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## SCIENTOMETRIC ANALYSIS OF RESEARCH PRODUCTIVITY OF THE SUA PEST MANAGEMENT CENTRE, TANZANIA

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### ABSTRACT

A scientometric consider was directed to break down the examination profitability of the SUA Pest Management Center (SPMC) for a period from 2000 to 2015. Information were recovered utilizing the Publish or Perish programming that utilizes Google Scholar to acquire productions and sources which refer to them. An aggregate of 418 distributions were created by SPMC researchers were recovered with a normal of 26.13 distributions every year and the most gainful year was 2014. As the rate of development of productions expanded, the comparing multiplying time diminished. Over half (55.26%) of the distributions had at least six joint creators and the normal level of coordinated effort was 0.98. All researchers have demonstrated varieties in different measurements. SPMC researchers had distributed their exploration discoveries in 102 diaries. In any case, 33% (32.4%) of the aggregate diary articles were distributed in onlyeight diaries. Various suggestions have been made dependent on the examination discoveries.

**Keywords :** research efficiency, bug the board, scientometrics, Tanzania

### INTRODUCTION

Assessing the exploration profitability of scholars provides proof on the size of their individual research performances well as that of their institutions. Collectively, inquire about works of individual analysts frame the essential establishments of research gatherings or foundations. For a long time, investigate profitability and academic effect thinks about have been utilized toinform look into approaches, arranging and choices for foundations to set objectives, graph advance, influence budgetary assignments, to put resources into research offices, and decide the efficiency of their staff. In colleges, examine efficiency is a vital basis for staff recruitment, promotion, residency and reward, researchfundsallocation,and remaining burden decisions(Read 1998; Kotrlik and Bartlett 2002). Different purposes behind estimating research productivityinclude responsibility and esteem for-cash contemplations.

### Sokoine University of Agriculture Pest Management Centre

SPMC was set up in July 2000as one of the scholarly organs of the Sokoine University of Agriculture (SUA). By the by, the historical backdrop of SPMC goes back to 1986 when it was set up as the Tanzania - Belgium Rodent Research Project. This collaboration was ended in 1989 however the undertaking was continued through the University bolster under the name of Rodent Research Project. The essential question of SPMC is to do bother research and the board concentrating principally on farming, ranger service, creature and general wellbeing. Other functions of SPM Cinclude to offer trainingin zones of irritation

science, nature and the board; give augmentation benefits, and embrace consultancy in vermin the executives exercises; fill in as a noteworthy systems administration community for bug research and the board exercises in Tanzania; and fill in as a source of perspective centre for writing on nuisance research(SUA 2005).During this investigation, SPMC had a total eight academicians-four Research Professors, two Associate Research Professors and two Research Fellows. There were two specialized staff - one Principal Technologies and one Field Officer who were also engaged with research and logical composition exercises.

## Methods

This scientometric examination was directed inside three days from 29thto31st December 2015. This brief period was importantbecause reference checks continue gathering. Examination of each of the 10 researchers was directed for the 16-years time span from 2000 to 2015 by utilizing the PoP programming. This specific programming was utilized in light of the fact that it recovers information through Google Scholar which has more extensive inclusion than that of different databases, for example, ISI and Scopus. Google Scholar covers every single insightful distribution that are and that are not recorded by different databases (Harzing 2013).

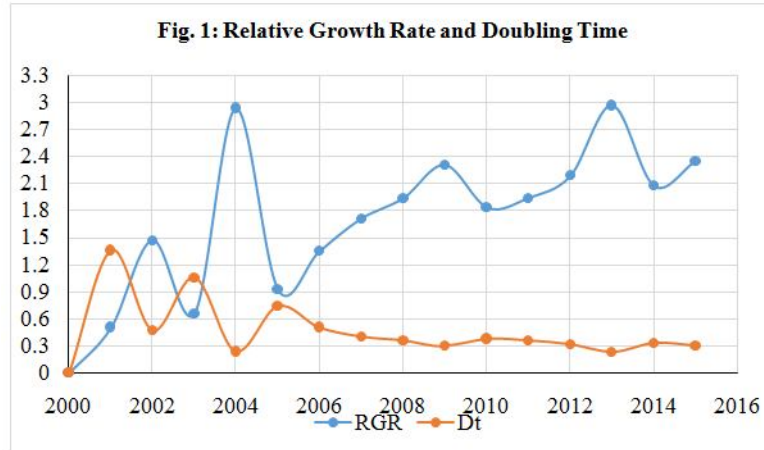
## Results and discussions

### Publication productivity at SPMC

In view of the "typical tallying technique" whereby each creator gets a full mean joint distributions, a sum of 418 productions were recorded for every one of the 10 SPMC researchers amid the period somewhere in the range of 2000 and 2015. Of these, 389 (93.06%) were diary articles and the rest were articles in meeting procedures, book parts and a book. This was normal on the grounds that most insightful articles are typically distributed in diaries. The normal number of distributions every year was 26.13 with the year 2014 having the most noteworthy (47; 11.24%) number of productions pursued continuously 2011 and 2015 with 40 (9.57%) distributions each. The year 2004 had the most reduced (3; 0.72%) number of distributions (Table 1).

**Table 1: Year-wisepublication productivity**

Year	No of publications	Percent	Cumulative publications	lnN <sub>1</sub>	lnN <sub>2</sub>	RGR	Mean RGR	Dt	Mean Dt
2000	8	1.91	8	-	2.08	-		-	
2001	12	2.87	20	2.48	3.00	0.51	1.30	1.36	0.77
2002	6	1.44	26	1.79	3.26	1.47		0.47	
2003	28	6.70	54	3.33	3.99	0.66		1.06	
2004	3	0.72	57	1.10	4.04	2.94		0.24	
2005	37	8.85	94	3.61	4.54	0.93		0.74	
2006	33	7.89	127	3.50	4.84	1.35	1.83	0.51	0.39
2007	28	6.70	155	3.33	5.04	1.71		0.40	
2008	26	6.22	181	3.26	5.20	1.94		0.36	
2009	20	4.78	201	3.00	5.30	2.31		0.30	
2010	38	9.09	239	3.64	5.48	1.84		0.38	
2011	40	9.57	279	3.69	5.63	1.94	2.31	0.36	0.31
2012	35	8.37	314	3.56	5.75	2.19		0.32	
2013	17	4.07	331	2.83	5.80	2.97		0.23	
2014	47	11.24	378	3.85	5.93	2.08		0.33	
2015	40	9.57	418	3.69	6.04	2.35		0.30	
			<b>Mean</b>				<b>1.70</b>	<b>0.46</b>	



### Authorship collaboration patterns

Collective research is an unavoidable wonder in numerous controls especially in science and innovation fields (Natarajan and Kaliyaperumal, 2016). The investigation discoveries demonstrate a reasonable control of different initiation design (98.09%). The greater part (55.26%) of the distributions were contributed by at least six joint creators pursued at an inaccessible by the productions that had four (15.55%) joint creators. Just eight (1.91%) productions were single created (Table 2). The proportion of cooperation to that solitary creator work was 51:1 demonstrating that SPMC scientists very want to attempt explore exercises in coordinated effort. Past studies (Hazarika et al. 2003; Sharma 2009; Sudhier 2013; Baby and Kumaravel 2011) have built up comparative initiation designs. This high level of cooperation may be not just in light of the fact that exploration work is commonly community oriented in nature yet additionally on the grounds that examination in irritation the executives is exceptionally multidisciplinary. This may drive specialists from differing fields to share their aptitude.

**Table 2: Collaboration patterns**

Year	Number of papers per number of authors							Collaboration coefficient
	Single author	Two authors	Three authors	Four authors	Five authors	Six or more authors	Total	
2000	0	0	1	2	3	2	8	1.00
2001	1	0	1	7	0	3	12	0.92
2002	0	1	1	0	3	1	6	1.00
2003	1	3	5	5	2	12	28	0.96
2004	0	0	0	1	1	1	3	1.00
2005	1	2	6	5	6	17	37	0.97
2006	1	3	8	9	2	10	33	0.97
2007	2	1	4	7	6	8	28	0.93
2008	0	1	5	2	5	13	26	1.00
2009	0	1	4	2	2	11	20	1.00
2010	1	0	1	9	6	21	38	0.97
2011	0	2	3	4	2	29	40	1.00
2012	0	0	1	4	3	27	35	1.00
2013	0	0	0	1	2	14	17	1.00
2014	1	0	3	6	8	29	47	0.98

2015	0	0	1	1	5	33	40	1.00
<b>Total</b>	<b>8</b>	<b>14</b>	<b>44</b>	<b>65</b>	<b>56</b>	<b>231</b>	<b>418</b>	<b>0.98</b>
<b>Percent</b>	<b>1.91</b>	<b>3.35</b>	<b>10.53</b>	<b>15.55</b>	<b>13.40</b>	<b>55.26</b>	<b>100.00</b>	

### Citations trends of individual publications

References are regularly viewed as an impression of research articles utilize and affect. There were eight very referred to distributions with no less than 50 references each. The most extreme number of references was 149 for the paper titled "Mice, rodents, and individuals: the bio-financial aspects of rural rat bugs" distributed in *Frontiers in Ecology and the Environment* in 2003 (mutually contributed by 14 creators) trailed by 144 references for the paper titled "Multilocus arrangement composing technique for ID and genotypic order of pathogenic *Leptospira* species." distributed in *Annals of Clinical Microbiology and Antimicrobials* in 2006 (together contributed by 7 creators) (Table 3). In spite of the fact that the quantity of references relies upon numerous components, for example, the age of the distribution, the nature of the production, the extent of established researchers, the quantity of writers in a solitary distribution and the subject which ones distributes (Bornmann and Daniel 2008), the perceivability and simple availability of articles has a more prominent potential to quicken the reference tallies (Antelman, 2004; Eysenbach, 2006; Gupta, 2015). For this situation, all very referred to articles were uninhibitedly accessible either through open access diaries, membership based diaries that had open access alternatives or self-documented in informal communities, for example, Research Gate.

**Table 3: Highly cited articles**

No	Title of article	Journal /book	Journal's mode of publishing	Authors	Year	Citations
1	Mice, rats, and people: the bio-economics of agricultural rodent pests	Frontiers in Ecology and the Environment	Subscription-based (open access for special issues)	N. C. Stenseth, H. Leirs, A. Skonhoft, S.A. Davis, R.P. Pech, H.P. Andreassen, G.R. Singleton, M. Lima, R.S. Machang'u, R. H. Makundi, Z. Zhang, P.R. Brown, D. Shi, X. Wan	2003	149
2	Multilocus sequence typing method for identification and genotypic classification of pathogenic <i>Leptospira</i> species.	Annals of clinical microbiology and antimicrobials	Open access	Ahmed, N., Devi, S.M., D. Á. Valverde, M., Vijayachari, P., Machang'u, R.S., Ellis, W.A., Hartskeerl, R.A.,	2006	134
3	Seasonality and host utilization of the invasive fruit fly, <i>Bactrocera invadens</i> (Dipt., Tephritidae) in central Tanzania	Journal of Applied Entomology	Subscription-based (open access option available)	M.W. Mwatawala, M. De Meyer, R.H. Makundi, A.P. Maerere	2006	81
4	Rodent Pest Management in East Africa - an Ecological Approach	Ecologically-based Rodent Management	Free	R. H. Makundi, N. O. Oguge, P.S. Mwanjabe	1999	62
5	Plague and the human flea, Tanzania	Emerging Infectious Diseases	Open access	A. Laudisoit, H. Leirs, R. H. Makundi, S. Van Dongen, S. Davis, S. Neerinckx, J. Deckers, R. Libois	2007	61
6	Host range and distribution of fruit-	Bulletin of entomological	Subscription-based (open	M.W. Mwatawala, M. De Meyer, R.H. Makundi,	2009	59

	infesting pestiferous fruit flies (Diptera, Tephritidae) in selected areas of Central Tanzania	research	access option available)	A.P. Maerere		
7	Biodiversity of fruit flies (Diptera, Tephritidae) in orchards in different agro-ecological zones of the Morogoro region, Tanzania	Fruits	Subscription-based (open access option available)	M.W. Mwatawala, M. De Meyer, R.H. Makundi, A.P. Maerere	2006	57
8	African pouched rats for the detection of pulmonary tuberculosis in sputum samples	International Journal of Tuberculosis and Lung Disease	Subscription-based (open access option available)	Weetjens B.J., <a href="#">Mgode G.F.</a> , <a href="#">Machang'u R.S.</a> , <a href="#">Kazwala R.</a> , Mfinanga G., <a href="#">Lwilla F.</a> , <a href="#">Cox C.</a> , <a href="#">Jubitana M.</a> , <a href="#">Kanyagha H.</a> , <a href="#">Mtandu R.</a> , <a href="#">Kahwa A.</a> , <a href="#">Mwessongo J.</a> , <a href="#">Makindi G.</a> , <a href="#">Mfaume S.</a> , <a href="#">Van Steenberge J.</a> , <a href="#">Beyene NW.</a> , <a href="#">Billet M.</a> , <a href="#">Verhagen R.</a>	2009	55

### Productivity and scholarly impact of individual scientists

The investigation discoveries in Table 4 on individual researchers' insights demonstrate that the production yield extended from 10 to 114 for the period somewhere in the range of 2000 and 2015. This somewhat largerange is mostly due the way that two creators in particular C.A. Sabuni and G.G. Mhamphiwere specialized staff whose significant job is research facility work.R. H. Makundi was the most productive creator contributing 27.3% of allSPMC's distributions trailed by L.S. Mulungu(17%) and R.SMachangu(11.2%). At the point when re-positioned dependent on different measurements, Makundi reliably held the principal position in most metricswhile different researchers changed differently. In reference checks, Machangu(774 citations)ranked the second pursued byMulungu(450 references) while in the yearly effect, L.L. Mnyone(53.45 refers to every year) held the second positionfollowed byMachangu(48.38 refers to per year).When separating the aggregate number of references by the aggregate number of papers, Machangu(16.47 refers to per paper) positioned the first pursued by Mnyone(15.58 refers to per paper) and G.F. Mgode(11.93 refers to per paper).In this case, R. H. Makundi dropped to the fourth placemainly in light of the fact that a portion of his publicationshad got low reference checks. A nearby look of the profoundly referred to articles for every one of these researchers uncovers that most were unreservedly accessible either through open access diaries or self-filing. This further backings the contention that academic works have a more noteworthy research effect on the off chance that they are unreservedly accessible.

### Journal preference

Determination of correspondence directs in research is a vital factor due to pulling in the consideration of researchers and other crowd. The investigation of circulation of articles in diaries uncovered that amid the period somewhere in the range of 2000 and 2015, an aggregate of 225 diary articles were distributed in 102 diverse journals.During this examination, all these 102 diaries were being distributed on the web, which builds the perceivability of the exploration articles. The Tanzania Journal of Health Research had 22 articles pursued by the Belgian Journal of Zoology (10 articles) (Table 5). In spite of the fact that the discoveries show that these researchers have been distributing their exploration discoveries in an extensive variety of global diaries, it can likewise be said that there is shortage of important diaries in the nation for these examination to distribute their articles.

**Table 5: Journal-wise distribution of publications**

Sn	Journal	No of articles	Sn	Journal	No of articles
1	Tanzania Journal of Health Research	22	52	The International Journal of Tuberculosis and Lung Disease	1
2	Belgian Journal of Zoology	10	53	International Pest Control	1
3	Wildlife Research	8	54	International Rice Research Notes	1
4	African Zoology	7	55	Insect Science and Its Application	1
5	Integrative zoology	7	56	Journal of Afrotropical Zoology	1
6	Mammalia	7	57	Journal of Agriculture and Ecology Research International	1
7	ACIAR Monograph Series	6	58	Journal of Animal and veterinary Advances	1
8	Journal of Entomology	6	59	Journal of Applied Microbiology	1
9	Parasites & Vectors	6	60	Journal of Applied Sciences	1
10	PLoS Neglected Tropical Diseases	6	61	Journal of Biological Sciences	1
11	African Journal of Ecology	5	62	Journal of Clinical Microbiology	1
12	International Journal of Pest Management	5	63	Journal of Economics and Sustainable Development	1
13	<a href="#">Malaria Journal</a>	5	64	Journal of Entomology and Nematology	1
14	Crop Protection	4	65	Journal of Global Infectious Diseases	1
15	Emerging infectious diseases	4	66	Journal of Heredity	1
16	Tuberculosis	4	67	Journal of Parasitology Research	1
17	Archives of Phytopathology and Plant Protection	3	68	Journal of Plant Diseases and Protection	1
18	Asian Journal of Plant Sciences	3	69	Journal of Public Health in Africa	1
19	The American journal of tropical medicine and hygiene	3	70	Journal of Rural and Tropical Public Health	1
20	Tropical animal health and production	3	71	Journal of Sustainable Agriculture	1
21	Vector-Borne and Zoonotic Diseases	3	72	Livestock Research for Rural Development	1
22	Actatropica	2	73	Malaria Research and Treatment	1
23	Applied and environmental microbiology	2	74	Molecular Phylogenetics and Evolution	1
24	Asian Australasian Journal of Animal Sciences	2	75	New Zealand Journal of Crop and Horticultural Science	1
25	Frontiers in Ecology and the Environment	2	76	Pest management science	1
26	Fruits	2	77	Phytoparasitica	1
27	Journal of Agronomy	2	78	Population Ecology	1
28	Journal of Applied Entomology	2	79	South African Journal of Science	1
29	Journal Of Economic Entomology	2	80	The Journal of parasitology	1
30	Journal of Zoological Systematics and Evolutionary Research	2	81	Transactions of the Royal Society of Tropical Medicine and Hygiene	1
31	Journal of Zoology	2	82	Tropical Pests Management Bulletin	1
32	Julius-Kühn-Archiv	2	83	Veterinarskiarhiv	1
33	Pan African Medical Journal	2	84	Veterinary medicine international	1
34	Parasitology Research	2	85	Virology	1
35	RendicontiLincei	2	86	West African Journal of Applied Ecology	1

					1
36	Statistics and Operations Research Transactions	2	87	Zoosystema	1
37	Tanzania Veterinary Journal	2	88	FEMS Immunology & Medical Microbiology	1
38	Tropical Root and Tuber Crops	2	89	Genetica	1
39	ActaPhytopathologica et EntomologicaHungarica	1	90	Hereditas	1
40	Actatheriologica	1	91	Indigenous Knowledge and Development Monitor	1
41	Actavirologica	1	92	Insect Science and its application	1
42	African Journal of Microbiology Research	1	93	International Journal of Infectious Diseases	1
43	AgriculturaTropica et Subtropica	1	94	International Journal of Plant & Soil Science	1
44	Annales de la Sociéetémentologique de France	1	95	International Journal of Tropical Insect Science	1
45	Annals of clinical microbiology and antimicrobials	1	96	International journal of systematic and evolutionary microbiology	1
46	Beilstein journal of organic chemistry	1	97	Chinese medical journal	1
47	Biological Journal of the Linnean Society	1	98	Clinical case reports	1
48	BMC infectious diseases	1	99	Conservation Genetics Resources	1
49	Bulletin of Animal Health and Production in Africa	1	100	Current microbiology	1
50	Bulletin of entomological research	1	101	Current Zoology	1
51	International Journal of Tuberculosis and Lung Disease	1	102	Environment and Development Economics	1

Each control has center diaries that dependably contain pertinent articles in that discipline. The idea of center diaries is gotten from Bradford's Law of Scattering, which expresses that if logical diaries are orchestrated arranged by their diminishing efficiency of articles on a given subject, they might be partitioned into a core of periodicals all the more especially committed to the subject, and a few 'gatherings' or 'zones' containing indistinguishable number of articles from the core. The quantity of periodicals in the core and succeeding zones will be 1: n: n<sup>2</sup>, where 'n' is a multiplier (Vickery 1948). Bradford multiplier is the proportion of the quantity of periodical titles in any gathering to the quantity of periodical titles in any promptly going before gathering. In this investigation, the aggregate quantities of diary articles were isolated into three equivalent zones in a proportion of 8:24:70

### Conclusion and recommendations

The examination discoveries demonstrate that SPMC researchers were effectively associated with research since the middle's foundation in the year 2000. Considering the moderately little group of specialists at SPMC, the recorded number of publications indicate a great distribution profitability with journal articles being the most noticeable sort of publications. There was high dimension of group spirit and joint efforts with researchers somewhere else as most productions having multiple writers. A decent number of distributions had been referred to by different researchers which recommends a more prominent research affect. All researchers have demonstrated varieties in different measurements and Makundi was the most productive researcher. In spite of the fact that Anyone had few publications, he had gotten a decent number of citations. this bolsters the contention that reference tallies rely upon components other than the quantity of productions. While SPMC researchers have been distributing their examination discoveries in an extensive variety of global diaries, a third (32.4%) of the diary articles were distributed in just in eight diaries;



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demonstrating an adherence to the Bradford's Law of Scattering. Just a couple of articles were distributed in the couple of accessible Tanzanian diaries.

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