Patients and Scientific Productivity of Academics: Implication for Industrial Growth and Poverty Reduction in Nigeria

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The study examined the determinants of scientific productivity and attitudes of some academics towards patent rights protection in faculties of science and technology at Obafemi Awolowo University, Ile-Ife Nigeria. A total of 53 lecturers from the rank of lecturer II and above completed the questionnaire which was analyzed using econometric methods of OLS, Logit and Negative Binomial Models. The result shows that personality traits and senior lecturer cadre were strong determinants of scientific productivity. Moreover, the academics were positively disposed to patent rights protection for promoting scientific productivity in the university.

INTRODUCTION

The United Nations Industrial Organization Report (UNIDO, 2006) provides an overview of the progress recorded by countries towards the achievement of the Millennium Development Goals (MDGs), especially in the area of poverty reduction. Economic development was found to have lifted millions of people out of poverty between 1991 and 2001 with a reduction of people living on less than $1 a day from 28 to 21 percent. However much of the progress recorded was attributed majorly to advances in South and East Asia countries, while the sub-Saharan African countries rather experienced an increase in the proportion of people living with less than $1 a day from 45 percent of the population to 46 per cent.

Indeed, the 2004 Industrial Development Report observed that there is a consensus that low-income African countries will not break free from the shackles of poverty unless and until they diversify their economies, especially through industrialization. The report pointed out that slow progress in poverty reduction can be attributed to shortcomings in respect of private sector development and structural reform (UNIDO, 2006).

An analysis of drivers of industrial performance by Industrial Development Report of 2002/2003 showed that technology which comprises domestic research and development as well as access to foreign technology through foreign direct investment has a powerful influence. Among the drivers of industrial performance, R&D was found to be the most significant determinant (UNIDO, 2002/2003). Hence, many developed nations have undertaken various reforms towards harnessing R&D from various sources

towards industrial applications. The universities for instance which hitherto were responsible for producing knowledge and disseminating such freely to the general community have come under patent reforms. For instance, the United States passed the Bahy-Dole act to address ownership rights arising from knowledge generated from the universities such that researchers creating such knowledge could receive adequate reward for their effort which invariably will stimulate the continuous production of knowledge. However, this move have been criticized on the grounds that protection of knowledge generated from the universities may have an adverse effect on the culture of open science and also hinder teaching quality as researchers in pursuit of monetary rewards could dedicate more time towards creation of knowledge with commercial application rather than basic research (Stephan, 2001). While this issue has received tremendous attention by scholars from developed countries, there has been little or no studies addressing this in developing countries especially Nigeria.

This study is thus initiated to examine the determinants of knowledge production among researchers in faculties of science, technology, agriculture and pharmacy at Obafemi Awolowo University, Ile-Ife Nigeria. This work is divided into 5 sections. Section one has articulated the research problem, while section two focuses on the literature review while section three deals with the research methodology and section four presents the analysis of results and findings. The last section makes some conclusions and recommendations.

LITERATURE REVIEW

The literature identifies several factors determining scientific productivity. Among them are age, gender, rank, experience, and departmental support and personality factors. The literature on age and scientific productivity posits that young scientists made more outstanding contributions to science than older ones. Using different measures for age: chronological (Clemente 1973; Cole 1979; Pelz and Andrews 1966); Years of professional experience (Creswell, Patterson and Barnes, 1984, 1984); and Years since the receipt of PhD degree (Allison & Stewart, 1974; Bayer & Dutton 1977). The general finding indicates that age impaired performance, although performance improved with age. The literature on gender hypothesized that men publish more than women. Empirical evidenced have confirmed this (Waworuntu, 1986; 1986; Kyvik, 1990; 1990).

Some studies have indicated that personality traits may be an important factor distinguishing academics in scientific productivity. Some of the traits bother on attitude and motivation, work habits and creativity. Productivity of scientists is assumed to be propelled by inner drive or compulsion to succeed. Eminent scientists are believed to posses some abilities such as, ability to play with ideas, differentiate stimuli, recombine concepts, and tolerate ambiguity and abstraction (Gordon and Morse, 1970). They are also believed to be reliant and self confident with their ideas, which makes them to devote more time to their research (Merton, 1973). Productive university research scientists are found to be motivated, and have a strong drive to explore new ideas. They are also found to be very organized with respect to time and materials (Mills, 1959). Woods (1990) also identified the following factor as contributing to scientific productivity—ability to cope with extra work loads, intellectual curiosity and ability to write and set apart time for research.

The professional rank of a researcher is also expected to influence his productivity. Certain studies have confirmed that academic staff at the higher ladder of the professional rank has larger publications than those in the lower rank (Blackburn, Behymer and Hall, 1978: Creswell, Patterson and Barnes, 1984). The average number of publications have been found to increase with the number of years of professional experience. Rushton, Murray and Paunonen. (1987) indicated that productivity varied with age and experience.

The Literature has also identified various ways in which the department can be of great support to scientific productivity. Barnhill and Linton (1992) provided some insights into the role of the head of department in stimulating productivity. These include; promoting a balance between teaching and research, encouraging team research groups, creating the right research climate, informing staff of available grants; sharing copies of successful proposal and setting up periodic research seminar.

RESEARCH METHODS

This study makes use of a primary research method by administering questionnaire on a cross section of researchers in the faculty of science, Obafemi Awolowo University Ile-Ife. The study was targeted at researchers from the rank of lecturer 2 and above, especially those with a Ph.D. degree. There are about 500 lecturers in the target faculties and a total of 250 questionnaires, which represented 50% of the lecturers, were administered. Only 53 of them were properly filled and returned, which gives a response rate of 21% and about 11% of the total number of lecturers in the faculties.

Model Specification

Five different measures of Scientific Productivity (SP) were used for this analysis. These include; Average Publications in the past Five Years (APFY), Average Total Publications (ATP), Average Foreign Publications (AFP), Number of grants won by the researchers (GRANT) and Recognition or Prizes received by the researchers on account of research produced (PRZ). The independent variables include; Personal, Academic, Departmental and Personality variables. The model is specified thus:

$$SP = b_0 + b_1 Age + b_2 Gen + b_3 NOC + b_4 FPHD + b_5 XPHD + b_6 WEXP + b_7 DSPT + b_8 PROF + b_9 SL + b_{10} L1 + b_{11} PMT + b_{12} EXTVT + b_{13} AGRBLE + b_{14} OPEN + b_{15} CSNTS + b_{16} STBLE$$

Table 1 provides definition of the variables.

Techniques of Analysis

Two major techniques used for analyzing the data were descriptive and econometric. Three econometric techniques were used for the analysis of the models. The first three dependent variables, i.e. APFY, ATP and AFP, were analyzed with the use of Ordinary Least Square Method (OLS), while the GRANT variable, which is a count variable, was analyzed with the use of Negative Binomial model, while the fifth variable, representing recognition and award (PRZ), was dichotomized into two, those with grant and those without. This was subsequently analyzed with the use of logit model.

TABLE 1
DEFINITION OF VARIABLES

	Variable	Definition	Measurement
1	Age	Chronological Age of the Respondents	Years
2	Gen	Gender	1 = male; 0 = female
3	NOC	Number of Children	Number of children
4	NCT	Number of children below the age of 10 years	Same as (3) above
5	FPHD	Foreign-awarded PhD	1=foreign; 0= local
6	XPHD	Number of years since the award of PhD	Number of years
7	WEXP	Number of years since working in academics	Number of years
8	DSPT	Departmental support	Average point of a 5-point rating scale
9	PROF	Professorial cadre	1 = prof; 0 = others
10	SL	Senior lecturer cadre	1 = senior lecturer; 0 = others
11	L1	Lecturer 1	1 = lecturer 1; 0 = others
12	PMT	Promotion	Number of promotion earned since in employment
13	EXTVT	Extrovert	Average point of a 5-point rating scale
14	AGRBLE	Agreeable	Same as (13)
15	OPEN	Openness	Same as (13)
16	CSNTS	Conscientious	Same as (13)
17	STBLE	Emotional stability	Same as (13)

Result of Econometric Analysis

Table 2 presents the results of the econometric analysis of the five models adopted for this study. We first measured the influence of the socio-demographic variables on the scientific productivity of the researchers. The age of the researchers was found to have a negative impact on the scientific productivity in two of the three OLS models. Average foreign publication was an exception, which turns out positive. However, none of them was statistically significant. The negative impact of age on productivity seemed to be confirmed by the other two models, this was statistically significant in the logit model. Hence, age of the researchers has a negative impact on scientific productivity, especially when it involves outstanding works that can attract prizes and awards. This result confirmed that real scientific productivity varies inversely with age. Moreover, the role of gender was positive in 4 out of the 5 models. However, none of them was statistically significant.

Furthermore, the number of children recorded a negative impact on productivity, this was statistically significant in the first 2 models (APFY, ATP). It was positive for grants and negative for prizes, however, no statistical significant impact was noticed.

Furthermore, the place where Ph.D. degree was awarded was expected to impact on productivity. Ph.Ds awarded in prestigious institutions were expected to have some positive impact on productivity. In our work, we could not determine how prestigious our local institutions are, however, we tried to divide the researchers into two, those with foreign Ph.D. and those with local Ph.D. Our results show that foreign PhD holders recorded a negative relationship with productivity. This result is unexpected, but on a further consideration, it may be that researchers trained abroad were trained under very good conditions, with good infrastructure and incentives, however, on returning home, the absence of such incentives and infrastructure may have constrained their efforts in producing papers which may eventually lead to frustration.

TABLE 2
RESULTS OF ECONOMETRIC ANALYSIS

	APFY (OLS)	ATP (OLS)	AFP (OLS)	GRANT (Negative Binomial)	PRZ (Binary Logit)
C	2.050 (2.2906)	2.4496 (2.3339)	-0.0856 (1.0833)	3.3989 (8.1891)	11.4202 (10.2367)
Age	-0.0009 (0.0523)	-0.0106 (0.0532)	0.0170 (0.0247)	-0.1868 (0.1951)	-0.6237 (0.3513)***
GEN	0.2767 (0.3780)	0.1199 (0.3851)	-0.1516 (0.1788)	0.8215 (1.3264)	0.3467 (1.6113)
NOC	-0.2476 (0.1382)***	-0.3085 (0.1408)**	-0.0986 (0.0653)	0.2217 (0.4887)	-0.3413 (0.7543)
NCT	0.5964 (0.4710)	0.6496 (0.4916)	0.3112 (0.2175)	0.9676 (1.3314)	-2.5470 (2.3720)
FPHD	-0.5776 (0.4846)	-1.0428 (0.4937)**	-0.6470 (0.2292)*	1.1941 (1.1945)	-3.1863 (2.9716)
XPHD	0.0536 (0.0532)	0.1497 (0.0542)*	0.0668 (0.025)*	0.0154 (0.1864)	0.1046 (0.3282)
WEXP	-0.0029 (0.0392)	-0.0567 (0.0400)	-0.0391 (0.0186)**	0.0562 (0.1182)	0.5932 (0.2901)**
DSPT	-0.4726 (0.2100)**	-0.2378 (0.2140)	0.0729 (0.0993)	-0.2632 (0.5345)	1.2968 (0.8694)
Prof	0.7674 (1.0426)	1.3962 (1.0623)	-0.3851 (0.4931)	3.8836 (3.7769)	3.6929 (7.7120)
SL	1.7372 (0.6451)*	1.6040 (0.6573)*	-0.1050 (0.3051)	3.3144 (2.0102)***	8.1226 (4.9598)***

L1	0.6814 (0.3823)***	1.0100 (0.3895)*	-0.0536 (0.1808)	0.8051 (1.3841)	5.2944 (3.8863)
PMT	-0.1943 (0.1922)	-0.5700 (0.1958)*	0.0089 (0.0909)	-0.8049 (0.6161)	-1.2450 (1.0989)
EXTVT	-0.2591 (0.2209)	-0.4274 (0.2251)**	-0.3594 (0.1045)	-0.7417 (0.6524)	0.0437 (1.4677)
AGRBLE	-0.3460 (0.2316)	-0.1768 (0.2360)	-0.0305 (0.1095)	-0.6312 (0.6185)	-2.1900 (1.3678)
OPEN	0.2754 (0.2093)	0.2069 (0.9704)	0.1075 (0.0990)	0.4271 (0.6030)	0.5957 (1.0601)
CSNTS	0.2999 (0.2686)	0.5441 (0.2737)**	0.1593 (0.1270)	2.2550 (1.0057)**	3.8469 (2.0829)***
STBLE	-0.0737 (0.3697)	-0.0809 (0.3766)	0.1518 (0.1748)	-0.8057 (0.9199)	-1.6046 (2.4700)
R^2	0.5531	0.6007	0.5100	0.860	0.4557
AR^2	0.3360	0.4070	0.2720	0.7923	0.3950
F (probability)	0.0094	0.0023	0.0278		
Durbin Watson	2.37	2.37	1.968		

** ** *** 1%, 5% and 10% respectively*

Furthermore, the number of years since the award of the PhD was also examined. Our results show that the variable had a positive impact on all our variables of productivity measurements. However, it was only significant when we considered ATP and AFP. In all the other variables, it was not significant. In addition, we considered the number of years of working experience of the researcher and found out that working experience had a negative impact on publications, especially foreign papers. However, experience was found to have a positive and statistical significant impact on research works that can attract prizes.

The impact of status on scientific productivity revealed that professorial cadre has no significant impact on the productivity of researchers. However, the senior lecturer cadre impacts significantly on productivity of researchers. The variable was positive in four out of the five models, while it was statistically significant in the four models. This is in contrast with other studies that found professors to publish more than the lower rank officers (Blackburn, Behymer and Hall 1978). Similarly, the lecturer I cadre impacts significantly on average productivity in the past five years and average total publication (ATP). It was not significant for grants and awards of prizes.

The impact of promotion on scientific productivity showed a negative relationship. Ideally, we would have expected that promotion will induce productivity. However, it turned negative and significant when we considered average rate of publication. It was also negative for average publication in the past five years, grants and prizes; however this effect was insignificant.

We subsequently examined the impact of some personality factors on productivity. The variable examined include; extroverts, agreeableness, openness, conscientious and emotional stability. On a five-point rating scale, the researchers were asked to evaluate themselves on the measures of the personality factors. The result shows that extroverts, those with friendly and outgoing traits record an inverse relationship with productivity. This was found to be statistically significant in the average number of papers published. It was, however, not significant for other variables of scientific productivity. In the same manner, those with agreeable traits also have a negative impact on productivity, but it was not significant in any of the variables of measurement. Likewise, with those with emotional stability traits. However, those who possess conscientious and openness traits recorded positive impact on productivity. But in terms of significance, conscientious traits play a positive and significant impact on scientific productivity. It was significant for average total publications, grants received and prizes won.

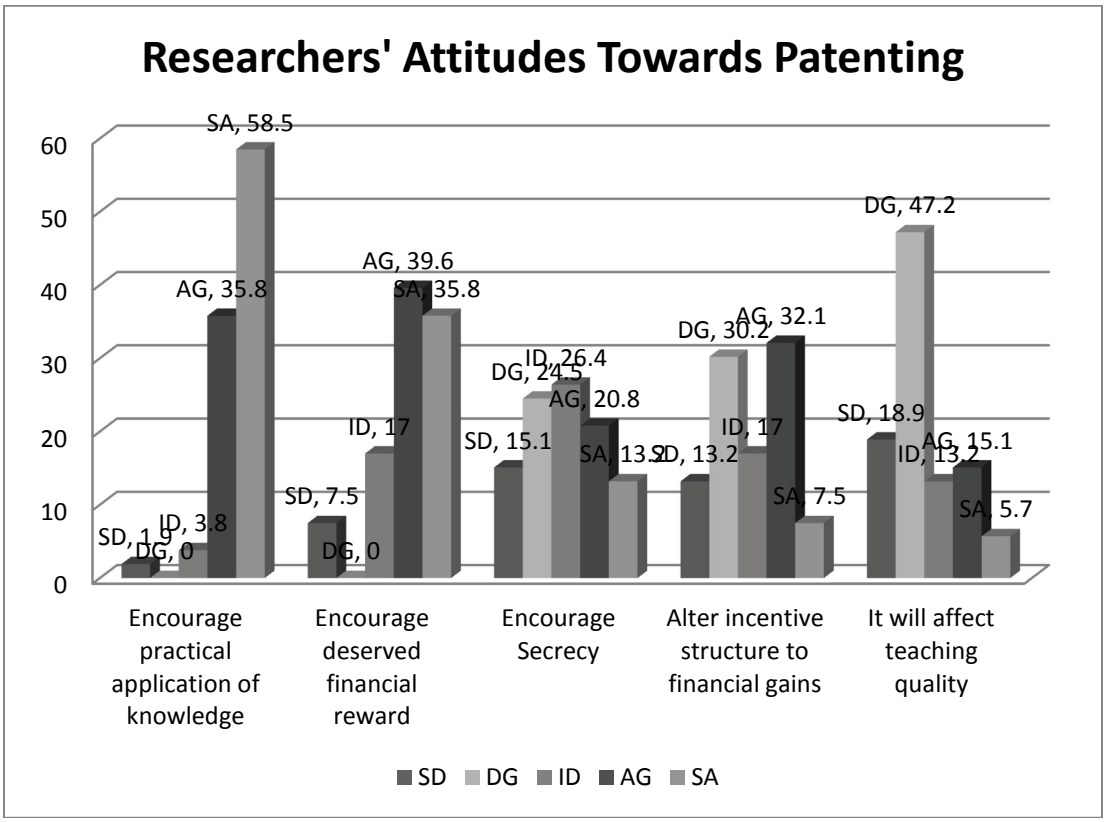
Finally, when we considered the five models of our analysis, the negative binomial model which made use of number of grants received as the measure of scientific productivity performed best. The R^2 was 86%, while its adjusted R^2 is 79%. This model identified two significant variables predicting

scientific productivity. These include; the personality trait—conscientious and the senior lecturer cadre. These were the only two variables predicting scientific productivity in our study.

ATTITUDES TOWARDS PATENTS

The attitude of the researchers towards patenting academic research is presented in the figure 2 below. Their opinions are represented on a five-point Likert rating scale as follows: SA = Strongly Agree; AG = Agree; ID = indifference; DG = Disagree; SD = Strongly Disagree.

FIGURE 1
ATTITUDES OF RESEARCHERS TOWARDS PATENTING ACADEMIC RESEARCH



From the figure, the role of patents in encouraging practical application of knowledge received an overwhelming support among the researchers. About 58.5% of the researchers strongly agreed with the issue while another 35.8% expressed their agreement. Dissenting views were very minimal. Furthermore, the role of patents in ensuring that researchers receive deserved financial reward also receives support from the researchers. About 39.6% of them expressed their agreement, while another 35.0 % were strongly in agreement. About 17.0% of them were indifferent, while only 7.5% strongly disagreed with the opinion. One of the criticisms of the application of patent right protection on academic research is that it will discourage the open science culture of the universities. Opinions of researchers on this issue seem to be sharply divided. While, 13.2% of the researchers strongly agreed, 15.1% of them strongly disagreed. Similarly, while 20.8% of them expressed their agreement, 24.5% of them expressed their disagreement, and 26.4% of them were indifferent. Another area of concern about patent right protection of academic research is that, it has the capability of altering the incentive structure of academics from publications to seeking financial gains. Opinions were also sharply divided on this issue, as 32.1% of them agreed, while

about 30.2% of them disagreed. More so while, 7.5% of them strongly agreed, 13.2% of them strongly disagreed and 17% of them were indifferent. Finally, the expected impact of patent right protection on teaching quality as assessed by the researchers revealed that it will not have a negative impact on teaching quality. While 47.2% of the academia expressed their disagreement, only 15.1% of them were in agreement. Furthermore, while only 5.7% of them strongly agreed that patent will affect teaching quality, 18.9% were strongly against the opinion. 13.2% of them were indifferent.

In conclusion, the average opinion seems to support the implementation of patent right protection in the universities, at least in the Obafemi Awolowo University, Ile-Ife, where this work was carried out.

CONCLUSIONS AND RECOMMENDATIONS

This work was initiated to examine the factors that determine the knowledge-creating capabilities of scientists in a Nigerian university. The study identified that large number of children, lack of departmental support; extroverts constitute hindrances to scientific productivity, while lecturers in the rank of senior lecturer, number of years of working experience and conscientiousness were factors that enhance productivity.

This study recommends that the position of heads of department should be handled by those who could organize the department in facilitating advancement of science and technology. Moreover, government may offer incentives or arrangements through which the number of children a researcher has does not interfere with his or her productivity. Furthermore, in recruiting researchers into academics, it may be necessary to screen for personality traits such that those that are highly motivated and conscientious be given the opportunity for research. As regards the role of patents, the implication of these results is that the implementation of patent reforms in universities will not likely hamper academic activities. Feelers from the academics suggest that patent rights protection will enhance inventive activities in the universities.

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