Pro-Research Growth Measures: A Plan for Early Career Faculty and Sustaining an Intensive and Rewarding Research Career

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College of Computing and Information Sciences
Makerere University

Grand Global Hotel, Kikoni
August 9, 2019
11:10 am. – 12:40 pm.

Tonny Oyana Ph.D., Professor of GIS and Spatial Analysis & College Principal, CoCIS, Makerere University

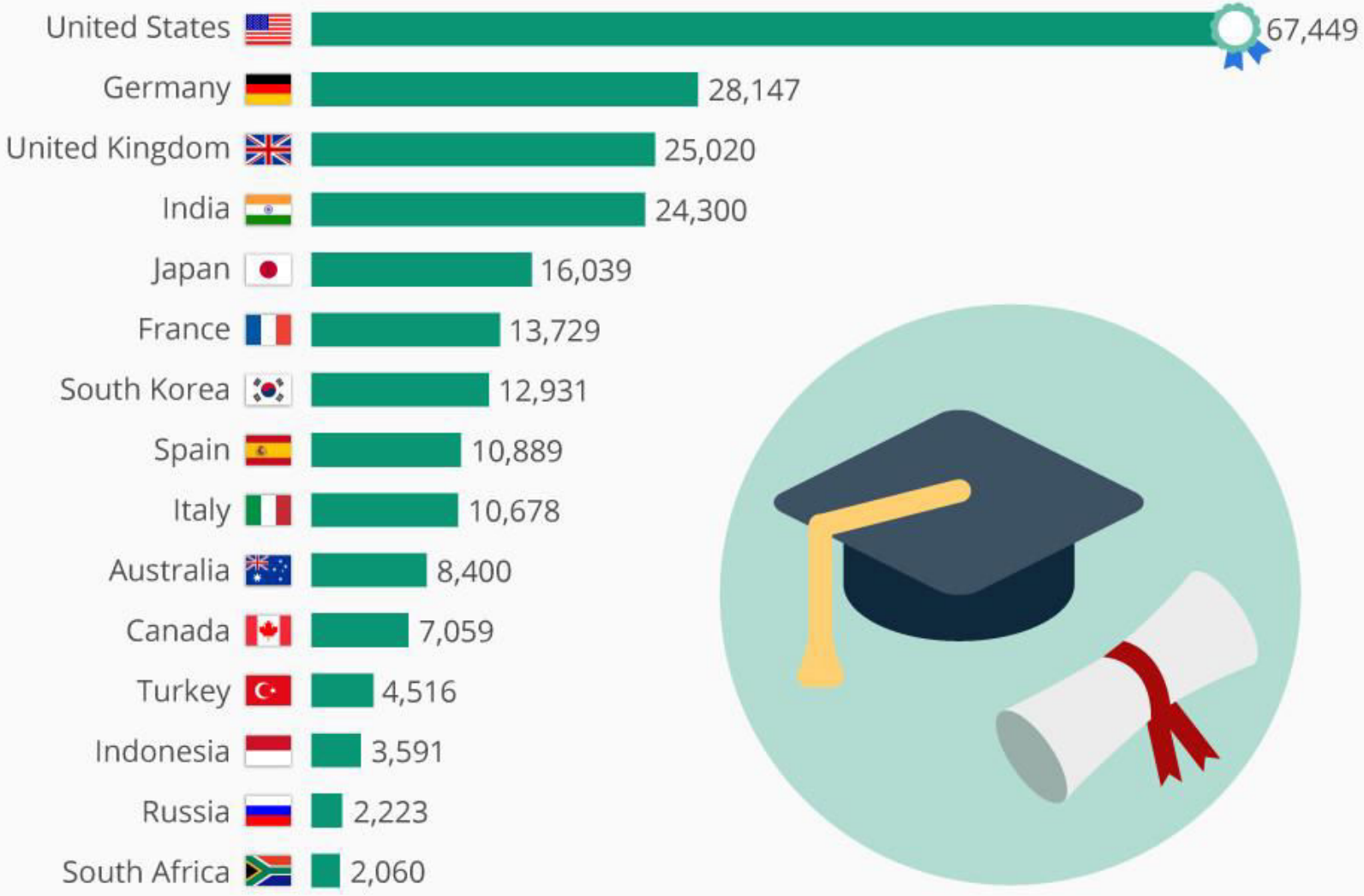
- More than 24 years of proven research and educational leadership with a strong track record of key accomplishments across a wide array of initiatives in North America, South America, Asia, Europe, and Africa.
- Internationally-recognized and seasoned expert in data management, strategies, GIS/GPS methods, algorithms, spatial analytics, and data science communication.
- Strong hands-on data science experience, knowledge, and skills in major computing platforms and programs, including centralized network systems, cloud-based systems, database systems, and a wide array of GIS data services and applications.

Dr. Tonny Oyana's Brand: Credentials, Achievements & Synergetic Activities

- Earned his PhD in GIS, State University of New York (SUNY) at Buffalo in 2003; master of science in GIS, National University of Ireland, University College Cork, Ireland, in 1996; and bachelor of science in education, University of Dar-es-Salaam, Tanzania, in 1993.
- Received postdoctoral training at the Dept. of Internal Medicine, SUNY at Buffalo with Dr. Jameson Lwebuga-Mukasa; & previously served as an assistant & associate professor at the Southern Illinois University Carbondale for 12 years and professor and director, University of Tennessee Health Science Center for 4.5 years.
- Authored over 100 scientific publications including 50+ journal articles, 2 books, 26+ refereed conference proceedings, and 10 book chapters. Received over $2.6 million in funding support from multiple agencies; and successfully mentored 9 PhD, 38 master students, 2 resident fellows, 2 medical physicians, and many undergraduates. Taught GIS and spatial analysis courses for more than 24 years.
- Developed several research products and methods, including four computational algorithms (FES-k-means, MIL-SOM, Flexible Genetic Algorithm, and Reaction-Diffusion mechanistic models for spatiotemporal modeling); and streamlined Diggle's method for a disease cluster detection software application.
- Currently focuses on three lines of research inquiry: (1) establishing the relationship between environmental health and life course exposure; (2) advancing GIS and data science methods, algorithm design, spatial analytical methods, rules, and strategies; and (3) understanding the factors that contribute to land systems change.

The Countries With The Most Doctoral Graduates

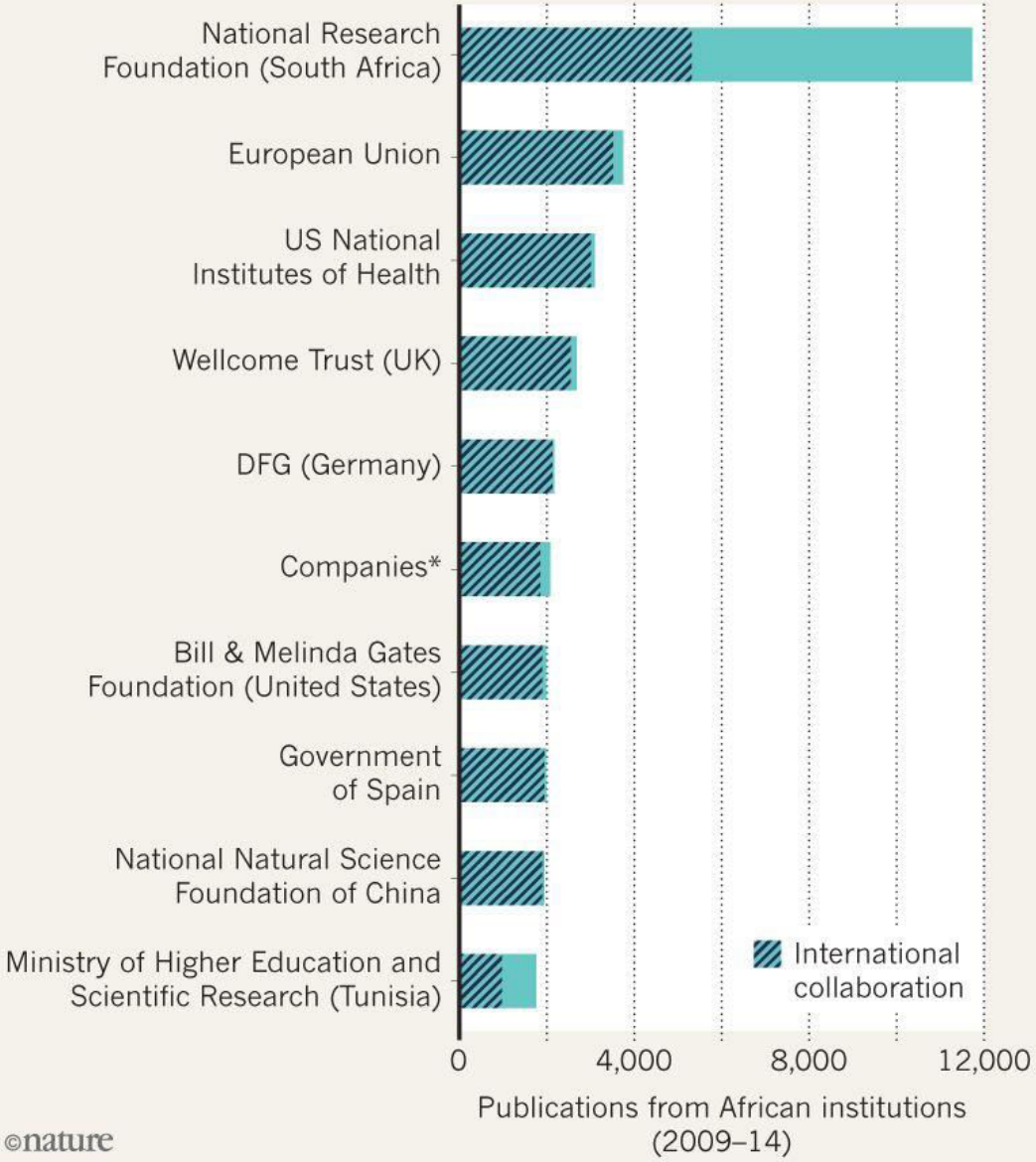
Number of doctoral graduates (all fields) in 2014



 Source: OECD

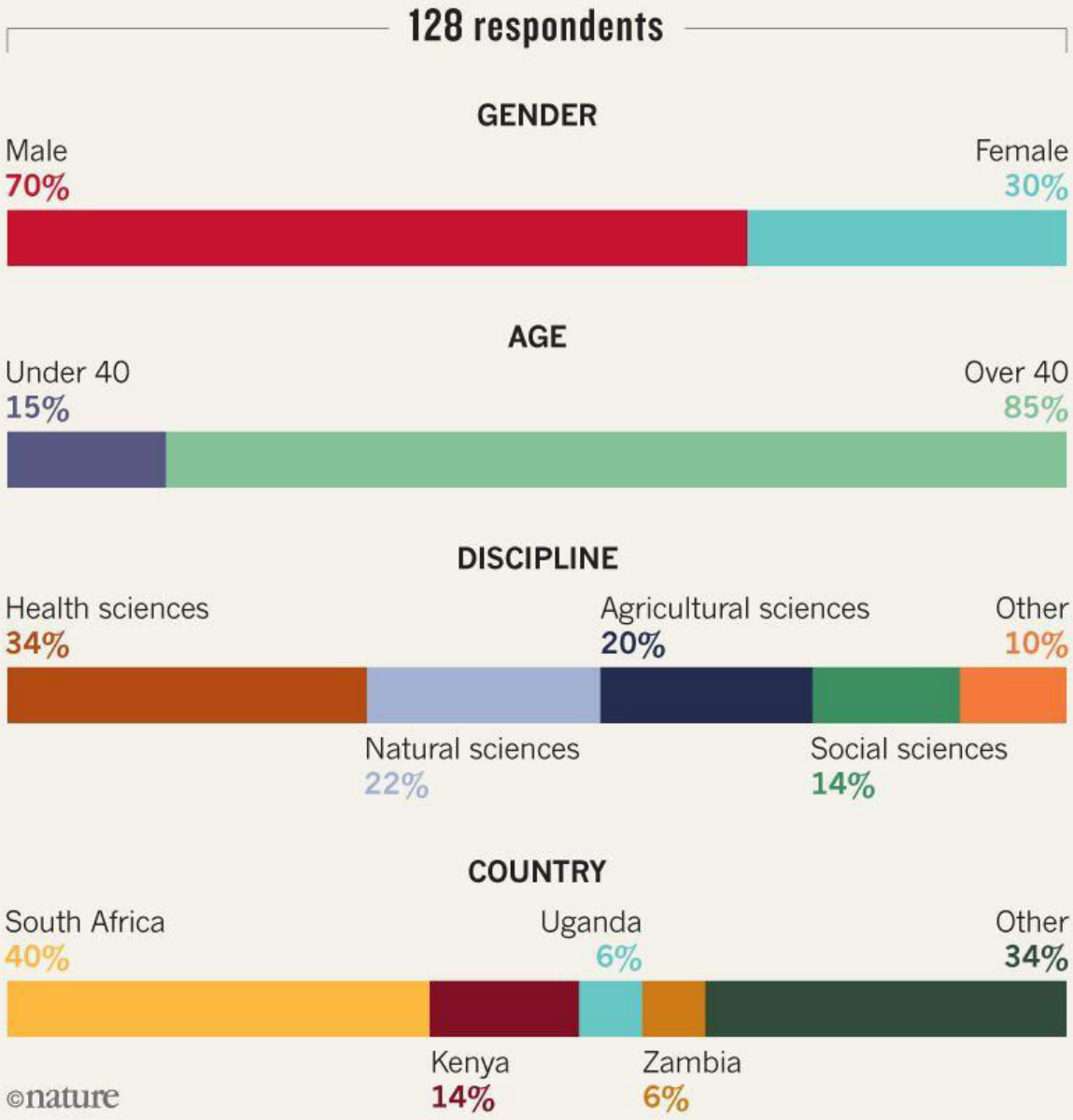
FUNDERS OF AFRICA'S SCIENCE

Research publications from Africa-based scientists are funded mainly from Europe, the United States and China. Foreign-funded papers are more likely to be a product of international collaboration than are those funded by local research agencies.



AFRICA'S TOP-FUNDED SCIENTISTS

Of 128 respondents who said they received more than US$1 million over past 3 years, most were male, over 40, based in just four countries and work in health or natural sciences.



UNDER PRESSURE

YOUNG RESEARCHERS ARE HAVING TO FIGHT HARDER THAN PAST GENERATIONS FOR A SMALLER SHARE OF THE ACADEMIC PIE.

BY BRENDAN MAHER AND MIQUEL SUREDA ANFRES
DESIGN BY JASIEK KRZYSZTOFIAK

Scientists and policymakers around the world increasingly worry about the plight of young researchers in academia, and for good reason. Competition for tenure-track positions has surged, and some early-career researchers face tough odds in the quest for funding. As a result, many see lower pay-offs for their efforts in preparing and writing grant applications. Although everyone is under pressure, those just starting out seem to feel the impacts more acutely.

PHDS RISING, JOBS FLAT

The number of graduates with advanced science and engineering degrees has been rising around the world. The Organisation for Economic Co-operation and Development (OECD) has recorded an increase in the number of science-related doctorates that would typically funnel into academic positions. The leading OECD nations in 2014 were:

		Average annual increase
UNITED STATES	40,100	▲ 4.3%
GERMANY	20,600	▲ 0.8%
UNITED KINGDOM	17,400	▲ 6.2%
JAPAN	12,800	▲ 0.7%

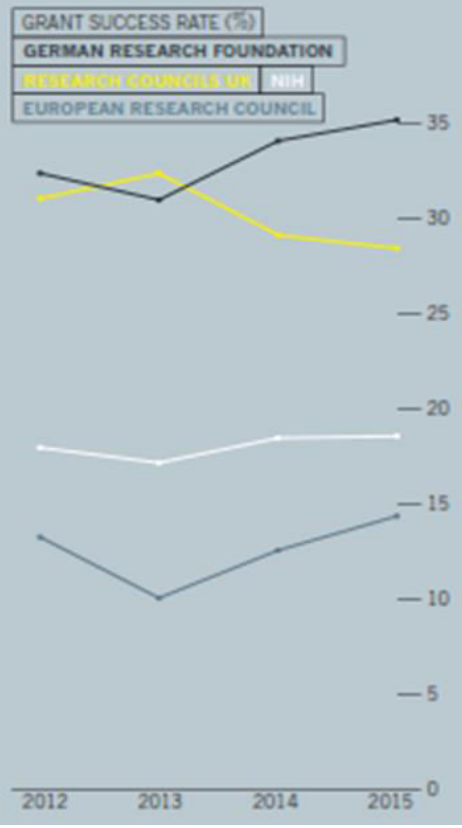
1.6% The proportion of young people completing a doctorate of any kind in OECD member countries has doubled from **0.8%** less than two decades ago.

3,000 In most countries, however, the growth in academic jobs has not kept pace. US universities, for example, create only about **3,000** new full-time positions annually.

YOUNG SCIENTISTS
A *Nature* special issue
nature.com/youngscientists

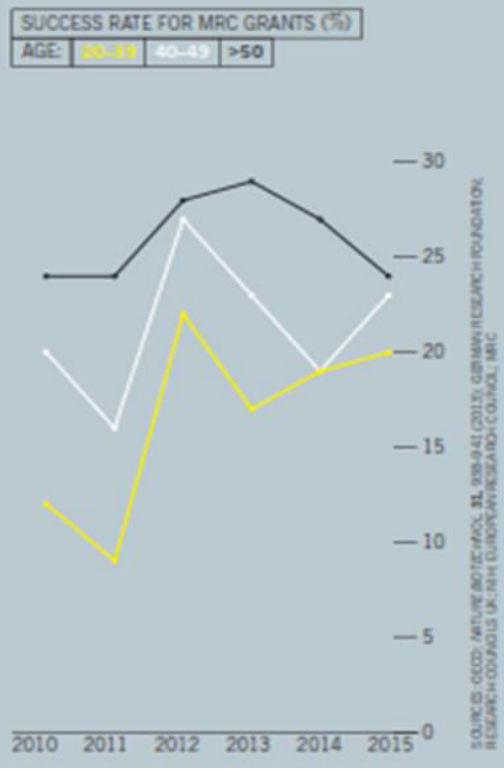
FUNDING FALTERS

Government funding for research has plateaued or declined in many countries, and success rates for grants is now below 20% for some of the most important funders.



TOUGH COMPETITION

Early-career scientists struggle to compete for grants against researchers who have a better knowledge of the system, more academic and administrative resources and richer publication lists. The Medical Research Council (MRC) — part of Research Councils UK — for example, shows lower success rates for younger scientists.



SOURCES: OECD; *NATURE BIOTECHNOL.* **31**, 938–941 (2013); GERMAN RESEARCH FOUNDATION; RESEARCH COUNCILS UK; NIH; EUROPEAN RESEARCH COUNCIL; MRC

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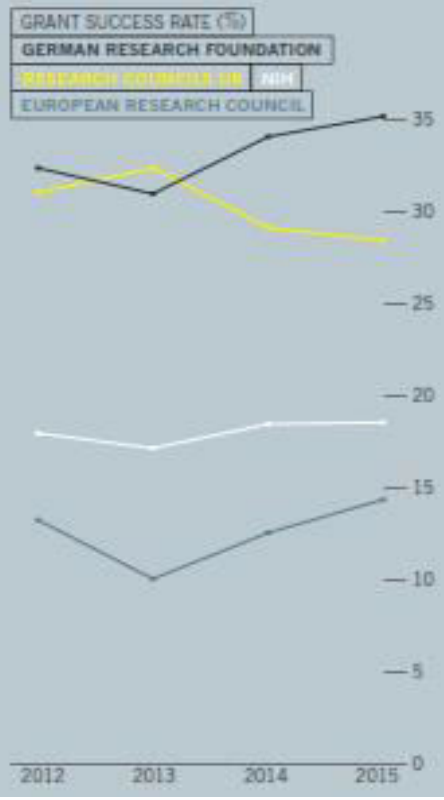

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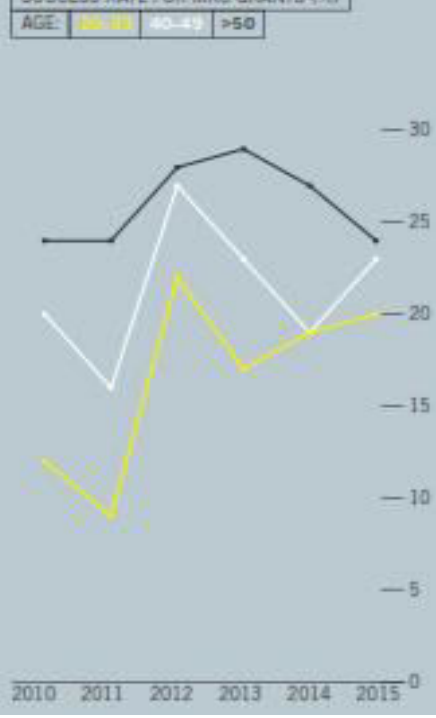


SOURCES: OECD; NATURE 527, 9 (2015); GERMAN RESEARCH FOUNDATION; RESEARCH COUNCILS UK; NIH; EUROPEAN RESEARCH COUNCIL; MRC

Africa's science 'millionaires': survey spotlights top-funded researchers

Scientists in the agricultural and health sciences generally have easier access to funding and to greater individual sums, the report found.

Foreign financing was linked to a higher level of international collaboration. Around 95% or more of papers funded by the leading grant-makers from outside Africa were a product of such partnerships, compared with only around half of those with no foreign funding.

Overall, the report supports the notion of a 'rising tide of African science'. African scientists have more than trebled their production of research papers from around 15,000 in 2005 to 54,000 in 2016 — with Africa's share of the world's scientific output reaching 3.2% — and those papers generate more citations.

But these positive changes are likely a result of a continued increase in investment by international funders and greater collaboration, rather than result of strategies or polices of African governments, the report suggests.

Entry Point: Unified track for Masters and PhD

Students can enter program without an Masters degree.

First 1.5-2yrs:

Focus on skills development by course work

Qualifies student for Masters award

Coursework/modules waiver for entrants with Masters

Last 3yrs:

Focus on research

Layers of training a graduate student

Assessment of GPA, Reference Letters, Research Statement and Aptitude tests to select top 15%

1. 1st year: Diagnostic & general courses
2. 2nd year: Advanced specialized courses
3. Comprehensive/Candidacy exams
4. Dissertation development (proposal & oral defense)

Tip: Involvement in teaching, research and service activities

What is **Makerere University Talent Pool**? Who has the list?

Pro-Research Growth Measures

- Return a portion of the indirect costs to the investigator to use for various expenses (unfunded research, additional staff salaries, professional memberships, etc.)
- A monetary bonus incentive
- A strong program of support for emerging research groups
- Build support for grant writing

Pro-Research Growth Measures

- Provision of 'start-up' funds at the time of appointment
- Internal 'development grants/seed grants' that prioritize research projects that align with Mak's strategic institutional research goals
- Build research support & infrastructure
- Invest and promote both fundamental science (basic) and applied science

A Plan for Early Career Faculty and Sustaining an Intensive and Rewarding Research Career

- Assigning research mentors and mentoring time as part of a junior/early faculty member's documented 'career development plan
- Assigning recognized work time and accountability to grant writing outcomes (150h p.a.)
  - Assign a specific grant to be submitted to a specific agency by a specific date. (i.e. as a formalized part of faculty's job and performance review)

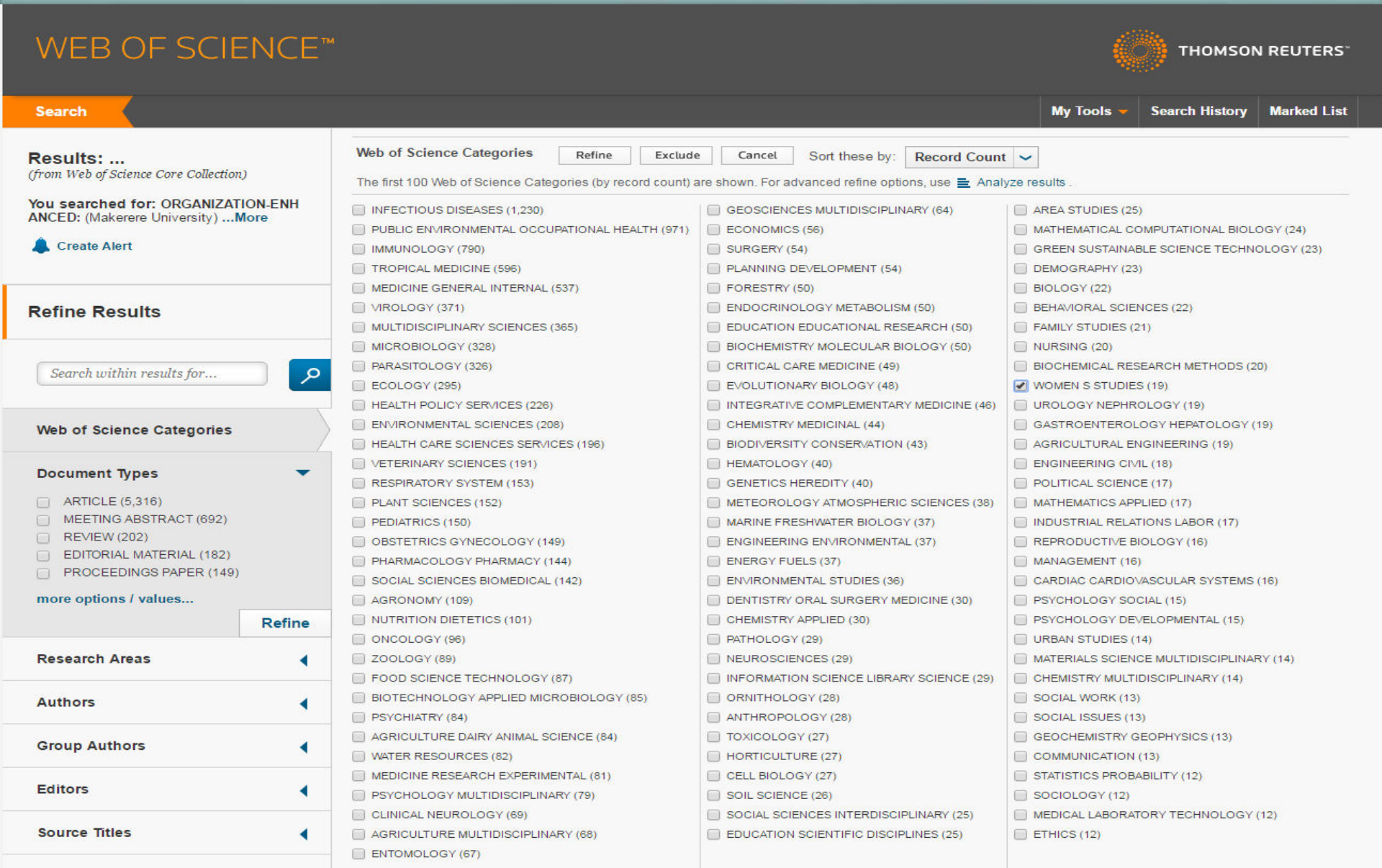
A Plan for Early Career Faculty and Sustaining an Intensive and Rewarding Research Career

- Teaching research as an organizational skill that can be taught, learnt and practiced.
- Initiate a grant development program (GDP) to acknowledge and advance research knowledge and skills to potential and promising researchers
- This GDP requires a very intensive process of refining a basic idea for a grant using a one-page bullet point summary and/or a 3 minute 'elevator pitch' to a panel of expert grant writers/successful researchers.

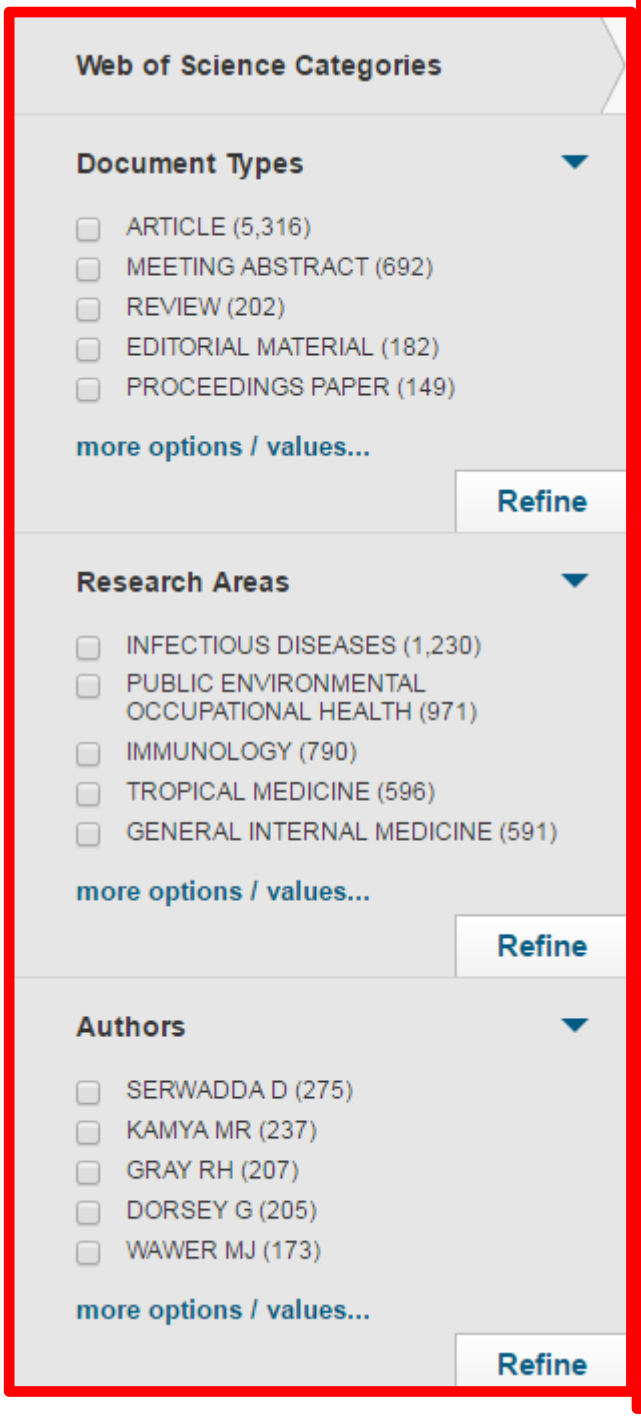
A Plan for Early Career Faculty and Sustaining an Intensive and Rewarding Research Career

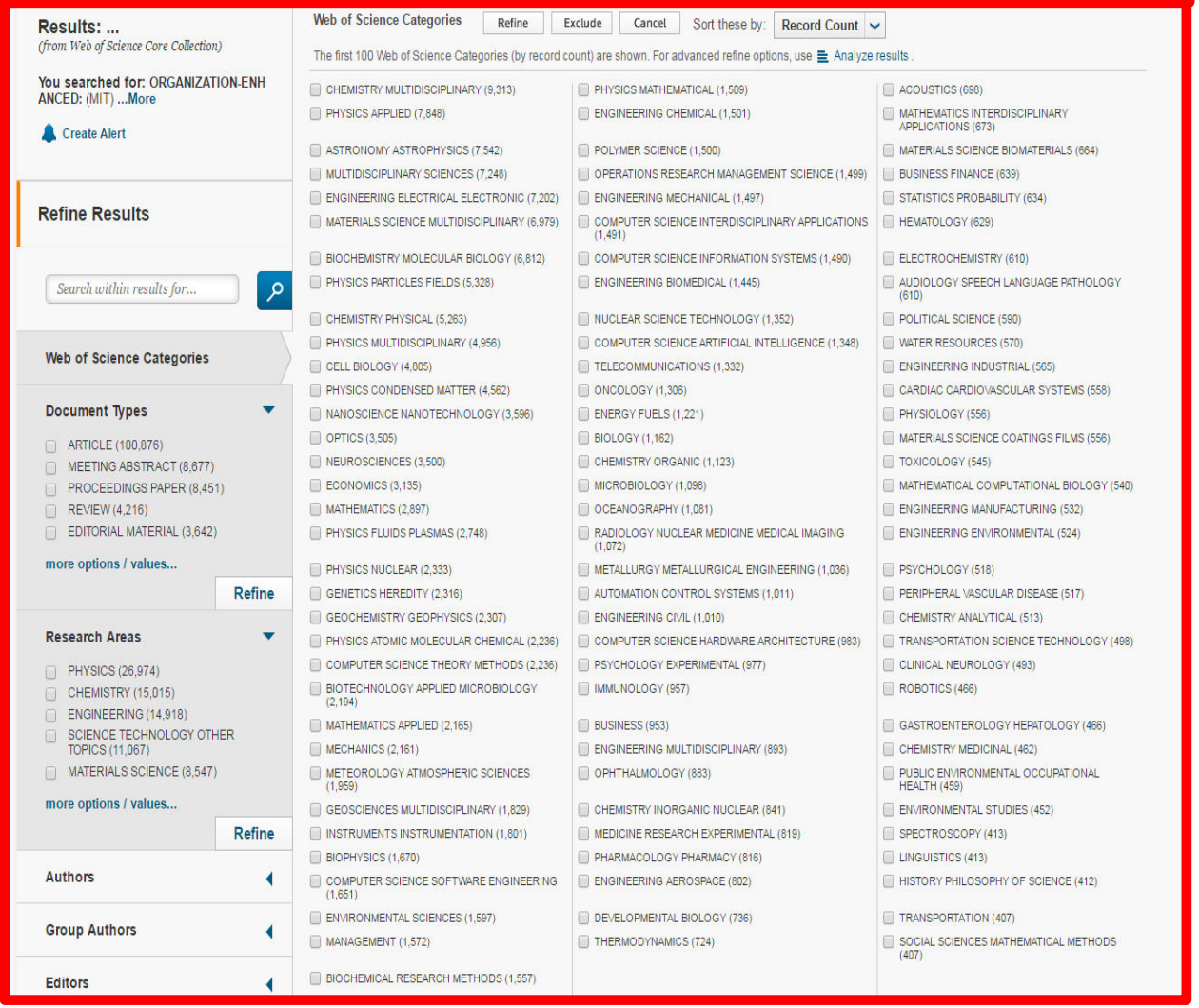
- GDP's central aim is to get researchers' ideas well-structured and fundable shape
- Prioritize effort soundly based on small-, medium-, large-sized grants.
- Conduct several iterations (>=20) and ensure by the time a grant app is sent for review, you only have to correct superficial rather than substantive aspects of the grant (e.g. spelling, grammar and formatting).
- Connect researchers with funding sources
- Team science approach guarantees plentiful success

The Good Work: MAK



1. Computer Science Theory Methods
2. Computer Science Software Engineering
3. Computer Science Interdisciplinary Applications
4. Computer Science Information Systems
5. Computer Science Artificial Intelligence
6. Computer Science Hardware Architecture





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- Meeting the challenges of research across Africa. Seven researchers from African nations discuss the career implications of developing their research at home or abroad. Nature 572, 143-145 (2019). 10.1038/d41586-019-02311-22019-07-29.
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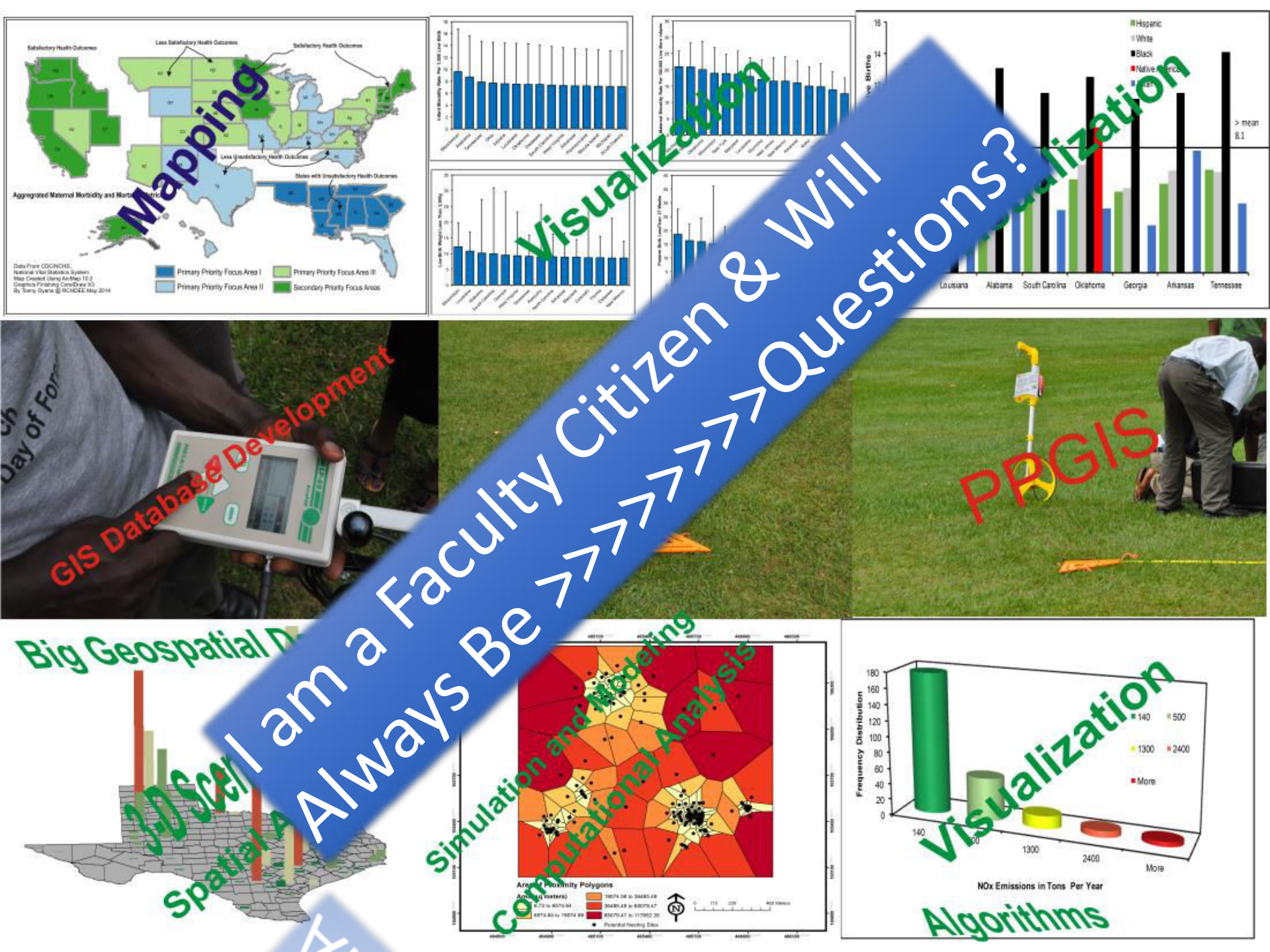
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PPGIS
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Computational Analysis
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Frequency Distribution
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Louisiana
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South Carolina
Oklahoma
Georgia
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Tennessee
Hispanic
White
Black
> mean
8.1
Primary Priority Focus Area I
Primary Priority Focus Area II
Primary Priority Focus Area III
Secondary Priority Focus Areas

Tips and experiences

- Attract and select the most promising (do not ignore/underrate non-academic attributes

- Departments should **communicate** clearly and frequently

  The greatest problem in communication is the illusion it has been achieved. —*George Bernard Shaw*

- Make students aware of both the formal requirements and the informal expectations.

  - **Formal:** courses, examinations, and assistantship duties
  - **Informal:** standards for quality of work, the process of choosing a research adviser, and participation in seminars and social events

Tips and experiences

- Orientation for new students
- Annual meeting for all continuing students: (Covers changes in departments, new faculty, new courses, new policies)
- Individualizing/personalized advising and mentoring

Tips and experiences

Mechanisms for listening to Graduate students

- Inclusion of students in department committees as junior colleagues
- Student advisory committee (to program leaders; heads)
- Exit interviews
- Focus groups
- Surveys