KANSAS STATE UNIVERSITY

2025 Research Themes Committee

Identifying Opportunities for Focused Research Expansion

August 1, 2012

Executive Summary

We were tasked with identifying research areas that are likely to support K-State's attainment of its 2025 goals. We chose to identify those research opportunity areas that (1) are likely to attract support from funding agencies in the future and (2) have a strong base of success already established at Kansas State University. Our data-driven analysis included evaluation of current research funding at K-State and the citations resulting from publications authored by K-State researchers. Based on our analysis, we recommend that the following areas be considered for focused research investments in the near term. We believe each area has a coherent and productive research team and has the potential to attract significant new research dollars.

- *Animal Health and Models of Human Disease*
- *BioEnergy*
- *Ecology and Grassland Ecosystems*
- *Genomics, Lipidomics, Proteomics*
- *Plant Health and Production*
- *Particles and Optics*
- *Standard Model / High Energy Physics*
- *Water*
- *Cancer / Immunology*
- *Food Safety*
- *Nanomaterials*
- *STEM Education: Undergraduate, Graduate, and Post-doctoral Education*

Additional recommendations for actions to be taken to promote research success include:

1. Target research investments to add faculty lines and major infrastructure,
2. Ensure the retention of successful researchers,
3. Expand the fraction of K-State faculty members engaged in externally-funded research activities,
4. Promote interdisciplinary and multi-disciplinary teaming,
5. Periodically repeat this process to ensure currency of K-State capacity information and new federal funding opportunities.
6. Extend the vision 2025 process to those research areas where external funding for research is not necessary to succeed. Driven by the 2025 metric of research expenditures, this committee has identified research areas as successful if they attract significant external funding. In doing so, we have consciously overlooked those research topics that successfully operate with little or no external support. *The reader is cautioned that this report provides an analysis of those areas for which the metrics of research funding and publication citations apply, but not for that segment for which they do not.* As the 2025 process proceeds, we recommend that a group be tasked with completing a similar analysis focused exclusively on the social sciences, arts, and humanities.

Committee Members

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Contents

I. Prologue

What this report attempts to do:

- Measure the value of current research support from external sponsors for a given research area
- Measure the impact of recent K-State research by tracking the citations of publications relating to a given research area
- Gain an understanding of the expected areas for future federal funding for research
- Determine overlap between these metrics

What this report does not do:

- Provide any indication of the academic value of a faculty member or department

  Faculty members at K-State contribute to the overall mission of the University through teaching, service, and research. While recognizing the immense importance of teaching and service, these activities are outside of the scope of analyses completed in this report. Thus, this report makes no attempt to speak to the success of an individual or group with respect to the overall mission of the university.

- Evaluate the quality of research conducted at K-State

  The analyses completed here do not attempt to provide insight into the *quality* of research conducted at K-State. Rather, we have evaluated the *quantity* of research funding and the extent to which K-State publications are cited by others.

Limitations of the analyses completed

- Determining the correct research area in which to place any given PI is the single task that is most prone to error, especially for investigators that contribute to multiple research areas, and has the largest potential impact on the report finding.
- The static nature of the databases employed potentially limits the currency of the results.
  - The funding database analyzed contains data input through February, 2012. Any later awards or amendments are not included in the analysis. Some of these later awards are significant and their absence from this analysis might well be noted.
  - The list of K-State researchers was provided by the Division of Human Resources (acquired May, 2012) and is a static document. Thus, faculty members who have left K-State or announced their intentions to do so should have, perhaps, been excluded from analysis. As there was no systematic way to track these individuals, they are included in the dataset.
- The committee was unable to evaluate several important indicators of research productivity due to the lack of available data. These include publications and productions other than peer-reviewed research articles; public impact; and philanthropic gifts that support research. Furthermore, the publication databases available to the committee focused primarily on scientific fields rather than social science fields such as education, sociology, or business which lead to an under counting of publications from these fields.
- Contributions from academic areas where externally funded research is not necessary to succeed – such as the arts, the liberal arts, and some of the social sciences - are not adequately represented by the available data sources used in this report. To determine the leading research areas within these sectors at K-State, metrics different than those utilized here would have to be developed and evaluated.

II. Approach

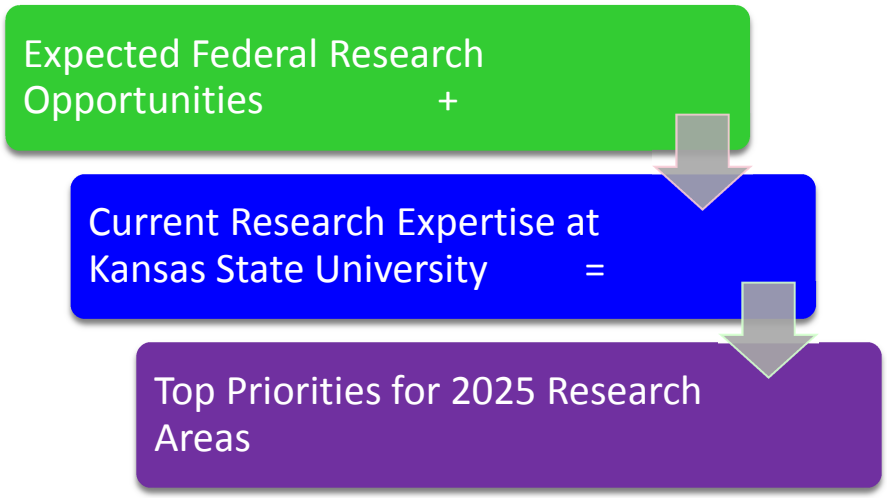
The committee was tasked with identifying research areas that are likely to support K-State's attainment of its 2025 goals. The committee's analysis of the metrics that will be used to measure attainment of our 2025 goals indicated that only one was related directly to our task:

Total Research and Development Expenditures

While three other metrics were related indirectly to our task:

Number of National Academy Members
Number of Faculty Awards
Number of Doctorates Awarded

Based on identifying research areas which would advance our position within these 2025 metrics we chose to identify those opportunities that (1) are likely to attract support from funding agencies in the future; and (2) have a strong base of success already established at Kansas State University. The committee employed a data-driven process to identify future opportunities and areas of current research success as demonstrated by publication excellence and / or extramural research support excellence. Current K-State research expertise was defined as areas which have a strong foundation of research expenditures and from which highly cited publications have resulted. Research expenditures are a direct 2025 metric. Citations garnered for research publication are an indirect contributor to National Academy membership, faculty awards, and should be positively correlated with the number of doctorates awarded.



III. Recommended Areas for Focused Research Investments

The committee recommends that each of the following areas be considered for focused research investments in the near term. We believe each area has a coherent and productive research team and has the potential to attract significant new research dollars.

Recommended Areas for Focused Research Investments
(presented in alphabetical order within each group)

GROUP ONE

- *Animal Health and Models of Human Disease*
- *BioEnergy*
- *Ecology and Grassland Ecosystems*
- *Genomics, Lipidomics, Proteomics*
- *Plant Health and Production*

GROUP TWO

- *Particles and Optics*
- *Standard Model / High Energy Physics*
- *Water*

GROUP THREE

- *Cancer / Immunology*
- *Food Safety*
- *Nanomaterials*
- *STEM Education: Undergraduate, Graduate, and Post-doctoral Education*

Data supporting the selection of each of the recommended areas are provided in Table 1. Group One received the highest ratings in current K-State strengths in both publication and external grant excellence and for which future federal funding opportunities are expected (represented as +++, +++, +++ in Table 1). Group Two represents areas with future federal funding opportunities expected and where the K-State researchers are in the top tier in one productivity measure and in the second tier in the other (+++, +++, ++ in Table 1). Group Three topics represent areas in which K-State productivity is significantly above average but future federal funding opportunities are not explicitly articulated or in which funding opportunities are expected but current K-State productivity is at a lower level than Groups One or Two, as indicated by the examined databases (two out of three columns at ++ level or higher in Table 1).

Table 1: *K-State research expertise and expected future federal research foci.*

Area	Funding Opportunities Expected	Publication Excellence	Grant Funding Excellence
Environment, Natural Resources, Landscape Processes			
Climate change	+++		
Water	+++	++	+++
Natural resources	+++	+	
Ecology & Grasslands ecosystems	+++	+++	+++
Rural landscape	+++	+	
Environ quality/pollution prevention		+	+++
Agricultural Systems and Products and their Safe and Sustainable Utilization			
Plant health and production	+++	+++	+++
Animal health and production	+++	+++	+++
Food safety	+++	+	+++
Food sensory analysis		++	+
Human Health and Well-Being			
Obesity and disease	+++		
Nutrition/disease prevention	+++		
Quality of life	+++	+	++
Cancer/immunology		+++	++
Epithelial cell function		+	++
Biomedical/human health		+	++
Quantitative methodologies	+++	+	+
Ethics and leadership	+++	+	
Adaptation to rapid change	+++		
Molecular Biology			
Lipidomics, proteomics, genomics	+++	+++	+++
Physics			
Particle and optics	+++	+++	++
Standard model/high energy physics	+++	+++	++
Stable Energy Supply			
Wind	+++		
Solar	+++	++	
Smart grid	+++		
Bio-fuels	+++	+++	+++
STEM Education/Workforce development			
K-12 STEM education	+++		+
STEM teacher preparation	+++		
Undergrad, grad, post-doc education	+++		+++
Technical education	+++		
K-State Strengths Not Specifically Identified as Major Themes for Future Federal Funding			
Transportation infrastructure			+++
Nanomaterials		+++	++
Neutron detectors		++	
Molecular simulations		++	
Tech transfer/commercialization			++
Laser processing of materials			+

Areas ranked 1-10 at K-State = +++; 11-20 = ++; 21-30 = + (See Tables 3 and 4 for details).

IV. Details about Each Area

Table 2 provides additional details from each of the areas identified as having the potential to be expanded through the infusion of additional resources. Within the table, the leading researchers and departments are identified. Inclusion on this list results from a high ranking in either the leading authors or leading principal investigators list (with all of the limitations associated with those analyses). The list of departments is not inclusive, but provides the top contributors with respect to publications or research grants. Finally, brief summary information for each area is provided.

Table 2: *Details for each of the areas recommended for focused research investment. Leading Researchers for each area are selected from those with high contributions to funding, publication, or both (as detailed in Sections VI and VII). Information regarding Researchers, Departments, and Funding Agencies is presented in approximate order of contributions to the group.*

Leading Researchers*	Leading Departments	Primary Funding Agencies
Animal Health and Models for Human Disease		
Richt, J Ma, W Ganta, R Nagaraja, T Rowland, R Renberg, W Richards, R Roush, J	Diagnostic Medicine & Path Clinical Sciences	Homeland Security HHS CDC
BioEnergy		
Rezac, M Hohn, K Nelson, N Wang, D Pfromm, P Staggenborg, S Rice, C Vadlani, P	Chemical Engineering Biological & Agricultural Eng Agronomy Grain Science Ag Economics	NSF USDA Energy Education Packard Foundation
Ecology and Grassland Ecosystems		
Dodds, W Ferguson, C Craine, J Blair, J Johnson, L McLauchlan, K Welch, S Sandercock, B	Biology Agronomy Geography	NSF USDA Education Energy Interior
Genomics / Lipidomics / Proteomics		
Welti, R Muthukrishnan, S Beeman, R Jakhunova, A Brown, S Zhu, K Park, Y Kanost, M Tomich, J Reese, Fleming, S	Biology Biochemistry Entomology Biology Plant Pathology Computer Science	HHS NSF EPA
Plant Health and Production		
Wheat		
Gill, B Pumphrey Seifers, D Akhunov, E Whitfield, A Shi, Y Fritz, A Faris, J	Agronomy Plant Pathology Grain Science Biochemistry	USDA KS Wheat Monsanto
Sorghum		
Yu, J Prasad, V Tesso, T Minton, E	Agronomy	USDA NSF US AID KS Sorghum

Particles and Optics					
	Chang, Z Lin, C	Ben-Itzhak, I Corwin, K	Esry, B Washburn, B	Physics	Energy NSF Defense
Standard Model / High Energy Physics					
	Bolton, T Horton-Smith, G	Lin, C Maravin, Y	Thumm, U	Physics	Energy NSF Fermi National l Lab
Water					
	Devlin, D Harmoney, K Douglas-Mankin, K Dalton, T	Barnes, P Murphy, J Hutchinson, S	Klocke, N Zhang, N Gido, K	Agronomy Biological & Agricultural Eng Ag Economics Biology	USDA EPA Interior Defense
Cancer / Immunology					
	Tamura, M Weiss, M Poole, D	Chapes, S Wei, A Michel, K	Troyer, D Muthukrishna,S Blecha, F	Anatomy & Physiology Biology Biochemistry; Kinesiology	HHS USDA NSF
Food Safety					
	Chang, K Roberts, K	Phebus, R Aramouni, F	Scott, H Kwon, J	Diagnostic Medicine Animal Science Hospitality Mgt & Dietetics	USDA Multiple Industry NSF Defense
Nanomaterials					
	Berry, V Jankowiak, R Bossmann, S	Aakeroy, C Klabunde, K Chikan, V	Li, J Ito, T Sorensen, C	Chemical Engineering Chemistry Physics	NSF Defense Energy HHS
STEM Education – Undergraduate, Graduate, Post-Doctoral Education					
	Montelone , B Douglas-Mankin, K Champion, B		Rebello, S. Moxley, V Dandu, R	Physics Arts & Sciences, Dean's Office Industrial Engineering Director of Sustainability Human Ecology, Dean's Office K-State Salina	USDA NSF KS Health Foundation

Animal Health and Models for Human Disease: The focus of this work is the study of animal health and the use of animals as models for human diseases. This emerging area leverages the existing strengths in BRI and will be positioned to use the resources that will develop in conjunction with NBAF. Additional expertise in both production and companion animal health exists at K-State, but to a lesser extent than that of the animal-human nexus.

BioEnergy: The conversion of biomass into fuels and chemicals holds the potential to reduce greenhouse gas emissions, enhance the economic profitability of agricultural practices, and improve system sustainability. Achieving these goals requires the efforts of researchers studying agricultural, technical, and socio-economic issues related to this theme. Thus, this topic is highly interdisciplinary

with funding and publication leadership from three colleges. The group is characterized by having the most grants of any of the research areas identified, albeit with a lower overall research funding level than several of the other top tier categories. Federal funding opportunities for this topic are currently strong and expected to remain so for the foreseeable future.

Ecology and Grassland Ecosystems: Ecology studies the relationships of organisms to each other and to their environment. Grasslands cover ca. 40% of the Earth's land surface, contribute to agricultural economies, and provide ecosystems services like carbon sequestration, water purification, and disease control. Conserving and sustaining this critical resource requires a thorough understanding of grassland ecological processes as influenced by global change, management decisions, and natural factors. K-State's Konza Prairie Biological Station is a world-class grassland research station that attracts international researchers and plays a key role in high-profile national ecological programs like the Long-Term Ecological Research Network, the National Ecological Observatory Network, the Stream Ecological Observatory Network, NSF Macrosystems Biology, and many others.

Genomics / Lipidomics / Proteomics: "Omics" is the broad discipline of science and engineering for analyzing the interactions of biological information objects in various "omes". This research comprises 1) mapping of information objects such as genes, lipids and proteins; 2) finding interaction relationships among the objects; 3) understanding and engineering regulatory mechanisms. Both, the development of new methods and techniques, as well as the application of the resulting novel technology in virtually all research areas at K-State concerned with living organisms, has been pursued by this highly diverse group of scientists. Applications and study areas at K-State range across many species (crops to cattle along with their pests and pathogens) and topics as diverse as drugs and biomaterials. These activities are supported by facilities for Integrated Genomics, DNA Sequencing, and Plant Transformation; the Biotechnology/Proteomics Core Lab; and the Kansas Lipidomics Research Center.

Plant Health and Production: This is an exceptionally broad category with a significant fraction of the researchers in the College of Agriculture contributing in some way. K-State has internationally recognized leadership in wheat research and is developing a leadership position in sorghum. Other strengths in this category include work on weed and pest control, crop disease, and a fundamental understanding of plant molecular genetics. As world population continues to grow and the availability of arable land and water are reduced, efficient production of grain crops will be essential.

Particles and Optics: Termed atomic, molecular, and optical physics (AMOP) at K-State, this group studies the interactions of atoms, molecules, and light. AMO physics lies behind much of the physics of lasers and other everyday devices. The K-State-AMOP program boasts one of the largest groups of AMOP faculty at a U.S. university and is primarily organized around the J.R. Macdonald Laboratory (JRML). The JRML houses several major facilities, including the lasers of the Kansas Light Source (KLS),

several ion sources, and ion accelerators. Much of the K-State-AMOP theoretical effort is related to these topics as well.

Standard Model / High Energy Physics: K-State particle physicists use some of the largest scientific instruments on Earth to measure the smallest constituents of matter and energy in the universe. Such elementary particles include quarks and neutrinos, which are practically undetectable particles emitted by stars and decaying nuclei. While the K-State group is housed exclusively in the department of physics, the research conducted here is highly inter-institutional. For example, the CMS experiment operated at the Large Hadron Collider at CERN in Geneva, Switzerland include a team of more than 900 scientists from 48 U.S. institutions (including the K-State HEP group).

Water: Water has been identified as one of the most critical resources for the future. K-State has expertise and experience ranging from a broad spectrum of competitively awarded grants to the Kansas Water Resources Institute to the newly formed Urban Water Institute. All seek to develop sustainable water management practices as related to specific applications. Because of the broad nature of this question, researchers from the majority of K-State's colleges are involved with leadership from the Colleges of Agriculture; Architecture, Planning and Design; Arts and Sciences; and Engineering.

Cancer / Immunology: This group has unique strength based upon its focus areas, but could be much larger and more diverse by modifying the heading only slightly. As it stands, this group includes only a portion of the researchers associated with the Johnson Cancer Center, which provides support for one of the premier undergraduate research programs on campus. The group includes international leaders in immunology and the development of host defense mechanisms. Others in the group also comprise the core of the highly productive stem cell group.

Food Safety: This represents a diverse group that has a footprint in a number of colleges and departments and a broad base of funding sources. Members of the group are poised to evaluate and insure food safety at all stages of production, processing, transportation, and delivery to the consumer, either as ready to prepare or ready to eat products. Group members are associated with the BRI, the Center for Excellence fo Food Safety Research in Child Nutrition Programs, the K-State Rapid Response Center, and the multi-institutional Food Safety Consortium.

Nanomaterials: Nanomaterials for numerous applications are being developed by a highly interdisciplinary team, with funding and publication leadership from the Colleges of Engineering and Arts & Sciences. Kansas State University has been a leading institution in synthesis, characterization, modeling and engineering of organic, inorganic and composite nanomaterials since the early 1990's. This endeavor has attracted many new colleagues and a respectable level of external funding.

STEM Education – Undergraduate, Graduate, Post-Doctoral Education: This area incorporates activities that provide formal and informal STEM education to individuals within the post-secondary structure and across the STEM spectrum. Researcher awards in this area include projects which focus on STEM teacher development and pedagogy as well as those in which teams of research focusing on a scientific question develop education or outreach materials or programs. These include programs like the NSF REU, IGERT, GK-12; Department of Education GAANN; USDA National Needs Fellowships; and many others. Credit for the research funding and publications resulting from several of these projects has been included in with the scientific topic.

V. Expected Federal Funding Opportunities

Method

To project future funding from extramural sources, the group decided that examining documents that provided the longest view would be the most helpful. Although the group perused current solicitations from several sources, such as the US Department of Agriculture (NIFA), the National Science Foundation, and several programs within the Department of Health and Human Services, it was understood that these sources were very short term as solicitations and RFPs change frequently. In addition, the solicitations represented current requests rather than long-term perspectives. Therefore the group used these sources: strategic plans of top U.S. federal agencies (some but not all), analysis of Grand Challenges documents from agencies, professional societies and associations, examination of high growth areas in publications (10% or more per year), and examination of strategic plans of competitive universities. Strategic plans were located on agency websites and were analyzed for common themes and topics. Grand Challenge documents were analyzed for common themes. The most helpful of these included the National Research Council's *Frontiers of Agricultural Research* and *Grand Challenges in Environmental Sciences*; and the National Academy of Science's *Grand Challenges for Engineering*. High growth areas in publications from Kansas State University were part of the analysis of the committee's research sub-group and were utilized to help define and clarify themes that were pulled from the other documents. The strategic plans of other universities, while interesting, were not helpful for the work of the group except for identifying the critical needs to maintaining high faculty morale and faculty retention as central to any future university success.

These document analyses were discussed and related to the strength areas identified in SciVal® Spotlight by the publications sub-group to assure that there were no obvious omissions and that our list of potential funding opportunities were in line with work being done at K-State. The analysis does not include potential opportunities available from foundations, state government, or industry sponsors.

Findings

The areas of expected future federal funding opportunities are provided in Table 1. Because of changes in the political and global arenas, the committee does not assert that these are actual future funding streams, but, rather, our best assessments of such at this time.

VI. Current Research Publication Expertise at Kansas State University

One measure of the contributions of a research group is the overall quantity, quality, and impact of its members' publications. Here, we use a variety of algorithms to assess quantity, quality and impact. The metrics relate to the number of times K-State authored papers have been cited and the relative proportion of the world's publications that are authored by K-State faculty. The resulting top 30 research areas are presented in Table 3. Raw data for each highly cited author are presented in Appendix A.

Table 3: *Top 30 research areas at K-State as determined by publication productivity. Information presented in alphabetical order within each decade of ranking.*

Overall Rank	Research Area	Number of Authors*	Highly Cited Papers	Citations of Highly Cited Papers	Rank by Spotlight Analysis I	Rank in Spotlight Top 10
Top 10	Animal Health and Models of Human Disease	10	21	314	10 & 17	7
	BioEnergy	15	29	494	5	4
	Cancer / Immunology	14	37	687	6	10
	Ecology & Grassland Ecosystems	15	34	786		9
	Genomics / Lipidomics / Proteomics	25	69	1248	7	
	Nanomaterials	11	27	659		
	Particles and Optics	6	21	435	1	1
	Production Animal Health	10	18	224	2	11
	Standard Model/High Energy Physics	6	50	1033		
	Wheat	9	18	499	4	2 & 5
11-20	Epithelial Cell Function	3	9	180		
	Food sensory analysis	2	4	54	8&14	3
	Molecular genetics - Plants	6	11	241		
	Molecular Simulations	1	7	215		
	Neutron Detectors	2	5	71	16	6
	Pest control	8	13	231		
	Rice	3	7	182		
	Solar Energy	3	7	215		
	Sorghum	2	7	293		
	Water	5	5	80	9	8
21-30	Business Ethics	n/a†	n/a†	n/a†		3
	Environmental air quality	2	2	96		
	Exercise Physiology	6	8	110		
	Food safety	3	6	76	12	
	Game Theory	1	3	48		
	GIS; Land Use	2	4	66		
	Microbiology	2	7	127		
	Molecular Diagnostics	1	4	71		
	Organizational Behavior	2	3	39	11	
	Soil microbiology	1	4	105		

**number of highly cited authors in this research area*

†no authors received more than 10 citations for work published 2009 - 2012

METHOD 1: Highly Cited Authors

Citation of research publications is one measure of the impact that a publication has had on the external research community. The more widely cited K-State authors are, the more widely recognized our institutional research capabilities, and, ultimately, the more likely the chances that K-State researchers will secure research funding and receive awards recognizing their research success. Thus, productivity in publication and citations are indirect contributors to the attainment of the K-State 2025 goals.

This analysis focuses on the use of citation databases to track the number of citations received by publications authored by K-State researchers. Rankings are based on achieving the largest number of citations within a given research area. Table 3 provides a ranking of the top 30 publication areas with information on the number of highly cited articles and the number of times these articles were cited.

Methodology

- Use Scopus, Web-of-Science, and Web-of-Knowledge databases.
- Set publication years to 2009 – 2012 and set author address to include '66506'.
- Download all publications that meet these criteria.
- Sort processed data by number of citations.
- Eliminate all publications with fewer than 10 citations.
- Further process to create a single entry for each author with Name / Number of Publications with 10 citations or more / Total citations for these papers.
- Eliminate all authors from the list who are not K-State faculty[1] members (students, post-doctoral scholars, and authors from other institutions removed from the list). K-State faculty members were determined by a list of K-State employees provided by the Division of Human Resources (acquired May, 2012).
- Assign a single research area to each author as determined from that author's publication titles and personal webpage.
- Group authors with similar research areas and tally the total number of publications with more than 10 citations, and the total citations resulting from those publications.
- In determination of the ranking within the 'Highly Cited Research Areas' category, emphasis was placed on the total number of citations for the studied authors.

Limitations of the Highly Cited Authors Data and the Analysis

This analysis was labor intensive and the results for this analysis are prone to potential errors. These include:

- In order to reduce the volume of data to a manageable level, only papers with 10 or more citations were included. The committee recognizes that this is a significant citation barrier and that it is biased toward certain fields and types of publication and against others.

[1] Faculty defined as tenured/tenure-track academic faculty, research faculty members, and instructors.

- Publications were included in the data analysis once for each K-State faculty author. This resulted in papers with multiple K-State faculty authors being over-emphasized. There appears to be considerable disciplinary variability in the typical number of co-authors. Perhaps influenced by the citation standards (which typically employ author's last name and publication year within the text), papers authored by social scientists appear to have fewer co-authors than those written by experimental physicists, for example.
- Information for some authors was conflicting and resulted in the opportunity to attribute their products in two or more research areas. Ultimately, all contributions from each author were attributed to a single area.
- Time to publication varies considerably among the research areas actively pursued at K-State. While some areas can have manuscripts published within 3 months of submission, others require over 3 years. Thus, this analysis will be biased in favor of fields with rapid publication times.

METHODS 2 & 3: Spotlight

The committee completed an analysis of K-State's research excellence as determined from research publications using SciVal® Spotlight. Spotlight is a customized web-based tool developed and licensed from Elsiever that enables one to evaluate research performance and determine areas of interdisciplinary research excellence (defined as "competencies" by Spotlight). This database analysis tool provides an integrated and interdisciplinary view of unique research strengths and vulnerabilities, SciVal® Spotlight helps provide answers to questions such as:

1. What are the research strengths of my institution?
2. What are our emerging research strengths?
3. Do peer or competing institutions have research strengths in our areas of expertise?
4. Who are our existing and potential collaborators worldwide?

While it's possible to answer each of the questions posed above, this analysis focused on questions 1 and 2. The analysis was completed on the 2010 dataset that includes articles published from 2006 – 2010. The dataset included a total of 6,350 articles published by K-State authors and available through the Scopus database. Of these, 5,987 were analyzed by Spotlight and 1,976 were determined to be within the 84 competency areas defined by Spotlight.[2] Figures 1 and 2 provide indications of the subject areas in which publications occurred and those that were deemed to be in areas of competency.

[2] The precise number of publications and the fraction included in the defined strength areas is dependent upon the time-period analyzed (defined by the dataset year). The total number of publications in the dataset has increased from 5900 in 2008 to 6600 in 2011. Nevertheless, the fraction of the publications that are deemed to be in areas of institutional excellence by Spotlight is consistently 30 – 32%. This percentage is similar to that of other Research Intensive Institutions.

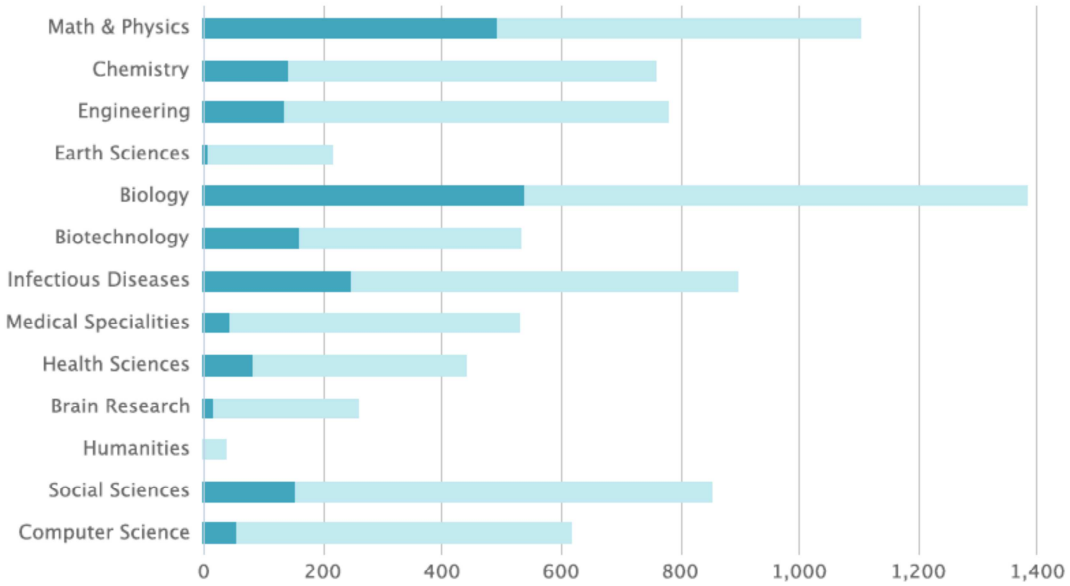


Figure 1: *Spotlight analysis of 2010 K-State publication dataset. The fraction of articles that are deemed to be in areas of strength varies by discipline.*

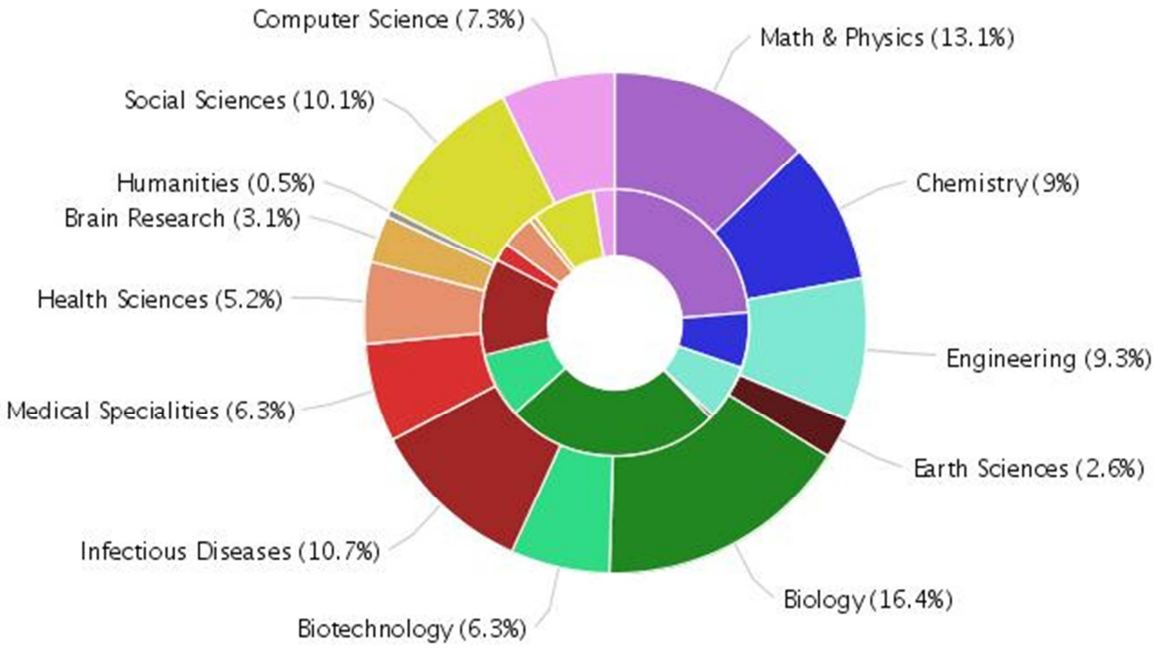


Figure 2: *Spotlight analysis of 2010 K-State publication dataset. Outer ring: All published articles, by subject area. Inner ring: Articles in strength areas, by subject area*

METHOD 2: Spotlight Analysis I

In order to prioritize the 84 areas of strength, the topics were scored on several scales, including:

- World growth
- KSU growth
- Rank by number of articles
- Relative article share
- Relative citation share
- Number of citations
- Spotlight 'state of the art' score[3]
- Overall Spotlight score[4]

The 84 areas were sorted by their performance in each of the subject categories. The top 12 areas for each criterion received a score of 1 in that area. The bottom 72 received a score of zero. The overall performance was determined by the sum of performance in the eight categories. In recognition of areas that are growing in importance internationally and at K-State, a rank score was added and the overall score tallied. The rank score, shown schematically in Figure 3, is highest for those areas growing globally (on the top of the graph) and lowest for those areas that are experiencing declining production and for which K-State has a small fraction of the overall article share (the bottom left quadrant). Figure 3 provides an analysis of each of the 2010 strength areas. This analysis resulted in a group of 17 technical

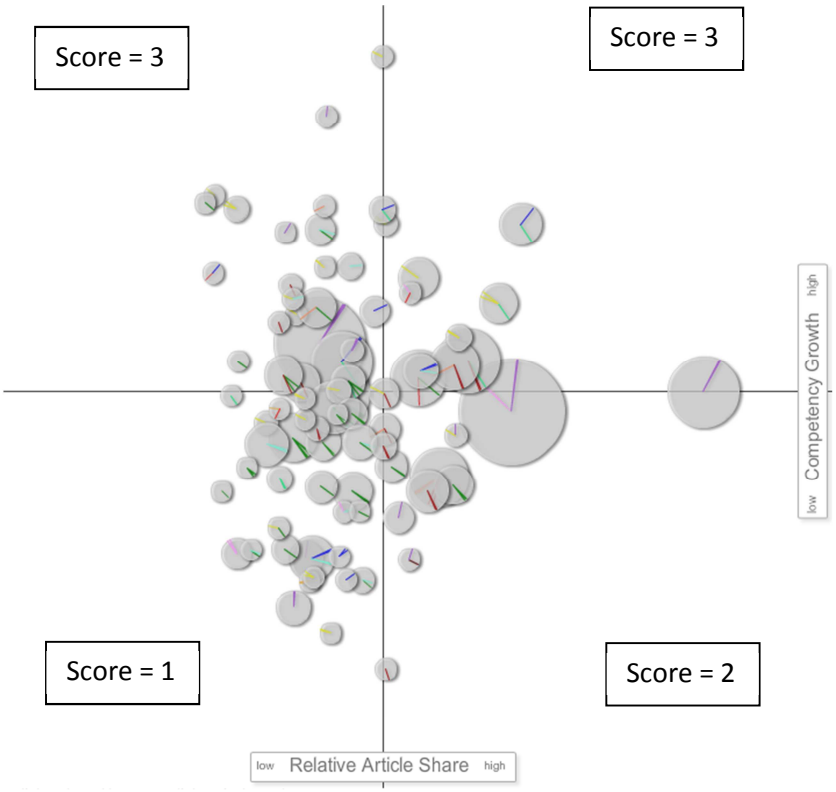


Figure 3: *Publication strengths at K-State as defined by the Spotlight analysis. The size of the individual circles is an indication of the total number of articles published within that area. Location on the graph indicates growth in the global publications in that area.*

[3] The precise algorithm used by Spotlight to arrive at the numerical value of the state-of-the-art score is not available for evaluation or optimization by the user. In general, however, it measures the recency of citations used in the article. Papers that cite more older literature are considered less "state-of-the-art".

[4] The precise algorithm used by Spotlight to arrive at the numerical value of the overall score is not available for evaluation or optimization by the user.

areas that scored distinctly higher than the remaining areas. These are listed in Table 3 under the heading 'Rank by Spotlight Analysis I.'

METHOD 3: Spotlight Top 10 Analysis

Spotlight has provided an analysis of those strength areas in which K-State ranks within the top 10 groups in the world. The 11 areas that are within this group are ordered in terms of their individual significance relative to each other.

Limitations of the Spotlight Data and the Analysis

This analysis relied heavily on the data analysis tools incorporated within the Spotlight software and the results for this analysis are prone to potential errors. These include:

- Spotlight typically categorizes about 30% of all K-State publications into areas of institutional strength. This ratio is smaller than desirable and is of concern to the committee members (although it is consistent across many universities).
- A single set of strength areas has been defined by Spotlight and used for all institutions in the U.S. This set included approximately 1800 areas. While it is not possible to influence these areas or to understand the precise boundaries of each, it is clear that they are much more finely-grained than those employed in other areas of this report. For example, of the 90 strength areas defined in the 2011 data set, four share a single author and would be grouped into a single 'research area' as defined in this report.
- The strength areas defined by Spotlight are dependent upon the publication data set used and non-trivial differences are observed on a year-to-year basis. While variations in, say, the bottom 50% of the areas tabulated might be both expected and of limited impact, variations in the top 10 areas are also seen thus complicating interpretation.

Merging the Results from the Three Analysis Tools

Determination of areas of K-State publication expertise requires a single metric for comparison. In the development of this algorithm, three separate but related analyses were completed and weighting was given to each. In each of the three areas, individual categories were ranked from 1 to n and awarded points according to equation (1)

$$points\ awarded = \frac{(n+1-Rank)}{n} * maximum\ points\ possible \qquad \text{equation (1)}$$

Table 4 details the number of groups included in each metric and the maximum points possible for each.

Table 4: *Parameters of Algorithm for Determination of the Areas of Publication Excellence.*

Metric	***Number of Research Areas Analyzed***	***Maximum Points Awarded***
Highly Cited Authors	40*	30
Spotlight Analysis I	17	10
Spotlight Top 10	12	10
COMBINED	40	50

*A total of 57 research publication areas were identified. Only the top 40 areas were awarded credit under this analysis.

VII. Current Research Funding Expertise at Kansas State University

Analysis of the Funded Research Database provided an indication of the most productive research areas currently active at Kansas State University, the results are presented in Table 5. For this analysis, equal weight was given to ranking with respect to the number of active sponsored projects within an area, and the total value of those active sponsored projects. The reasoning being that an area with many active grants would be better positioned to withstand the loss of a key faculty member or changes in priorities made by a funding agency. Of course, other weighting algorithms are possible and, as such, we are hesitant to place too great an emphasis on the specific placing in this table but would suggest that the data presented give general information regarding the current areas of research success at K-State.

Table 5: *Top 30 Research Areas at Kansas State University during the first quarter of 2012. Information presented in alphabetical order within each decade of ranking.*

Overall Rank	Research Area	# of Active Awards	Total Value of Active Awards
Top 10	Animal Health and Models of Human Disease	29	$ 28,534,547
	BioEnergy	40	$ 13,976,819
	Ecology and Grassland Ecosystems	16	$ 10,587,091
	Environmental Air Quality	17	$ 11,173,609
	Food Safety	13	$ 9,452,829
	Genomics, Lipidomics, Proteomics	12	$ 11,838,064
	Plant Health & Production: Wheat	31	$ 10,930,310
	STEM Education: Undergraduate, Graduate, and Post-doc Education	14	$ 9,814,239
	Transportation Infrastructure	27	$ 8,205,876
	Water	34	$ 7,541,932
11-20	Biomedical / Human Health	8	$ 5,319,785
	Cancer / Immunology	13	$ 4,530,476
	Epithelial Cell Function	6	$ 27,579,753
	Indoor Air Quality	17	$ 3,552,010
	Nanomaterials	20	$ 5,297,614
	Particles and Optics	10	$ 9,202,890
	Plant Health & Production: Sorghum	32	$ 3,605,062
	Plant Health & Production: Weed Control	7	$ 5,549,536
	Standard Model / High Energy Physics	6	$ 9,146,797
	Technology Transfer	14	$ 4,322,446
21-30	Companion Animal Health	9	$ 1,138,440
	Food Sensory Analysis	4	$ 2,010,903
	Human Eye	4	$ 8,560,737
	Micromachining / Laser processing of materials	5	$ 6,307,231
	Molecular genetics of plants	5	$ 2,792,259
	Plant Health & Production: Great Plains Diagnostic Network	3	$ 4,299,055
	Plant Health & Production: Soybean	7	$ 1,214,622
	Production Animal Health	12	$ 2,954,829
	Software models and validation	8	$ 3,480,712
	STEM Education: K-12	5	$ 4,021,313

Methodology

The goal of the committee was to evaluate the current and past research awards to identify research areas that were successful in terms of attracting external research support. To achieve this, the database of research awards administered by the Office of Sponsored Projects was obtained from the University Library and analyzed. ***The dataset evaluated is static and was retrieved in February, 2012. Thus, new awards and incremental allotments to ongoing projects entered into the database after the retrieval date are not included in this analysis.***

To focus on current research strengths rather than historic success, data for research awards that had terminated prior to December 31, 2011 were eliminated from the evaluation. This resulted in 806 awards active in 2012 with a total value of $437,454,323 with individual awards ranging in value from $3,300 to greater than $34 million. These awards had 388 unique Principal Investigators (PI).

Assigning research areas to each award was done manually via the following procedure:

- Grants were sorted by PI and the total research dollars for each PI calculated.
- To reduce the manual processing required, the dataset was screened for productivity metrics and the lowest portion of the dataset was eliminated from further analysis. The metrics employed are presented in Table 6. The expectation here is that future research success is predicted equally by dollars and numbers of awards.

Table 6: *Criteria used to determine if research awards from a given PI would be included in the research funding analysis.*

Total Number of Projects for this PI	Total Value of Research Awards Required to be Kept in Analyzed Dataset
1 or 2	Greater than $499,999
3	Greater than $249,999
4 or more	Greater than $149,999

- Following application of these criteria, the data set was reduced from 806 total awards to 508 (a reduction of 37%) and the value of the awards analyzed was reduced to $404,135,771 (a reduction of 8%).
- For the remaining data, a single research area was assigned to each PI as determined from that PI's research project titles, personal webpage, and research publications.
- PIs with similar research areas were grouped and the total number of active projects and the total value of those projects were calculated.
- Finally, it was recognized that many of the projects awarded to K-State were for public service rather than research. As our task is to identify research areas around which additional resources could be spent and by so doing, the overall research success of the university could be positively impacted, these public service projects were removed from the final analysis. In recognition of the accomplishments of the Principal Investigators, these service awards are included in Appendix B even though they are not included in Table 5.

Limitations of the Research Funding Data and the Analysis

There are certain limitations that should be considered when the data are used in decision-making. Given sufficient time, resources, and desire, each of these limitations could be resolved. Yet, for the analysis provided, they exist.

- The data set analyzed does not include awards received after approximately January 31, 2012.
- Funding data includes only the dollars transferred to K-State as of approximately January 31, 2012. Some multi-year projects have the entire budget transferred at the beginning of the project. Others receive payment in annual installments. This analysis does not account for funding committed for out-year activities that has not yet been transferred to K-State. As such, projects and agencies that transfer all funding at the beginning of the project period will be unduly favored in this analysis.
- The analysis includes all projects active on December 31, 2011. Most projects in this analysis have periods of less than five years. A few projects in the analysis have periods of more than 20 years (the result of continuations being awarded following the initial project period). As a result, the value of these long-term projects may appear more significant than appropriate (i.e., $2 M cumulative over 20 years is less significant than $2M in 3 years).
- Research expertise is strongly correlated with the individual researchers working at K-State. This analysis did not attempt to correct for the loss of researchers through retirement or resignation or the contributions of individuals who have joined K-State within the past year.

VIII. Capturing the Contributions of Researchers from Broader Areas

In the course of this study, it became clear that a number of academic units were under represented in both the Funding Expertise and the Publication Expertise categories. These units are predominantly in the College of Architecture, Planning & Design, the arts and social science sectors of the College of Arts & Sciences, the College of Business Administration, and the College of Technology & Aviation. In this section, we discuss additional analyses that have been completed which highlight their limitations for groups from Broader Areas.

Excellence in Publications

Analysis of the total publication from K-State researchers indicates that those articles in the 'hard sciences' (and included within the Web of Science database) publish at a rate of about 1000 papers per year. K-State researchers from the underrepresented areas (and whose publications are tracked in the SSCI[5] and AHCI[6]) publish at a rate of approximately 200 papers per year. Additionally, the rate of citation of the papers in the SSCI/AHCI considerably lags that in the Web of Science. From the 'science' data, the highest cited paper published during the period 2010 – 2012 had 150+ citations in mid-2012. It took more than twice as long for the most cited SSCI paper to receive 150 citations (for an article published in 2004).

Figure 4 presents the average number of citations per published article as a function of time. The work indexed in the Science database is cited at a higher rate and, at long times, the average citations per published article within the Science group is more than twice that of SSCI/AHCI index. As a result, the relative importance of publications in those fields indexed in the SSCI/AHCI is systematically underrepresented in the citation analyses presented in this report.

To provide a reference framework, the citation rates resulting from K-State publications are compared with those of peer institutions in Figures 5 and 6 for the science index and the SSCI/AHCI indexes, respectively. With regard to the 'science' publications, K-State's rate of citations per published articles is approximately the same as our peer institutions. Those K-State papers indexed in SSCI/AHCI are cited at a slower rate than those of the selected peer institutions. As K-State's research activity increases, one would expect this metric to increase relative to our peers. While the lag time for changes to be observed is probably at least five years, it may be interesting to follow the average citation rates for papers published at K-State relative to our peers.

[5] SSCI = Social Sciences Citation Index of the Web of Science

[6] AHCI = Arts & Humanities Citation Index of the Web of Science

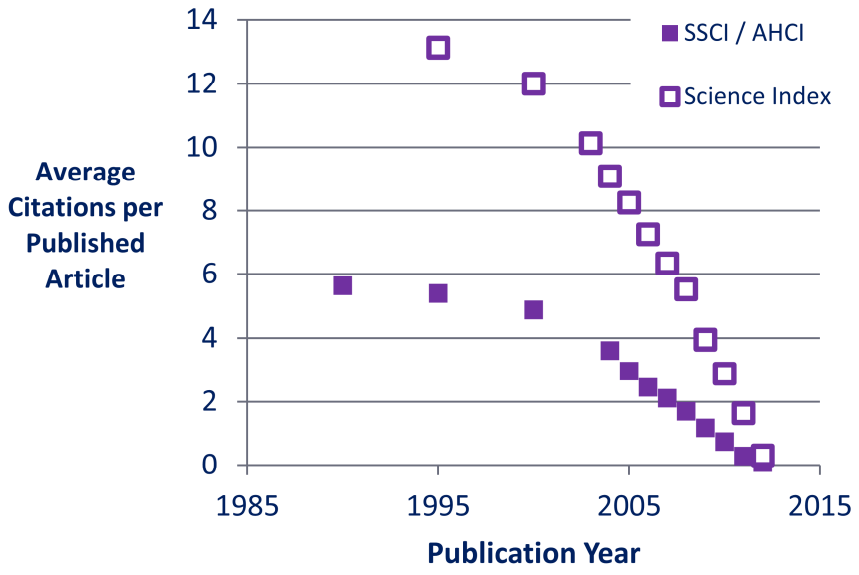


Figure 4: *Rate of citations for K-State authors indexed in the Science section of the Web of Science (Science) database and those indexed in the SSCI and the AHCI section of the Web of Science database.*

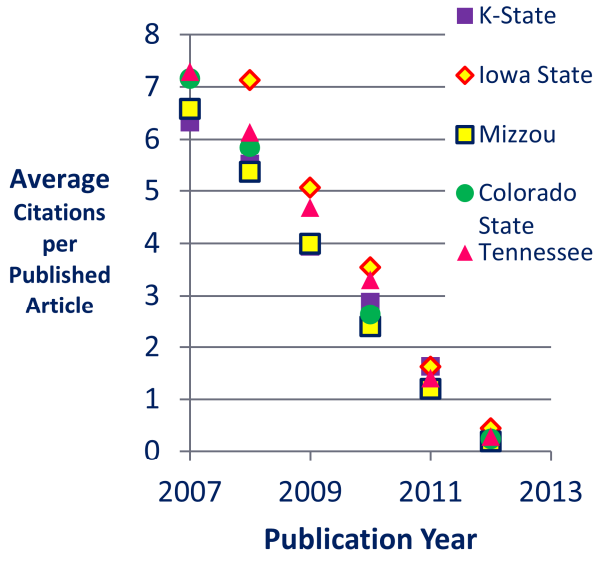


Figure 5: *Rate of citations for K-State authors indexed in the **Science section** of the Web of Science as compared to peer institutions.*

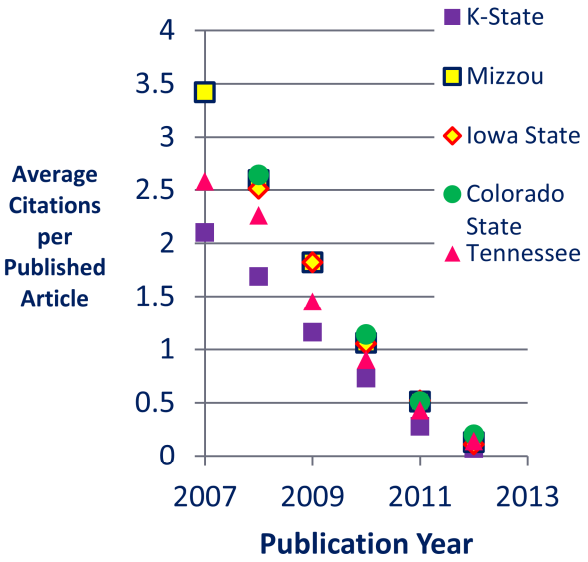


Figure 6: *Rate of citations for K-State authors indexed in the **SSCI/AHCI sections** of the Web of Science as compared to peer institutions.*

It is possible to complete additional analyses of citations that normalize for the nature of the research published. In such an analysis, one could consider including SSCI/AHCI indexed articles published since 2009 with four or more citations (to compensate for the differences presented in Figure 4). Unfortunately, such an analysis would require coding of every K-State author to determine if they are indexed in the 'science' index or the SSCI/AHCI. As there is no systematic way to accurately achieve such a coding at this time, this is beyond the scope of this report.

Research Funding Expertise

As previously discussed, the research funding expertise analysis excluded the 298 research awards with the lowest monetary value from the overall analysis. (The top 508 awards, representing 63% of the awards by number and 92% of the research dollars generated, were analyzed and the results discussed in section VII.) These 298 awards were further evaluated to determine if they contained important contributions from these under-represented areas. Results from the analysis are presented in Table 7. Based on these findings, the analysis based on the awards with the top 92% of the research dollars appears to be valid. There is no indication of systematic oversight of any group. Nearly 95% of the research dollars that were excluded from the analysis in Section VII resulted from projects with PIs from a highly active research department. On the other hand, the dollars generated by faculty members from under-represented departments contribute less than 6% of the unaccounted value or 0.42% of the total value of research awards as of December 31, 2011. Additional analysis of these remaining 298 awards could be completed, but there is no indication that doing so would result in the identification of a new subject area worthy of inclusion on the 'Recommended Areas for Focused Research Investments' list presented in Section III.

Table 7: *Research awards to PIs from 'Broader Areas' during the first quarter of 2012*

Group	# of Grants	Value of Grants ($)	% of Unaccounted Value	% of Total Research Value
Grants not included in analysis in Section VI	298	32,715,029	100	7.48
Social Science	21	1,286,330	3.93	0.29
Arts	1	133,062	0.41	0.03
Architecture	3	51,508	0.16	0.01
Business	4	248,657	0.76	0.06
Leadership Studies	4	120,905	0.37	0.03
Total from 'Broader Areas'	33	1,840,462	5.63	0.42
Total Ag, Science, Education, Engineering, Human Ecology, Education, Vet Med	265	30,874,567	94.37	7.06
Total Grants active on 12/31/2011	806	437,454,323	--	100

Books as Research Output

The Web of Science has developed a Book Citation Index that would have been useful in providing an analysis of books as an indicator of research productivity. Unfortunately, our library does not have a subscription at this time. We requested a list of faculty books from the President's Office, but upon inspection, we found it to be too incomplete for substantial analysis. Since there does not appear to be any other formal recordkeeping of books published by K-State faculty, we recommend that the University Library consider purchasing access to the Book Citation Index so that the President, Research Office, and other administrators can gain a more complete picture of the research activity of K-State faculty in the arts and social sciences.

Please refer to the following link for more information:
http://wokinfo.com/products_tools/multidisciplinary/bookcitationindex/.

Book Citation Index factsheet:
http://wokinfo.com/media/pdf/bkci_fs_en.pdf.

IX. Committee Recommendations

Extend the vision 2025 process to those research areas where external funding for research is not necessary to succeed

Driven by the 2025 metric of research expenditures, this committee has identified research areas as successful if they attract significant external funding. In doing so, we have contentiously overlooked those research topics that successfully operate with little or no external support. As the 2025 process proceeds, we recommend that a group be tasked with completing a similar analysis focused exclusively on the social sciences, arts, and humanities.

Targeted Research Investments should be used to add Faculty Lines and Major Infrastructure

We recommend that new investments made in research be used to add faculty lines to a given area and to provide new infrastructure that is beyond the scope for which external funding might be expected. We recommend a few, large investments (in people, buildings, or large-scale equipment) rather than multiple modest investments (as in the model of the previous Targeted Excellence program).

Retention and Development of Successful Researchers is Critical

Research at K-State is successful because researchers are successful. Identification of outstanding researchers may be more important than the identification of priority research areas. Great researchers will adapt to opportunities. Therefore, the committee believes it is imperative to develop a structure that supports these individuals, identifies the next generation, and facilitates their development into world-recognized leaders in their areas. Retaining successful faculty is more economically viable than replacing them. Committee members expressed concerns that current salary conditions and research support are not competitive in the marketplace, and that leading researchers are actively being sought out by competing universities. Therefore, we strongly urge that administrators at all levels develop policies and practices through which successful researchers can be supported and retained.

Expanding the Research Capacity of All K-State Faculty Members

Leveraging currently successful researchers to expand the overall research productivity of the university is, perhaps, the safest investment of limited dollars and likely to have immediate impact. Yet, attainment of the 2025 goals will almost certainly require an increase in the fraction of K-State faculty members actively engaged in externally-supported research activities. Therefore, we recommend that efforts be made to facilitate research capacity expansion in units eager to participate in this endeavor but with limited expertise or experience.

The Importance of Interdisciplinary and Multi-disciplinary Teaming

The strategic plans of the federal funding agencies examined consistently emphasized the importance of interdisciplinary and multi-disciplinary work in extramurally funded programs. We recommend that the Vice President of Research, the Associate Deans for Research, the Sponsored Research Office, Faculty Senate, and others continue to develop procedures and practices that enable faculty to conduct research as a member of multidisciplinary research teams.

The Need to Adapt to Future Opportunities

This committee recommends that research infrastructure informational mechanisms be developed for identifying what's currently "hot" and what has high potential to be well funded in the next five years. This information could be shared with researchers, as part of the funding criteria for USRG grants and could be in the funding bulletin produced by the Office of Research and Sponsored Projects or on the University's research website.

The Need to Maintain Currency of Information

The evaluation reported here provides a fair indication of the state of research funding and citations at K-State in the first quarter of 2012. We recommend that the analysis be completed with some frequency (perhaps every five years) to ensure that resource allocation decisions are made on data that accurately reflect the current state of the University.

Lack of a Universally Accepted Definition of Research

One of the findings of this committee is that the term 'research' is defined differently by the various members of the campus community. Metrics that one segment of the faculty might use to quantify research may not be valued by others, and vice versa. The previous paradigm which associated the term "research" exclusively with the sciences is increasingly insufficient to describe creative activities in a modern university setting. Universities are institutions of higher learning where the cross-disciplinary nature of research and creative activities cannot be confined to traditional laboratory settings. This is also related to the wide array of activities that the university expects from faculty "researchers" as everyday job requirements. Ultimately, as the University progresses to its 2025 goals, there may be value in developing and publishing a definition of what constitutes research at K-State.

X. Appendix A: Authors of Highly Cited Papers

This appendix provides a list of all faculty members who have authored publications receiving more than 10 citations since 2009.

In completing the list, the following steps were taken:

- Searches were run on the Scopus, Web-of-Science, and Web-of-Knowledge Databases with the following parameters:
  - Publication years of 2009 – 2012
  - Author address to include '66506'.

  (Search was completed in April, 2012.)
- Publications that meet this criterion were downloaded.
- Publications with fewer than 10 citations were removed from the list.
- Authors who were not included in a list of K-State employees with rank of Instructor or higher were removed from the list. (database acquired in May 2012)
- A single entry was created for each author with Author Name / Number of Publications with 10 citations or more / Total citations for these papers.

This appendix provides the summarized data sorted in alphabetical order by author's last name.

Author Name	Department	Papers with 10+ cites	Citations these Papers received
Aakeroy, C	Chemistry	3	170
Adhikari, K	Human Nutrition	1	11
Aiken, R	NW Res Ext Center Colby	2	26
Aikens, C	Chemistry	7	215
Akhunov, E	Plant Pathology	3	92
Akhunova, A	Plant Biotechnology Center	1	38
Alavi, S	Grain Science & Industry	2	22
Amanor-Boadu	Agricultural Economics	1	14
Andrews, G	Veterinary Diagnostic Lab	2	38
Bai, G	Agronomy	2	39
Bai, J	Veterinary Diagnostic Lab	4	71
Barnes, P	Biological & Ag Engr	1	22
Barstow, T	Kinesiology	2	30
Bean, S	Agronomy	2	36
Beeman, R	Entomology	4	59
Ben-Itzhak, I	Physics	1	17
Berry, V	Chemical Engineering	4	184
Blair, J	Biology	1	19
Blecha, F	Vet Med Center Dean of	1	16
Bolton, T	Physics	23	502
Bossmann, S	Chemistry	3	44
Bowden, R	Plant Pathology	1	10
Bradford, B	Animal Sciences	2	33
Brase, G	Psychology	1	10
Briggs, D	Diagnostic Medicine	1	10
Briggs, J	Biology	1	16
Brown, S	Biology	3	44
Cai, G	Management	3	48
Caldas, M	Geography	3	44
Campbell, J	Entomology	1	12
Caragea, D	Computing Science	1	14
Chae, B	Management	1	13
Chakrabarti, A	Physics	1	11
Chambers IV, E	Human Nutrition	3	41
Chambers, D	Human Nutrition	1	13
Chang, K	Diagnostic Medicine	4	54
Chang, Z	Physics	8	194
Chapes, S	Biology	1	19
Chen, J	Biochemistry	6	105
Chen, K	Statistics	1	11
Chen, M	Entomology	3	41
Chikan, V	Chemistry	3	35
Clem, R	Biology	1	11
Cloyd, R	Entomology	1	13
Conrad, G	Biology	1	17
Corwin, K	Physics	3	45
Cox, T	Agronomy	1	25
Craine, J	Biology	4	91
Crow, J	Marketing	1	11
Culbertson, C	Chemistry	1	10
Culbertson, S	Psychology	1	11
Currie, R	SW Research Ext Cntr	2	25
Czermak, P	Chemical Engineering	1	15
Das, S	Electrical Engr	1	11
Depenbusch, B	Animal Sciences	1	13
Dittmer, N	Biochemistry	2	24

Author Name	Department	Papers with 10+ cites	Citations these Papers received
Dodds, W	Biology	8	171
Dogan, H	Grain Science & Industry	1	11
Douglas-Mankn	Biological & Ag Engr	1	14
Drouillard, J	Animal Sciences	3	33
Dryden, M	Diagnostic Medicine	1	12
Dzewaltowski, D	Kinesiology	1	12
Erickson, L	Chemical Engineering	1	48
Esry, B	Physics	5	119
Faris, J	Plant Pathology	1	19
Fellers, J	Plant Pathology	2	36
Flanders, B	Physics	1	27
Fleming, S	Biology	3	32
Fong, P	Anatomy & Physiology	1	21
Friebe, B	Plant Pathology	1	10
Fullagar, C	Psychology	1	10
Garrett, K	Plant Pathology	3	44
Gido, K	Biology	1	10
Gill, B	Plant Pathology	6	154
Gorman, M	Biochemistry	1	10
Gwinner, K	Marketing	1	15
Hancock, L	Biology	5	81
Harmoney, K	Agr Research Ctr Hays	1	19
Harms, C	Kinesiology	1	17
Hartnett, D	Biology	1	41
Higgins, D	Chemistry	1	16
Higgins, J	Statistics	1	13
Higgs, S	Biosecurity Research Institute	1	11
Hiromasa, Y	VP for Research	2	45
Hohn, K	Chemical Engineering	3	83
Horton-Smit, G	Physics	2	57
Hsu, L	Accounting	2	32
Hua, D	Chemistry	1	18
Hutchinson, J	Geography	1	22
Ito, T	Chemistry	1	17
Jankowiak, R	Chemistry	1	10
Jiang, H	Physics	4	115
Johnson, L	Biology	6	102
Jumpponen, A	Biology	4	105
Kambhampa, S	Entomology	1	14
Kanost, M	Biochemistry	7	97
Kim, H	Apparel Textiles & Int.	5	91
Klabunde, K	Chemistry	5	108
Klocke, N	SW Research Ext Cntr	1	15
Koper, O	Chemistry	2	24
Kramer, K	Biochemistry	2	31
Kumarappa, V	Physics	1	15
Lamsal, B	Grain Science & Industry	1	11
Larson, R	Clinical Sciences	1	12
Lechtenberg, K	Diagnostic Medicine	1	13
Lee, S	Biology	2	153
Lee, Y	Plant Pathology	2	42
Lei, S	Industrial & Mfg Sys Engr	1	10
Leslie, J	Plant Pathology	1	24
Leung, H	Plant Pathology	1	38
Lin, C	Physics	14	315

Author Name	Department	Papers with 10+ cites	Citations these Papers received
Lin, J	Physics	2	90
Liu, X	Entomology	3	55
Loneragan, G	Clinical Sciences	2	24
Lorenzen, M	Entomology	4	56
Ma, W	Diagnostic Medicine	2	33
Maghirang, R	Biological & Agr Engr	1	48
Maravin, Y	Physics	1	19
Marcus, D	Anatomy & Physiology	3	61
Marston, R	Geography	1	10
Mattson, R	Horticulture	1	10
Mayfield, M	Biology	1	58
McGregor, D	Mechanical Engr	3	41
McLauchlan, K	Geography	2	65
Michaud, J	Entomology	1	17
Michel, K	Biology	2	49
Miller, T	Educational Leadership	1	11
Musch, T	Kinesiology	1	10
Muthukrishn, S	Biochemistry	4	66
Nagaraja, T	Diagnostic Medicine	3	34
Narayanan, S	Diagnostic Medicine	1	10
Nechols, J	Entomology	1	12
Nelson, N	Agronomy	1	19
Nippert, J	Biology	1	12
Oppert, B	Entomology	2	28
Park, Y	Entomology	3	37
Paul, B	Geography	1	10
Pei, Z	Industrial & Mfg Sys Engr	2	23
Pfromm, P	Chemical Engineering	4	49
Phebus, R	Animal Sciences	1	11
Phillips, T	Entomology	1	32
Poole, D	Kinesiology	4	73
Pumphrey, M	Agronomy	3	81
Rajashekar, C	Horticulture	2	39
Ramalho-Ortigao, M	Entomology	1	10
Ramm, A	Mathematics	2	30
Rasheed, H	Civil Engineering	1	10
Ratra, B	Physics	1	10
Reeck, G	biochemistry	1	104
Reese, J	Entomology	1	49
Renberg, W	Clinical Sciences	1	13
Renter, D	Diagnostic Medicine	1	12
Rezac, M	Chemical Engineering	2	21
Rice, C	Agronomy	2	53
Richt, J	Diagnostic Medicine	4	77
Roelofs, J	Biology	2	46
Rotenberg, D	Plant Pathology	1	10
Roush, J	Clinical Sciences	2	25
Rowland, R	Diagnostic Medicine	3	40
Sang, Y	Anatomy & Physiology	2	27
Schlegel, A	SW Research Ext Cntr	1	12
Schrick, K	Biology	1	20
Schroeder, T	Agricultural Economics	1	21
Seifers, D	Agr Research Ctr Hays	1	17
Sheu, C	Management	1	13
Shi, J	Anatomy & Physiology	1	11
Shi, Y	Grain Science & Industry	1	11
Shultis, J	Mechanical Engr	2	30

Author Name	Department	Papers with 10+ cites	Citations these Papers received
Sloderbeck, P	Extension SW Area	1	11
Sorensen, C	Physics	2	22
Staggenborg, S	Agronomy	1	22
Stahlman, P	Ag Research Ctr Hays	3	32
Stevenson, J	Animal Sciences	1	11
Stith, S	Family Studies	1	27
Sun, X	Grain Science & Industry	1	12
Tamura, M	Anatomy & Physiology	6	96
Tesso, T	Agronomy	1	12
Thippareddi, H	Animal Sciences	1	11
Thomson, D	Clinical Sciences	3	34
Throne, J	Entomology	1	32
Thumm, U	Physics	9	130
Tomich, J	Biochemistry	2	45
Toomajian, C	Plant Pathology	2	26
Trick, H	Plant Pathology	1	21
Troyer, D	Anatomy & Physiology	6	96
Ungerer, M	Biology	2	40
Vadlani, P	Grain Science & Industry	3	47
Valent, B	Plant Pathology	4	102
Wagner, L	Agronomy	1	11
Walker, J	Hale Library	1	16
Wang, D	Biological & Ag Engr	3	62
Wang, H	Statistics	3	36
Wang, L	Anatomy & Physiology	6	161
Wangemann, P	Anatomy & Physiology	5	98
Washburn, B	Physics	3	45
Wei, Q	Biochemistry	1	15
Weiss, M	Anatomy & Physiology	4	91
Welch, S	Agronomy	2	103
Welti, R	Biology	7	163
Wetzel, D	Grain Science & Industry	1	16
White, B	Clinical Sciences	1	12
White, F	Plant Pathology	4	111
Whitfield, A	Plant Pathology	2	20
Whitworth, R	Entomology	1	11
Wildman, R	Human Nutrition	2	26
Wilkerson, M	Diagnostic Medicine	1	10
With, K	Biology	2	34
Wong, B	Kinesiology	1	15
Wright, T	Management	2	29
Yu, J	Agronomy	6	281
Zhu, K	Entomology	5	57

XI. Appendix B: Top Researchers based on success as a Principal Investigator

This appendix provides a list of all faculty members who are included in the analysis of the top researchers based on research funding.

In completing the list, the database of research awards administered by the Office of Sponsored Projects was obtained from the University Library and analyzed. To focus on current research strengths rather than historic success, data for research awards that had terminated prior to December 31, 2011 were eliminated from the evaluation. The dataset evaluated is static and was retrieved in February 2012. New awards and incremental allotments to ongoing projects entered into the database after the retrieval date are not included in this analysis.

- Grants were sorted by PI and the total research dollars for each PI calculated.

  While many research projects are awarded to a group of faculty members (including a PI, several co-investigators, and, in some cases, senior personnel), this analysis attributes all financial resources to the PI. For the purposes of this committee's work, such an accounting is desirable in that it provides a facile mechanism to avoid double counting of project dollars. However, it fails to account for the contributions of co-investigators. Thus, the information in the following table must be used with awareness of this limitation.

- To reduce the manual processing required, the dataset was screened for productivity metrics and the lowest portion of the dataset was eliminated from further analysis. The metrics are presented in Table 6. The expectation here is that future research success is predicted equally by dollars and numbers of awards.
- The PIs of the 508 awards completed in the analysis are presented in the following pages in alphabetical order.
- In preparation of Table 5, projects that were deemed to be non-research in nature (such as those for student services or the university child care center) were removed from the analysis. ALL awards (both research and other) are included in this appendix.

Reasons an individual's entries may appear different than expected:

1. The individual in question is a co-PI or senior personnel.
2. The project was terminated prior to December 31, 2011.
3. Multi-year funding has been committed but not received (only dollars received are included).
4. A new project or incremental funding was received after approximately January 2012.
5. The total research budget controlled by a PI does not meet the metrics set forth in Table 6 for inclusion in this analysis.

Research	# of Active Awards	Value of Active Awards ($)	Department
Aikens, C	4	471,243	Chemistry
Akhunov, E	2	715,784	Plant Path
Alavi, S	4	654,445	Grain Science
Allen, D	1	544,566	College of Education
Amanor-Boadu, V	2	503,080	Ag Econ
Anderson, D	3	393,645	Vet Med
Anderson, G	5	974,792	Vet Med
Aramouni, F	2	1,063,910	Animal Science
Asano, K	1	2,427,950	Biology
Barnhart, R	2	3,156,979	K-State Salina
Baublits, J	1	750,000	Division of Student Life
Beardsley, C	2	6,278,298	NABC
Ben-Itzhak, I	4	6,704,901	Physics
Bergtold, J	2	733,834	Ag Econ
Berry, V	4	530,794	Chemical Engineering
Bhadriraju, S	2	1,120,875	Grain Science
Biles, L	9	10,498,554	Forester
Blair, J	2	3,117,900	Biology
Bockus, B	4	669,337	Plant Path
Bolton, T	6	9,146,797	Physics
Bosco, P	3	251,197	Student Services
Bossmann, S	3	501,217	Chemistry
Bradford, B	4	579,298	Animal Science
Bremer, D	1	609,736	Horticulture
Briggeman, B	1	1,159,923	Ag Econ
Brown, S	2	3,653,259	Biology
Cai, L	3	330,947	Mechanical Engineering
Chambers IV, E	4	2,010,903	Human Nutrition
Champion, B	1	1,229,101	Director of Sustainability
Chang, K	1	2,975,322	Vet Med
Chapes, S	6	1,241,553	Biology
Cloyd, R	5	1,596,412	Entomology
Conrad, C	3	5,558,964	Biology
Corwin, K	2	739,000	Physics
Culbertson, C	3	1,180,359	Chemistry
Currie, R	1	690,515	Agronomy
Dalton, A	1	737,869	College of Education
Dalton, T	2	813,691	Ag Econ
Dandu, R	1	500,000	K-State Salina
DeRouchey, J	2	536,980	Animal Science
Devlin, D	11	2,904,480	Agronomy
DeWolf, E	4	428,110	Plant Path
Dodds, W	2	1,476,561	Biology
Douglas-Mankin, K	1	1,662,943	IMSE
Dryden, M	6	433,904	Vet Med
Eckels, S	4	787,920	Mechanical Engineering
Edgar, J	4	1,644,293	Chemical Engineering
Erickson, L	2	1,097,861	Chemical Engineering
Esry, B	3	865,989	Physics
Ferguson, C	1	1,652,598	Biology
Fleming, S	2	1,812,267	Vet Med
Fritz, A	3	1,890,360	Agronomy
Fry, J	2	1,509,890	Horticulture
Ganta, R	1	1,511,004	Vet Med
Garrett, K	4	277,963	Plant Path

Research	# of Active Awards	Value of Active Awards ($)	Department
Gido, K	3	237,511	Biology
Gill, B	6	4,644,666	Plant Path
Glasscock, M	8	46,242,716	Family Studies
Goodin, D	1	596,424	geography
Grauer, G	3	704,536	Clinical Sciences
Greene, K	4	1,323,686	Division of Student Life
Hadley, G	1	5,828,327	Ag Econ
Hancock, L	1	589,040	Biology
Hatcliff, J	4	2,096,746	Computer Science
Havlicek, B	4	2,466,947	College of Education
Herrera, S	3	3,307,723	Elementary Ed
Hesse, R	3	504,143	Diagnostic Medicine
Hohn, K	3	441,884	Chemical Engineering
Hosni, M	6	411,403	Mechanical Engineering
Hossain, M	8	2,589,767	Civil Engineering
Hutchinson, S	3	810,431	BAE
Ito, T	1	720,000	Chemistry
Jankowiak, R	2	830,000	Chemistry
Jardine, D	5	279,855	Plant Path
Joern, A	1	750,000	Biology
Johnson, L	2	873,242	Biology
Jones,B	7	2,352,687	Mechanical Engineering
Jumpponen, A	2	889,059	Biology
Kanost, M	3	6,760,317	Biochemistry
Kenney, M	4	1,583,618	Anatomy & Physiology
Kirkpatrick, K	1	501,340	Psychology
Kramer, B	8	3,449,686	AMI
Kumari, M	1	1,334,860	Anatomy & Physiology
Kwon, J	2	717,495	Dietetics
Lamm, F	3	303,720	BAE
Larson, N	5	3,755,504	Engineering Extension
Leatherman, J	3	263,351	Ag Econ
Lei, S	1	5,520,833	IMSE
Leslie, J	4	633,958	Plant Path
Li, J	3	704,297	Chemistry
Lin, C	1	893,000	Physics
Lindquist, J	1	1,218,767	College of Ag
Little, C	4	174,529	Plant Path
Ma, W	1	642,974	Vet Med
Maghirang, R	5	1,195,209	BAE
Maier, D	8	3,168,509	Grain Science
Marcus, D	2	23,179,355	Anatomy & Physiology
Martin, S	1	1,400,000	HSRC
McCornack, B	3	552,334	Entomology
McGregor, D	3	927,208	Mechanical Engineering
Mengel, D	4	296,788	Agronomy
Middendorf, B	9	450,643	OEIE
Miller, R	1	644,207	Grain Science
Minton, J	6	258,840	College of Ag
Montelone, B	4	2,832,567	Biology
Moxley, V	5	2,906,248	Human Ecology
Murphy, J	6	868,331	BAE
Murry, K	3	3,398,323	Secondary Education
Muthukrishnan, S	1	665,000	Biochemistry
Nagaraja, T	3	1,444,906	Animal Science
Neilsen, M	4	1,383,966	Computer Science

Research	# of Active Awards	Value of Active Awards ($)	Department
Nelson, N	1	1,090,453	Agronomy
Nutt, C	1	7,158,019	Counseling & Educ Psych.
O'Conner, N	1	1,174,112	Family Studies
Odde, K	1	2,759,544	Animal Science
Ou, X	3	699,506	Computer Science
Pagadala, P	10	1,785,426	Agronomy
Park, Y	2	659,869	Entomology
Pei, Z	4	786,398	IMSE
Peterman, R	4	1,217,661	Civil Engineering
Peters, P	3	22,934,040	Human Nutrition
Pierzynski, G	4	1,420,228	Agronomy
Poole, D	4	468,046	Kinesiology
Powers, A	1	1,283,269	Journalism
Presley, D	5	205,824	Agronomy
Procter, D	4	161,551	Ctr for Engagement & Comm Development
Rajashekar, C	1	500,698	Horticulture
Ramalho-Ortigao, M	2	1,247,506	Entomology
Rebello, N	3	1,378,946	Physics
Reeck, G	2	544,537	Biochemistry
Rezac, M	7	5,611,064	Chemical Engineering
Rice, C	4	1,95,8511	Agronomy
Richardson, R	2	2,747,478	Vet Med
Richt, J	6	12,804,809	Vet Med
Riding, K	7	375,060	Civil Engineering
Ring, D	3	285,179	Ctr for Child
			Development
Roberts, K	1	1,599,981	Dietetics
Rowland, R	5	5,085,450	Vet Med
Russell, E	4	335,000	Civil Engineering
Sandercock, B	5	1,435,060	Biology
Schapaugh Jr, W	2	934,767	Agronomy
Schultz, B	1	982,215	Anatomy & Physiology
Schulz, N	2	683,380	Electrical Engineering
Scott, H	4	2,054,371	Vet Med
Shi, J	2	905,150	Anatomy & Physiology
Shi, Y	6	504,272	Grain Science
Shoemaker, C	2	1,050,586	Horticulture
Smith, P	1	873,810	Chemistry
Snead, B	4	3,725,035	Engineering Extension
Spooner, B	2	1,640,693	Biology
Stack, J	3	4,299,055	Plant Path
Staggenborg, S	3	826,225	Agronomy
Stahlman, P	4	1,676,561	Agronomy
Steward, D	1	511,513	Civil Engineering
Stith, S	2	2,918,882	Family Studies
Stokes, R	4	3,688,388	Civil Engineering
Takemoto, D	1	3,001,773	Biochemistry
Tamura, M	1	500,000	Anatomy & Physiology
Tesso, T	5	237,500	Agronomy
Thompson, C	2	3,182,460	Agronomy
Thomson, D	3	1,041,750	Vet Med
Tomich, J	1	610,502	biochemistry
Trick, H	5	373,482	Plant Path
Tucker, J	4	369,680	AMI

Research	# of Active Awards	Value of Active Awards ($)	Department
Turner, M	2	2,652,900	Division of Student Life
Ungerer, M	1	609,999	Biology
Valent, B	4	1,739,185	Plant Path
Vanier, M	1	33,776,800	NABC
Wang, D	4	482,017	BAE
Wang, Y	2	1,337,749	Mechanical Engineering
Wangemann, A	1	2,513,033	Anatomy & Physiology
Webb, F	1	1,554,366	Family Studies
Weiss, M	5	195,973	Anatomy & Physiology
Welch, S	2	685,306	Agronomy
Welti, R	2	813,986	Biology
White, F	1	2,158,301	Plant Path
Whitfield, A	3	889,038	Plant Path
Yu, J	3	851,979	Agronomy
Zhang, N	2	828,904	BAE
Zurek, L	3	256,847	Vet Med