ACADEMIC ENTREPRENEURSHIP AND TRADITIONAL ACADEMIC PERFORMANCE AT UNIVERSITIES: EVIDENCE FROM A DEVELOPING COUNTRY

Adelowo C. M., Surujlal J.*

Abstract: Universities play central roles in the creation of knowledge economy and the fourth industrial revolution (Industry 4.0). They build critical human capital, generate new knowledge and strive to promote innovation through academic entrepreneurship. Despite the potential benefits of academic entrepreneurship (AE), the argument that AE fuels or impedes faculties' commitment to traditional activities in both developed and developing countries is still open. Therefore, this paper empirically examines the influence of academic entrepreneurship on teaching and publishing potential of faculties with a view to suggesting appropriate policy guide for promoting innovations and enhancing traditional activities among the academia in Nigeria. Data for this paper were collected from 229 faculty members within science and technology-related fields in 13 selected universities across Nigeria, through a cross-sectional survey design approach. Data collected were analysed using factor and regression analyses. The results showed that participation of faculty members in start-up formation and industry collaboration (SUFIC) (β =2.8, $p<0.05$) and faculty externship (FE) (β =2.3, $p<0.1$) have statistically significant and positive effects on the potential for publishing among the faculty members. Faculty externship (FE) also shows a positive and significant relationship to the teaching performance of faculty members. However, university-related entrepreneurial engagements (UREE) show a negative and significant relationship to both publication and teaching performance, suggesting caution when selections are made regarding such activities by the university administrators. The study concludes with managerial implications for the university managers and policymakers

Keywords: Academic entrepreneurship, traditional activities, performance, factor analysis, entrepreneurship ecosystem

DOI: 10.17512/pjms.2020.22.1.01

Article history:
Received June 18, 2020; *Revised* September 20, 2020*; Accepted* September 26, 2020

Introduction

The shape and nature of academic offerings at educational institutions and universities are changing at an accelerated rate in the face of the COVID-19

* **Caleb Muyiwa Adelowo** Dr, National Centre for Technology Management, Obafemi Awolowo University, Ile-Ife, Nigeria, and Postdoctoral Researcher, North-West University, Potchefstroom, South Africa. **Jhalukpreya Surujlal** Prof, North-West University, Potchefstroom, South-Africa,
✉ corresponding author: Babs.Surujlal@nwu.ac.za
✉ calebakinrinade@yahoo.com

pandemic. Universities play a significant role in the creation of the knowledge economy and promote national competitiveness. Apart from traditional activities of teaching and research where critical human capital is built and new knowledge is generated through research, they also strive to promote innovation for national competitiveness (Siyanbola 2014; De Silva 2015; Adelowo 2018). The knowledge spillover theory of entrepreneurship also supports that universities are repositories of talents and knowledge that could be exploited commercially (Acs, Audretsch & Lehmann, 2013). Faculties are important resources in universities. They engage in a multitude of activities, including teaching and learning, research and innovation, community engagement, and a host of activities related to student affairs. With regard to research and innovation, they play a critical role in publications, patents, and in generating commercialisable products or processes. Recently, policies and education programmes at universities have been developed to foster entrepreneurial activities (Badruddin, Burhanudddin & Halim, 2019).

Faculties who demonstrate strong entrepreneurial inclinations towards the generation of patents and its commercialisation are broadly referred to as academic entrepreneurs, given that they make rare efforts towards commercial exploitation of research outputs (Cantaragiu, 2012; Adelowo, 2018). Academic entrepreneurship (AE) has been widely discussed in the literature as a process of technology exploitation and spin-off creation. Cantaragiu (2012) defines AE as a process of transferring knowledge between the university and the external environment, in order to produce economic and social value, for both external actors and members of academia, and in which at least a member of academia maintains a primary role. The primary role here includes deliberate efforts by academia to participate in the process of floating business around inventions created or resorting to licensing. Experience on technology commercialisation has shown that most inventions from the knowledge centres require substantial efforts of demonstration, prototyping and marketing analysis before they can be marketed (Siyanbola, 2019). In these processes, academia or inventors are required to work with the funders or investors and entrepreneurs on the technical feasibility of the inventions. Some authors have argued that some of these entrepreneurship activities are not compatible with traditional academic activities and could distract scientists. Samsom and Gurdon (1993) and Siegel *et al.* (2003) also found venture creation to be at odds with the core objective of the university scientists. Studies have pointed to challenges and disharmony for academia that deviate from a research path to engage in AE. This disharmony is premised on the argument that university resources, including human, funding, infrastructure, and time meant for traditional activities are shared with engagements in AE and could possibly impair universities' traditional roles (Dasgupta & David, 1994; Bercovitz & Feldman, 2003). Since universities' performance (including traditional and AE) depends largely on the amount of resources available to them, fragmenting the resources between the two streams of activities may result in suboptimal performance in both (Bercovitz & Feldman,

2003; De Silva, 2015). It is also argued that researchers or scientists could 'contaminate' the essence of research as a result of potential commercial gains. Academics who are interested in patent or commercial exploitation tend to delay publications, or refuse to discuss their works freely among peers, in order to keep the novelty requirement of the inventions. This was perceived as fundamental impediments to academic freedom and autonomy, but has become a 'new normal' for entrepreneurial universities. Van Looy *et al.* (2004) noted that policies and mechanisms are put in place at some universities to manage this development. For instance, to overcome conflict of interest, manage and maintain balance between research and entrepreneurial activities, intellectual property policies and other administrative policies are enacted in the universities. Some universities established liaison offices or technology transfer offices (TTOs) to keep academics focused on their research activities, while the patent processes and industry linkages are centrally coordinated by the TTO managers.

Conversely, other streams of research have argued that faculties who engage in AE have a greater chance of being more productive in the traditional activities than non-entrepreneurs as they are more likely to access industry resources and find placement for their students. Accessing industry resources presents great opportunity for academic entrepreneurs to spread their networks and conduct high impact research that is likely to promote their reputations and that of the university. This is likely to attract more students to the university. Moreover, Azoulay *et al.* (2007) affirmed that academic patenting is generally preceded by high productivity in terms of journal publications. Gulbrandsen and Smeby (2005) established that Norwegian professors with higher levels of industry funding publish more than their colleagues. In a Belgium university, Van Looy *et al.* (2004) found that AE does not impair scientific publication, but results in larger publication outputs over time. Carayol (2007) and Becchi *et al.* (2007) also obtained similar results using French and Italian universities, respectively. The benefits of AE ranging from attracting industry resources to the university (1998) fostering regional economic development (Clark, 1998; Poh-Kam *et al.*, 2007), promoting national competitiveness (Louis *et al.*, 2016) and attracting best brains to the universities have been expounded on extensively in the literature. It also fosters global start-ups through technology transfer and commercialisation (Guerrero & Urbano 2012). The emergence of high tech companies and products and services, including internet of things, robotics, biotech and nanotech among others, which have created and continued to create jobs and wealth are proceeds of scientists' and researchers' efforts. In fact, the future of jobs relies on the ability to deploy new knowledge and creativity towards solving human problems, of which universities play important roles.

Universities across Africa are not left behind in the race for creating a positive ecosystem for entrepreneurship among the students and faculties. Universities on the continent have braced through diverse entrepreneurship programmes to

improve the entrepreneurship ecosystem within the institutions and in collaboration with industry. A number of talent and innovation hubs have been created from North Africa to the South, East and West. For instance, the Nigerian government in 2006 introduced a compulsory entrepreneurship education curriculum to promote entrepreneurial spirit in students (Olofinyehun *et al.*, 2018;). In addition, to encourage and stimulate technology transfer and research commercialisation among faculties and researchers, some initiatives were developed including the establishment of technology transfer offices in 2007/08 and a technology business incubation programme established in 1993 (Adelowo, 2020). The incubation programme was later revamped in 2005 to commercialise technologies developed in the knowledge institutions across the country. With these and many other initiatives to encourage commercialisation in the country, fewer studies exist on the level and extent of faculties' engagement in them (Adelowo, 2018). These few studies have examined the antecedents of AE and how faculties perceived universities' readiness for it. However, it remains unclear how faculties' engagement in AE affects traditional activities of teaching and research in Nigeria. Therefore, it becomes imperative to examine whether engagement in academic entrepreneurship impedes or enhances teaching and publishing performance among the faculties in Nigeria. Consequently, this study is designed to empirically examine the influence of academic entrepreneurship activities on the teaching and publication performance of 229 faculties selected from 13 universities in Nigeria.

Academic research and teaching performance

Productivity is the quintessential indicator of efficiency in any production system (Abramo & D'Angelo, 2014). Generally speaking, the objective of research activity is to generate new knowledge. Research activity is seen as a production process in which the inputs consist of human, tangible and intangible resources, and where output, the new knowledge, has a complex character of both tangible nature and intangible nature. The new knowledge production function has therefore a multi-input and multi-output character. The principal efficiency indicator of any production unit (individual, research group, department, institution, field, country) is productivity and it is the output produced in a given period per unit of production factors (Abramo & D'Angelo, 2014). Various metrics have been employed to capture research productivity such as number of publications per researcher, impact of publications (generally measured using citation index) and potential application of research outcomes. Abramo and D'Angelo (2014) argued that performance should be evaluated with respect to the specific goals and objectives that a research intends to achieve. This is because objectives and goals of research vary across research organisations and along timeframes, recommending a sole indicator of performance would be inappropriate, although, combining many unrelated indicators could amount to comparing apples to mangoes. In this study, the measure of performance for academics is estimated number of publications as

provided (Link & Scott, 2006) and subjective rating of a faculty's teaching performance. The number of publications are supplied by all faculties in the sample. Publications are major metrics of research productivities in most Nigerian universities. For instance, Neill, Thomson and Gibson (2015) have clearly argued that the main metrics of research productivities and knowledge production are intricately linked to the quality and quantity of publications, be they books, book chapters, articles, conference papers, book reviews among others. However, the emphasis is on impacts of those publication using bibliometric computations and citation indexes. In Nigeria, Okonedo *et al*. (2015) identified academic publications as major criteria for promotion and career progression among faculties. The focus is, however, not only on numbers, but also high indexes (impact) in the global academic community. Some universities have developed a database of publication outlets for their faculty members, particularly outlets indexed in Thompson Reuters' Web of Science and Scopus, among others.

On the teaching quality, many factors are considered when determining the quality of teaching in higher education institutions, particularly the teacher-student ratio, administrative and management policies and learning facilities among others. In the absence of formal data on teaching performance of faculties in Nigeria, the subjective rating and self-reported level of teaching performance was obtained from all respondents.

Context analysis

The Nigerian research system includes both public and private tertiary institutions and research institutes. Tertiary institutions include universities, polytechnics, monotechnics and specialised institutions and colleges of education (technical and conventional). The public research institutes are largely spread across several ministries, departments and agencies of the government. To date, there are about one hundred and seventy (170) universities in Nigeria owned by federal government (43), state government (48) and private individuals and faith-based organisations (79) (NUC, 2020). For the public universities (federal and state), government is the main funder through budgetary allocation and special intervention funds. The private or faith-based universities are run by individuals and religious organisations. All of these universities are regulated by the national universities commission, an agency of the Federal Ministry of Education in Nigeria.

Universities in Nigeria are faced with underfunding, weak infrastructure and poor incentive systems, among others (Faboyede, Faboyede & Fakile, 2017; Adelowo, 2018; Siyanbola, 2019). The percentage of funding allocation to the education sector from the national budget has fluctuated between 8.2% and 8.7% over the period 2004 to 2017, as opposed to 26% of GDP recommended by UNESCO (Okebukola, 2015). To expedite action on how Nigerian universities could be better positioned to meet development aspirations, the federal government

conducted a survey on the needs assessment of university system in 2012. The assessment report showed huge lapses in the Nigerian university system as the majority of the universities are under-staffed leading to huge faculty-students ratios, laboratories are under-equipped, classrooms are insufficient, and many abandoned and uncompleted projects littered the universities due to underfunding (Okebukola, 2015; Deji-Falutile & Oketola, 2014). To overcome this resource gap in the public universities across the country, Tertiary Education Trust Fund (TETFUND) was strengthened, particularly to bridge research, training and infrastructural gaps in universities. The TETFund has since provided competitive opportunities for academia to access research grants targeting a diverse spectrum of research fields in Nigerian public universities. Even with TETFund and universities' budgetary allocations, government encourages universities and research institutions to develop potential for grant attraction and supplement internally generated revenue in order to keep pace with developmental challenges confronting them. In this way, universities have intensified efforts to seek additional funding sources for research, including collaboration with industry, tuitions and development levies, consultancies, small businesses and manufacturing operations and research commercialisation. Furthermore, universities that have demonstrated competencies and capabilities in entrepreneurial engagements have attracted talents and industry partners over the years, contributing to economic growth and national competitiveness without compromising traditional activities (Secundo & Elia, 2014; Siegel & Wright, 2015). Faculties' orientation towards entrepreneurship is usually stimulated and sustained through policy incentives. For instance, the Bayh-Dole Act of 1980 transformed technology transfer activities among universities in the USA, while a similar strategy was adopted in European countries to overcome 'European Paradox' in the 1990s. Grundling and Steynberg (2008) have also unearthed principal forces shaping academic entrepreneurship in the Republic of South Africa. Nigerian university administrators are given the autonomy to formulate policy incentives to encourage technology transfer and entrepreneurship among the faculties. Essia (2012) noted that entrepreneurship culture among faculties is far from being realised; however, there has been consistent improvement following various discussions around industry-academia linkages in universities, administrators and industry managers (Abereijo, 2015; Siyanbola, 2019). Recently, there has also been a slight increase in the patenting culture of academia in Nigeria (Siyanbola, Adelowo & Mohammed, 2019). In summary, it is important to note that as the need to engage in academic entrepreneurship is improving in universities across the country, faculties' performances in teaching and publication are also key towards human capital development and shifting the frontier of knowledge in scientific fields.

Research methodology

Using a quantitative research approach, both primary and secondary data were used. Primary data were collected using the survey method because data on academic entrepreneurship are not available anywhere in Nigeria and specific information needed to achieve the research objectives has to be obtained from faculties through surveys. A structured questionnaire was designed to obtain the information from representative samples. For proper representation, public and privately-owned universities were included in the study, but preference was given to only NUC-accredited universities, those with well-established research centres and intellectual property and technology transfer offices. The main assumption here is that universities with these facilities would possibly have great potential for academic entrepreneurship. The population of the study included all academics in science, technology and engineering departments across the public and private universities in Southwestern Nigeria.

A multi-stage sampling technique was adopted to select a representative sample from faculty members in the universities in Southwestern Nigeria. Firstly, the purposive sampling method was used to select universities with research intensive activities, technology transfer offices and support structure for entrepreneurship. At this stage, 13 research-intensive universities in the Southwest were identified and selected for the study. These included both public and private universities. Since the study focused on academic entrepreneurship, the departments of interest were Science, Technology and Engineering. This became necessary as these departments are the main source of tangible research outputs in the country. Some of these departments included Chemistry, Physics, Material Science, Agricultural Science, Agricultural Engineering, Food Science and Technology, Pharmacy, Pharmacology, Chemical Engineering, Microbiology and Biochemistry among others. The faculties were later selected based on minimum academic qualification of MSc and status (Adelowo, 2020). Lecturer II and above were the main preference in this study as they possessed the requisite competence and capability for generating commercialisable outputs, and have the freedom to engage in entrepreneurial activities. A maximum of five and minimum of three faculty members were randomly selected at departmental level in each university through the assistance of faculty administrators and trained field officers. In all, a total of three hundred and fifty (350) faculty members from 13 universities were selected to participate in the survey, which lasted four months (November 2015 to February 2016). Two hundred and twenty-nine (229) usable questionnaires were received, representing a 65.4 percent response rate.

Instrument

The dependent variables of academic performance were measured using both teaching and publication productivity among the sampled faculties in the

universities. The faculties were requested to provide the number of publications by them. In this case, the data become amenable to ordinary least square (OLS) regression analysis. On teaching quality, the faculties were requested to rate how their engagement in AE activities has affected the quality of teaching on a three-point Likert rating scale of positive (2), no effect (1) and negative (0). The weighted mean average of the responses was computed, and used for the regression analysis.

Independent variables include the academic entrepreneurship activities/ engagements in which faculties have been involved over time. A holistic approach to academic entrepreneurship is adopted in this paper whereby the 15 academic entrepreneurship activities identified in De Silva, Uyarra and Oakey (2012), De Silva (2015) and Adelowo (2018) were adapted for this study. These academic entrepreneurial activities were measured using a three-point Likert scale. De Silva (2015) classified these activities into three categories, including teaching-related, research-related and company-creation activities using a qualitative approach. However, more robust empirical estimations are required for wider generalisation. In this paper, these 15 items were subjected to data reduction techniques through the principal component analysis (PCA) in order to prepare the variables for robust statistical tests and analyses. The PCA produced four factors that succinctly explained academic entrepreneurship among faculties in Nigeria, with significant Bartlett's test of Sphericity (1447.004, df = 105, $p<0.000$), and 'meritorious' Kaiser-Meyer-Olkin index of 0.884 (using the thresholds proposed by Kaiser, 1974). The first factor dimension is dominant, accounting for 43.3% of the variance, while others accounted for 9.04, 7.93 and 7.15% of the variance, respectively (see Table 1). The four factors followed theoretical richness and are themselves correlated. The factors were renamed considering the path of the structure matrix and how strong each item is correlated on the factors. The four factors include university-related entrepreneurial engagements (UREE), start-up formation and industry collaboration activities (SUFIC), faculty externship activities (FE) and teaching-related entrepreneurial (TRE) activities.

Table 1. Factor loadings from exploratory factor analysis of academic entrepreneurship engagements among faculties in Nigeria

Structure matrix	Components				Cronbach's α
	1	2	3	4	
UREE1 Contributing to the formation of joint ventures in which university and industry are joint partners	**.889**	.539	.414	.373	**0.878**
UREE 2 Contributing to the formation of one or more new spin off companies owned by the university	**.886**	.524	.236	.317	

UREE 3 Contributing to the formation of university centres designed to carry out commercialisation, e.g. incubator	**.885**	.469	.469	.462	
UREE 4 Contract research for industry through your university	**.680**	.459	.649	.443	
SUFIC1 Formation of company to commercialise own research output	.512	**.842**	.173	.305	
SUFIC2 Formation of company through personal industry collaboration	.563	**.831**	.261	.425	
SUFIC3 Collaborating with industry through joint research project	.386	**.765**	.561	.365	**0.845**
SUFIC4 Serving a consultants to firms/companies while still being attached to university	.445	**.741**	.489	.506	
SUFIC5 Developing products or services that have potential for commercialisation	.216	**.649**	.647	.385	
SUFIC6 Patenting of research output	.521	**.590**	.341	.587	
FE1 Placing students as trainees in industry	.275	.248	**.823**	.265	0.93*
FE2 Conducting seminars and training sessions for industry	.465	.405	**.678**	.430	0.89*
TREE1 Initiating the development of new degree programmes for schools	.417	.370	.453	**.845**	**0.71**
TREE2 External teaching, e.g. sabbatical	.228	.324	.212	**.829**	
TREE3 Attracting funds from government and non-governmental bodies	.294	.530	.457	**.611**	
Variance explained	**43.30**	**9.04**	**7.93**	**7.15**	**0.903**

*Individual item Cronbach's alpha
Extraction method: Principal component analysis
Rotation method: Promax with Kaiser normalisation

Results and discussion

The major constructs of academic entrepreneurship were captured using 15 items and was subjected to a data reduction strategy, where four factors were isolated and renamed for regression analysis. These factors are succinctly described in the methodology section of this paper.

The impact of academic entrepreneurial engagements on research performance of faculty members is assessed using least square regression analysis. The results, as presented in Table 2, show that the university-related entrepreneurial engagement (UREE) has a negative and significant impact on faculties' publication potentials (β =-3.86, $p<0.05$). This result implies that as faculty members engage more in university-related entrepreneurial engagements, their publication potential tends to

diminish. This result is not surprising considering the entrepreneurial activities that make up the UREE. Most of these activities are time consuming and the results are mostly neither personal nor immediate in nature, as it could be best described as community service for the faculties. In fact, they are the preliminary activities for universities that are transitioning to become entrepreneurial and most faculties involved are mostly highly ranked or have experienced professors in the universities. However, other categories of academic entrepreneurship reveal positive and significant effects on publication potentials of the faculties. The start-up formation and industry collaboration (SUFIC) show great contribution to the publication potential of faculties (β =2.84, $p<0.05$), indicating that researchers' publications tend to increase by a multiple of 2.84 at the instance of any additional effort towards SUFIC. Of course, SUFIC items are mostly personal and indeed synchronise well with the third mission objective of universities (Etzkowitz, 2011). Furthermore, the inclusion of industry collaboration and patenting in SUFIC positioned participating researchers for access to industry resources, giving them the opportunities to publish more than their colleagues without such collaboration. Faculty externship (FE) has a positive and significant relationship with publication potential at 93% significance level (β =2.25, $p<0.1$). The training-related entrepreneurial engagement (TREE) also has a positive but not significant effect on the publication potentials of faculties (β =1.92, $p>0.05$). These results imply that faculty members' publications tend to increase at different levels as engagement in SUFIC, FE and TRE is intensified. The results support the findings in Gulbrandsen and Smeby (2005), Azoulay *et al.* (2007), Carayol (2007), Breschi *et al*. (2007) and Rentocchini *et al*. (2014) which found researchers' publications surge as a result of their involvement in AE in some European and American universities. For instance, Gulbrandsen and Smeby (2005) found a significant relationship between industry funding and research performance among tenured faculties in Norway, particularly that professors with industrial collaboration reported more scientific publications as well as more frequent entrepreneurial results. Azoulay *et al*. (2007) found that patenting, as an indicator of entrepreneurial behaviour is also a function of scientific opportunities, which, in turn, have impacts on research productivity. Carayol (2007) concluded that publishing and patenting are positively related. Breschi *et al.* (2007) found a strong and positive relationship between patenting and publishing. Rentocchini et al. (2014) found that consultancy engagements have a negative effect on productivity of researchers in science and engineering fields in Spanish universities. The income level and job status of faculty members were controlled for in the analysis. The results revealed that income level was positive and highly significant to the publication performance (β =9.35, $p<0.01$). The income level is determined by the ranks of the faculty members and a measure of experience within the university. Given the dearth of resources in the Nigerian university system, research is sometimes conducted using personal savings. This explains why income level as a factor contributed positively to the research

performance of faculty members in the university system in Nigeria. However, the job status does not show a significant relationship.
All independent variables in the model were able to explain 56.1% of the factors explaining publication performance among faculties in the university. The analysis of variance also showed a significant difference ($F=31.4$, $p<0.01$) among the variables considered, indicating a good model fit.

Table 2. Regression analysis of the effects of academic entrepreneurship (TAE) on research performance

Independent variables	**B**	**T**	**Sig.**
(Constant)	-3.332	-1.391	.166
University-related entrepreneurial engagements	-3.868	-3.120	**.002***
Start-up formation and industry collaboration	2.840	2.133	**.035****
Faculty externship	2.248	1.827	**.070*****
Training-related entrepreneurial engagement	1.922	1.497	.137
Income level	9.346	5.136	**.000***
Job status	.929	.442	.659
R	74.9%		
R^2	56.1%		
ANOVA	F=31.362 P <0.01		

Note: publication performance is the dependent variable
p<0.01*, p<0.05**, p<0.08***

On the impact of academic entrepreneurship on teaching performance of the faculties, the results, as presented in Table 3, revealed that UREE (β =-0.02, $p>0.05$) and TREE (β =-0.03, $p>0.01$) have negative effects on the teaching performance of the faculty members, although the effects are not significant. UREE shows a similar negative relationship and effect on research performance. This suggests that selection into this engagement by the universities should be done with caution, paying particular attention to faculties who already have interest in these engagements. This could help the universities optimise their scarce time and human resources. The efforts that academia expends on TREE tend to impact on their teaching performance negatively, though the result was not significant. Income level also shows a negative and significant relationship with teaching performance (β=-0.10, $p<0.05$). This suggests that most academics' teaching performance declines with an increase in income. However, a sharp contrast was found with job status (β =0.1, $p<0.01$) indicating improved teaching quality as faculty members climbed the academic ladder.
In addition, SUFIC (β =0.05, $p>0.01$) and FE (β=0.12, $p<0.01$) show a positive relationship with teaching performance of the faculties; however, only FE is

significant. Of course, the faculty externships that are mostly related to teaching activities are obviously going to improve the faculty's teaching potentials. All the independent variables significantly accounted for 10.2% of the factors that could influence teaching performance in Nigerian universities. The analysis of variance revealed significant differences among the independent variables ($F=3.31$, $p<0.05$).

Table 3. Regression analysis showing the effect of academic entrepreneurship on teaching performance

Independent variables	B	t	Sig.
(Constant)	1.659	20.703	0.000
University-related entrepreneurial engagements	-0.02	-0.474	0.636
Start-up formation and industry collaboration	0.051	1.145	0.254
Faculty externship	0.115	2.788	**0.006**
Training related entrepreneurial engagement	-0.029	-0.656	0.513
Income level	-0.099	-2.049	**0.042**
Job status	0.111	2.479	**0.014**
R	32%		
R^2	10.2%		
ANOVA	F=3.31 P < 0.04		

Note: Teaching performance is the dependent variable
$p<0.01$*, $p<0.05$**

Conclusion

In this study, the relationship between and effects of academic entrepreneurship and universities' traditional activities (teaching and research) were examined within a developing country context. The proponents of entrepreneurial universities have argued that national competitiveness could be fast-tracked where universities are responsive to the technological needs of the industry and societies. More so, academics who engage in AE tend to do better in teaching and research performance. This is because AE provides the platform to access industry resources, find placement for students and make the faculty members more productive. The results of the analysis have aptly demonstrated that academic entrepreneurship could be categorised into four dimensions and that each dimension affects the performance of the faculties differently. It is interesting to note that university-related entrepreneurial engagement (UREE) decreases the potential of academics to publish. However, start-up formation and industry

collaboration (SUFIC) were identified as catalysts to their publication potentials. The TREE and FE also produced greater and more positive contributions to publication performance of the faculties. Moreover, while FE has the potential to improve the teaching performance of the faculties, UREE and TREE tend to diminish it. Therefore, the study concluded that university administrators should pay more attention to the AE that produces the desired effects through appropriate incentive mechanisms, while caution should be exercised while making selection into others AE activities.

Managerial implications

It is evident from the study that there are four clear indicators of AE and each factor affects traditional activities differently. University administrators and faculty members need to approach each AE in a strategic manner in order to optimise universities' time and resources. For instance, UREE is a preparatory phase of AE and it is therefore reasonable that before the committees are set up, university administrators need to consider the interest and entrepreneurial inclinations of the members. The interest of academic members should take priority in the selection, beyond seniority, so as to reduce the burden of UREE on faculty's publication and teaching performance.

The establishment and creation of a robust entrepreneurship ecosystem in universities also need to consider the entrepreneurship interest and orientation of the faculties to be involved. Faculties with great entrepreneurship potential should be allowed to champion the processes that will promote technology transfer and commercialisation in the universities. Furthermore, appropriate reward mechanisms or inventive systems should be established in the universities to further encourage the commercialisation potential of academics, as this study has shown that SUFIC and FE improve publication and teaching potential. In addition, this could promote universities' visibility and ranking among the community of universities locally and globally, thereby creating a platform for attracting top-class scientists and talented students. To make the university more industry relevant and adept to solving societal challenges, a properly centralised and well-coordinated centre has to be established for the collation of research activities in the universities, sensitisation of faculties on technology transfer and commercialisation, and to actively source and engage industry partners for technology uptake. Through this centralised office, academic entrepreneurs in the universities can better manage their time and resources. There is also the need for the government to improve capital allocations for research and innovations in the universities to bridge the 'valley of death' resulting from a poor venture capital system.

References

Abereijo, I. O., (2015). Transversing 'the Valley of Death': Understanding the Determinants to Commercialisation of Research Outputs in Nigeria. *African Journal of Economic and Management Studies*, 6 (1), 90-106.

Abramo, G., D'Angelo, C. A., (2014). How do you define and measure research productivity? *Scientometrics*, 101 (2), 1129-1144.

Acs, Z. J., Audretsch, D. B., Lehmann, E. E., (2013). The knowledge spill over theory of entrepreneurship. *Small Business Economics*, 41 (4), 757-774.

Adelowo, C. M., (2018). Factors influencing Academic Entrepreneurship in Nigeria. *International Journal of Innovation and Regional Development*, 8(4), 337-357.

Adelowo, C. M., (2020). Sources of technological learning among tenants of Nigeria's incubators. *African Journal of Science, Technology, Innovation and Development*.

Azoulay, P., Ding, W. and Stuart, T., (2007). The determinants of faculty patenting behaviour: Demographics or opportunities? *Journal of Economic Behaviour and Organization*, 63 (4), 599-623.

Badruddin, S., Burhanudddin, B. and Halim, P., (2019). The influence of innovation performance and national competitiveness on entrepreneurial education. *Polish Journal of Management Studies*, 20 (2), 104-113.

Bercovitz J., Feldman, M., (2003). Technology Transfer and the Academic Department: Who Participates and Why? *Working Paper, DRUID, Copenhagen*.

Breschi, S., Lissoni, F. and Montobbio, F., (2007). The Scientific Productivity of Academic Inventors: New Evidence from Italian Data. *Journal of Economics of Innovation and New Technology*, 16 (2), 101-118.

Cantaragiu, R., (2012). Towards A Conceptual Delimitation of Academic Entrepreneurship. *Management and Marketing Challenges for the Knowledge Society*, 7 (4), 683-700.

Carayol, N., (2007). Academic Incentives, Research Organization and Patenting at A Large French University. *Journal Economics of Innovation and New Technology*, 16 (2), 119-138.

Clark, B. R., (1998). *Creating entrepreneurial universities: Organizational pathways of transformation.* Pergamon: New York.

Dasgupta, P., David, P. A., (1994). Toward a New Economics of Science. *Research Policy* 23 (5), 487-521.

De Silva, M., (2015). Academic entrepreneurship and traditional academic duties: synergy or rivalry? *Studies in Higher Education*, 41 (12), 2169-2183.

De Silva, L. R., Uyarra, E. and Oakey, R., (2012). Academic Entrepreneurship in a Resource-Constrained Environment: Diversification and Synergistic Effects. *Technology Transfer in a Global Economy, 28 (International Studies in Entrepreneurship)*,73-97.

Deji-Folutile, O., Oketola D., (2014). *Experts Propose Creative Ways of Funding Nigerian Universities.* Available from http://odili.net/news/source/2014/nov/23/807.html

Essia, U., (2012). Entrepreneurial Culturing of Formal Education Programme in Nigeria. *Journal of Sustainable Society*, 1 (2), 52-62.

Etzkowitz, H., (2011). Normative Change in Science and the Birth of the Triple Helix. *Social Science Information*, 50 (3-4), 549-568.

Faboyede, S. O., Faboyede, A. O. and Fakile, S. A., (2017). Funding of university education in Nigeria: challenges and prospects. *European Journal of Social Sciences Studies*, 2(8), 221-238.

Grundling, J. P., Steynberg, L., (2008). Academic entrepreneurship in South African HEIs. *Industry & Higher Education*, 22(1), 9-17.

Guerrero, M., Urbano, D., (2012). The development of an entrepreneurial university. *Journal of Technology Transfer*, 37 (1), 43-74.

Gulbrandsen, M., Smeby, J. C., (2005). Industry funding and university professors' research performance. *Research Policy*, 34 (6), 932-950.

Link, A. N., Scott, J. T., (2006). U.S. University Research Parks. *Journal of Productivity Analysis*, 25(1-2), 43-55.

Louis, S, Steele, P., & Wayt L., (2016). *Evolving Higher Education Business Models: Leading with Data to Deliver Results*. Washington, DC: American Council on Education.

Neill, U. S., Thomson, C. B. and Gibson, D., (2015). *Accessing research productivity: A new way of evaluating academics research output using easily obtained data. Critic at Large, in The scientist: Exploring Life, Inspiring Innovation.* Available at: https://www.the-scientist.com/critic-at-large/assessing-research-productivity-36152.

National Universities Commission (NUC). (2020). List of universities in Nigeria. Available at https://www.nuc.edu.ng/nigerian-univerisities/federal-univeristies/

https://www.nuc.edu.ng/nigerian-univerisities/state-univerisity/

https://www.nuc.edu.ng/nigerian-univerisities/private-univeristies/

Okebukola, P. A., (2015). *Towards Models for Creatively Funding Higher Education in Nigeria.* In Okebukola P. A. (Eds) Towards Models for Creatively Funding Higher Education in Nigeria, AAU, Addis.

Okonedo, S., Popoola, S. O., Emmanuel, S. O., Bamigboye, O. B., (2015). Correlational Analysis of Demographic Factors, Self-Concept and Research Productivity of Librarians in Public Universities in South-West, Nigeria. *International Journal of Library Science*, 4 (3), 43-52.

Olofinyehun, A., Adelowo, C. M. and Egbetokun A. A., (2018). The Supply of High Quality Entrepreneurs in Developing Countries: Evidence from Nigeria. *Science and Public Policy*, 45 (2), 269-282.

Poh-Kam, W., Yuen-Ping, H. and Annette, S., (2007). Towards an "Entrepreneurial University" Model to Support Knowledge-Based Economic Development: The Case of the National University of Singapore. *World Development*, 35 (6): 941-958.

Rentocchini, F., D'Este, P., Manjarrés-Henríquez, L. and Grimaldi, R., (2014). The relationship between academic consulting and research performance: Evidence from five Spanish Universities. *International Journal of Industrial Organization*, 32 (1), 70-83.

Samson, K. J., Gurdon M. A., (1993). University Scientists as Entrepreneurs: A Special Case of Technology Transfer and High Technology Venturing. *Technovation* 13 (2), 63-71.

Secundo, G., Elia, G., (2014). A performance measurement system for academic entrepreneurship: a case study. *Measuring Business Excellence*, 18(3), 23-37.

Siegel, D. S., Waldman, D., Link, A. N., (2003). Assessing the Impact of Organizational Practices on the Productivity of University Technology Transfer Offices: An Exploratory Study. *Research Policy*, 32 (1), 27-48.

Siegel, D. S., Wright, M., (2015). Academic Entrepreneurship: Time for a Rethink? *ERC Research Paper* No. 32, 1-39.

Siyanbola, W. O., (2014). *Enterprise-Based Economy for sustainable development* A 2014 distinguished annual lecture paper presented at the national institute for policy and strategic studies, Kuru (NIPSS), Jos. National Institute, Kuru, Jos.

Siyanbola W. O., (2019). Stimulating the culture of innovation in a latecomer economy for sustainable development. A keynote paper presented at the *1st International Conference on knowledge and Innovation Management*, organised by Babcock University, Ilesan, Ogun state, Nigeria, 15-18 January, 2019.

Siyanbola, W. O., Adelowo, C. M. and Mohammed I., (2019). *Performance Assessment of IP and Technology Transfer Offices (IPTTOS) In Nigeria: Key Findings.* A paper presented at the Training of Trainer by the ARIPO Academy in Accra, Ghana between 11th and 15th November, 2019.

Van Looy, B., Ranga, M., Callaert, J., Debackere, K. and Zimmermannc, E., (2004). Combining entrepreneurial and scientific performance in academia: Towards a compounded and reciprocal Matthew-effect? *Research Policy*, 33 (3): 425-441.

PRZEDSIĘBIORCZOŚĆ AKADEMICZNA I TRADYCYJNE WYNIKI NAUKOWE NA UCZELNIACH: DOWODY Z KRAJU ROZWIJAJĄCEGO SIĘ

Streszczenie: Uniwersytety odgrywają kluczową rolę w tworzeniu gospodarki opartej na wiedzy i czwartej rewolucji przemysłowej (Przemysł 4.0). Budują krytyczny kapitał ludzki, generują nową wiedzę i dążą do promowania innowacji poprzez przedsiębiorczość akademicką. Pomimo potencjalnych korzyści płynących z przedsiębiorczości akademickiej (AE), argument, że AE napędza lub utrudnia zaangażowanie wydziałów w tradycyjne działania zarówno w krajach rozwiniętych, jak i rozwijających się, pozostaje otwarty. Dlatego niniejszy artykuł empirycznie bada wpływ przedsiębiorczości akademickiej na potencjał dydaktyczny i publikacyjny wydziałów w celu zaproponowania odpowiedniego przewodnika politycznego dotyczącego promowania innowacji i wzmacniania tradycyjnych działań wśród środowisk akademickich w Nigerii. Dane do tego artykułu zostały zebrane od 229 wykładowców z dziedzin związanych z nauką i technologią na 13 wybranych uniwersytetach w Nigerii, poprzez podejście do projektowania badań przekrojowych. Zebrane dane analizowano za pomocą analiz czynnikowych i regresji. Wyniki pokazały, że udział pracowników wydziału w tworzeniu nowych przedsiębiorstw i współpracy branżowej (SUFIC) ($\beta = 2,8$, $p<0,05$) oraz wydziałowych praktykach (FE) ($\beta = 2,3$, $p<0,1$) ma statystycznie istotny i pozytywny wpływ na potencjał publikacyjny wśród pracowników wydziału. Staż wydziałowy (FE) również wykazuje pozytywny i znaczący związek z wynikami dydaktycznymi członków wydziału. Jednak związane z uniwersytetami zaangażowanie w przedsiębiorczość (UREE) wykazuje negatywny i znaczący związek zarówno z publikacjami, jak i wynikami nauczania, co sugeruje ostrożność przy dokonywaniu wyborów dotyczących takich działań przez administratorów uczelni. Badanie kończy się implikacjami menedżerskimi dla kierowników uniwersytetów i decydentów.

Słowa kluczowe: przedsiębiorczość akademicka, tradycyjne działania, wyniki, analiza czynnikowa, ekosystem przedsiębiorczości

大学的学术企业家精神和传统学术表现:来自发展中国家的证据

摘要:大学在创建知识经济和第四次工业革命(工业4.0)中起着核心作用。他们建立关键的人力资本,产生新的知识,并努力通过学术创业精神来促进创新。尽管学术创业精神(AE)具有潜在的好处,但关于AE助长或阻碍教职员工对发达国家和发展中国家传统活动的承诺的争论仍未解决。因此,本文通过实证研究了学术企业家精神对教师教学和出版潜力的影响,以期提出适当的政策指南,以促进尼日利亚学术界的创新和加强传统活动。本文采用横断面调查设计方法,从尼日利亚13所选定大学的与科学和技术相关领域的229名教职员工中收集了数据。使用因子分析和回归分析对收集的数据进行分析。结果表明,教师参与创业组织和产业合作(SUFIC)(β = 2.8, $p<0.05$)和教师实习(FE)(β = 2.3, $p<0.1$)在统计学上具有显着和正向影响在教师中发布的潜力。教员实习(FE)也与教员的教学表现成积极且重要的关系。但是,与大学有关的创业活动(UREE)与出版和教学绩效之间存在着消极和重要的关系,这表明在选择大学管理者进行此类活动时要谨慎。该研究结论对大学管理者和决策者具有管理意义。

关键词:学术创业,传统活动,绩效,因子分析,创业生态系统