tailored to African contexts.

The data show strong variations across cohorts, with the 2012, 2015, 2016, and 2018 cohorts leading in publication output and citations. These cohorts benefitted from two week, on-site intensive training as well as structured follow-up, high-quality mentorship, and strategic host institutions. More recent cohorts (2023–2024), although currently exhibiting lower output due to shorter post-Academy durations, are already showing early signs of academic engagement. But since these cohorts have only benefitted from shorter, online PhD academies they may not reach the same level of productivity. The average of 0.67 articles per fellow is, however, a

notable metric of scholarly productivity in a region where barriers to publication are often high. Larivière and Costas (2016) further observed that researchers in the first five years of their careers generally exhibit low annual citation rates, a pattern that is likely to be even more pronounced in the Sub-Saharan African context.

The Academy's prioritization of fellows from low- and lower-middle-income countries has proven effective in targeting regions with the most severe research capacity constraints. Over 89% of fellows came from these income categories, underscoring the Academy's equity-centered mission. Ethiopia, Nigeria, and Kenya stand out for their high representation, reflecting both need and opportunity for national innovation system strengthening.

Despite this progress, gender disparities persist. Only 35.5% of fellows have been female, mirroring broader structural challenges in STI fields. Yet, the participation of 100 female researchers is a significant achievement, indicating the Academy's potential to act as a lever for advancing gender inclusion. The co-occurrence and co-authorship analyses provide complementary insights into the intellectual and collaborative landscape shaped by the AfricaLics PhD Academy. Thematic clustering of keywords from fellows' research highlights three primary areas of focus: analytical and methodological approaches to innovation research; innovation and learning in informal and microenterprise contexts; and industrialization, agro-processing, and technological capability development in Africa. These clusters illustrate a consistent orientation toward addressing African development challenges through contextually grounded innovation studies. At the same time, co-authorship analysis reveals eight distinct collaborative clusters reflecting varied regional, disciplinary, and thematic engagements.

In conclusion, the AfricaLics PhD Academy is a crucial mechanism for nurturing the next generation of African innovation scholars. Its impact goes beyond individual capacity-building to influence broader research ecosystems by promoting regionally grounded, policy-relevant scholarship and transnational academic networks.

4.2 Policy Recommendations

To further strengthen the impact and sustainability of the AfricaLics PhD Academy, a set of strategic policy recommendations is proposed:

First, there is a critical need to institutionalize post-Academy mentorship and research support. This can be achieved by developing a structured follow-up programme that assists alumni in publishing their research, disseminating their findings, and engaging with policy communities. Additionally, national LICS should be encouraged to establish mentorship hubs staffed by experienced researchers to guide fellows as they navigate their academic and professional trajectories after completing the Academy. A recent effort by the NigeriaLics hub to institutionalize mentorship programme is a good initiative in the right direction

Second, expanding support for female researchers is essential in addressing the persistent gender imbalance in science, technology, and innovation (STI) fields. While AfricaLics is already making commendable efforts in this field, more targeted fellowships or scholarships could be introduced specifically for women. Likewise, more efforts could be made to promote female-led research teams. Furthermore, mentorship relationships between senior female alumni and early-stage doctoral students should be more directly encouraged to build a more inclusive and supportive academic environment. The recent AfricaLics initiative to establish Research Coordinating Areas (RCAs), with two RCAs currently being led by women, represents a commendable and strategic step forward.

Third, providing competitive research and publication grants is essential to support fellows in finalizing their manuscripts and covering publication costs, especially in open-access journals. It's worthy of note that funding from Sida has helped promote equity, where priority has been given to fellows from low- and lower-middle-income countries and those engaged in underrepresented research areas. More of such funding from the private sector, philanthropists, regional and continental organisations in Africa would also encourage comparative studies and co-authorship across national boundaries to foster regional integration and collaboration in innovation policy discourse and broaden learning from diverse contexts. The grants could be effectively administered through existing structures such as the Research Coordinating Areas (RCAs), National LICS chapters, and the spokes and network hubs, thereby enhancing reach and impact.

Fourth, partnerships with host institutions must be strengthened. Host universities could be incentivized through national LICS to maintain long-term engagement with AfricaLics PhD Academy alumni by co-organizing writing workshops, research dissemination events, and academic exchanges. Recognizing outstanding institutions, national LICS, spokes and mentors through annual awards and highlighting their contributions in AfricaLics reports would further reinforce these collaborations.

Fifth, the AfricaLics alumni network should be strengthened through the incorporation of a dedicated webpage on the AfricaLics website that facilitates collaboration, peer review, and knowledge sharing among past fellows. This platform should also serve as a tool for tracking alumni career progression, research outputs, and policy engagement. Managed through the AfricaLics Secretariat and alumni network, it would support ongoing programme monitoring, learning, and continuous improvement.

Sixth, fostering regional and global research integration is critical to advancing the AfricaLics agenda. The Secretariat should actively facilitate cross-country research collaborations among fellows to promote comparative studies on African innovation systems. Research Coordinating Areas (RCAs), National LICS chapters, and spokes should be strategically encouraged and supported to drive such collaborative initiatives. Additionally, mechanisms should be established to connect AfricaLics scholars with global research platforms (in addition to the Globelics

network), think tanks, and international policy forums, thereby amplifying the visibility and influence of African innovation scholarship on the global stage.

Finally, promoting language diversity and inclusivity is essential to ensure that the Academy's impact extends across linguistic divides. Research summaries should be translated into French, Arabic, and Portuguese to enhance accessibility and regional dissemination to fellows from non-English-speaking countries. Fellows should also be encouraged to submit to multilingual high impact journals and regional platforms, which are often more accessible to non-Anglophone audiences.

Jointly taken, these policy measures will strengthen the Academy's role as a cornerstone of Africa's innovation research ecosystem and ensure its continued contribution to equitable and inclusive development on the continent.

Annex 1: An overview of all AfricaLics PhD academies conducted

	Cohort	Host institution	Location	Physical/Virtual	Fellow	Articles Published
1	2012	ACTS and Moi University	Nairobi, Kenya	Physical	30	19
2	2013	Institut Supérieur de Gestion et de Planification (ISGP)	Algiers, Algeria	Physical	19	11
3	2015	Moi University	Mombasa, Kenya	Physical	31	39
4	2016	Ecole Superieure de Commerce de Tunis in collaboration with the University of Manouba	Tunis, Tunisia	Physical	34	21
5	2017	NACETEM, Obafemi Awolowo University	Ile Ife, Nigeria	Physical	31	19
6	2018	Université Cadi Ayyad	Marrakech, Morocco	Physical	32	23
7	2021	University of Gondar	Gondar, Ethiopia	Physical	19	12
8	2022	Jaramogi Odinga Oginga University of	Nairobi, Kenya	Physical	21	14

		Science and Technology				
9	2023	University of Johannesburg	Johannesburg, South Africa	Virtual	21	9
10	2024	University of Johannesburg, South Africa and University of Thomas SANKARA	Johannesburg, South Africa and Burkina Faso	Virtual but with scholars from Burkina Faso in same place.	17	4
	Total				255	171

5. References

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