

Executive summary

Clearing the Path on the Endless Frontier

Kim A. Wilcox, Chancellor, University of California, Riverside

- President Franklin Roosevelt tasked Dr. Vannevar Bush with creating a strategy for federal support of scientific research that built on the successes seen during wartime. With the help of scientists and scholars, Dr. Bush produced *Science: The Endless Frontier*, a document that managed to facilitate the world-changing scientific and technological developments over the last 70 years. Federal support of basic research continues to be guided by principles outlined by Bush. Among the recommendations, three core principles are essential to U.S. research.
- **The federal government should fund basic research through the nation’s universities.** Since 1953, the federal government has provided over 50% of the nation’s expenditures on basic research, with the majority of that funding going to universities. Recent declines present challenges for the nation’s research universities, including a reduction in research, and a narrow pipeline for early-career investigators, the future researchers.
- **Free inquiry is essential to the creation of new knowledge.** The freedom to pursue knowledge wherever interests lies is a foundational component of basic research. Efforts by the media and politicians to disparage the work of peer-reviewed scientist is an attack on free inquiry and threaten truly groundbreaking discovery. Scores of research projects that may have seemed trivial have led to some of the most important scientific discoveries.
- **Access to higher education should be based on ability, not circumstance.** Of the three core principles, this is where we are most deficient. UC Riverside stands as a national model for student success for access to higher education. UC Riverside’s efforts have improved the outcomes of lowest-income and underrepresented minority students.
- The vision for government-led research still guides our basic research efforts, but we remain woefully inadequate on the third core principle—access to higher education. The graduation rates for minorities and Pell grant recipients remain low and family income is the main factor for who succeeds at the college-level. We need to replicate the successes of those institutions that defied these trends to realize the larger societal benefits and bolster the research enterprise vital to our nation and the world.

The Knowledge Archive as Convergence: Challenges of Scale and Sustainability for Scholarly Publishers, Libraries and Museums

Alex W. Barker, Director, Museum of Art and Archaeology, University of Missouri

- Museums and libraries both hold and offer access to growing amounts of information about objects—paper, digital, or dimensional—whose value is directly related to their accessibility or findability. Both play key roles in the archiving, presentation and preservation of knowledge, what has been called the knowledge archive.
- Rates of growth of archives in museums and academic publishing are staggering. There is increasing value to publishers in expanding the number of contributions published. The same pressures are at work at museums. Another trend is the equal concern with datasets on which research is based, to promote secondary research and to promote validation of data and conclusions. The demand for open access is another trend that poses challenges to most forms of academic publishing and less-advantaged scholars find it harder to contribute, because of the cost. The implications that emerge from these trends include massive increase in curated content, a shift in authority from editors to readers, and the erosion of the traditional forms of aggregation.
- As external pressures are forcing convergence between publishers, libraries and museums, new synergies are emerging, and old distinctions borne of legacy print-based workflows are blurring. Time will tell how robust those synergies will be, and in the meantime, they offer opportunity for scholarly inquiry and implications for research infrastructure.

Child Trauma Research: Future Directions and Next Steps

Yo Jackson, Professor and Senior Scientist, Clinical Child Psychology Program/Life Span Institute, University of Kansas

- The SPARK project, a five-year longitudinal study funded by the National Institutes of Health, is an example of a large-scale effort that follow youth and their development over time. Research on youth exposure to trauma is most often directed toward the study of the rate, nature, and outcome of experiencing atypical events during development. The relation between exposure to trauma in childhood and negative health outcomes is not, however, automatic and the study of resilience seeks to determine under what conditions do youth exposed to trauma progress typically and demonstrate expected developmental milestones across social, academic, physical, emotional, and behavioral health domains.
- To access youth in foster care for research, SPARK staff had to create working relationships with a myriad of stakeholders including the State of Missouri to gain access to the youth, as well obtain each child's case file. The staff also met and developed relationships with others, making the process time and labor intensive. The SPARK project

collected data from youth and foster parents on over 2,000 variables, while ensuring the well-being of participants.

- Data collection for the SPARK project was complete in 2015 and the staff has 10 published studies and over 15 conference presentations as a result. Though the big model is still in progress, preliminary results are available. Youth who demonstrate adaptive functioning do not have less exposure to trauma, nor are they better copers or more intelligent or have more social support. Those who fare poorly tend to have more family support, interpret trauma in a rigid manner, and tend to cope with trauma by avoiding it or enlisting the help of others.
- Projects like SPARK are not possible without the support from the university. Most beneficial to the SPARK investigator were having release time and support from the university infrastructure. As the role of community-based research at universities continues, administrators may do well to expand their definitions of faculty productivity and student success and include activities where students can get involved in projects that serve the broader community.

Technology and Research

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- The effective transmission of knowledge has led to significant advancements in technology, which has continued to revolutionize virtually every aspect of the world we live in today. For accurate transmission of technological knowledge, research is needed.
- Driving has become a primary necessity and it is an instrumental activity of daily living. Though, it is a high-risk activity with safety implications. There has been research focused on developing methods to assess and retrain drivers who have a medical condition that affects their ability to drive. Until the 1980s, assessment and retraining of these drivers took place in real cars on real roads. Researchers and clinicians have looked for safer, cheaper, and more effective technological alternatives to the on-road testing.
- Driving simulators provide an opportunity to assess and retrain affected drivers. Simulator-based assessment and intervention now offer near-realistic driving situations that allows the researchers and driving experts a better opportunity to assess and retrain.

- In the future, we plan to look at the benefits of measuring cognitive workload while performing different cognitive tasks of varying levels of difficulty in the driving simulator. Detection of abnormal changes in workload may provide early detection of cognitive decline. This can lead to interventions, which will decline progression of disease rate and prolong highest quality of life.
- To keep the vehicle of technological advancements going, it is important for universities and the industry to continue to engage in scientific partnerships. These partnerships will benefit from establishing clear agreements, effective communication, and well-defined expectations.

Animal Research Support: The Transition from Ancillary Service to Contract Research Organization

Jerry Zamzow, Assistant Vice President for Research, Iowa State University

- The use of animals in research, a vital component for advancing the human condition, is controversial at times. Public perception of the use of animals in research has shifted recently, and institutions are assuming much of the responsibility. Centralization is a mechanism that institutions are using to meet regulatory aspects, mitigate questionable research practices and reduce bias.
- The model of a Central Research Organization (CRO) is an opportunity for an institution and research offices to provide a greater level of service to principal investigators and their research. The CRO would be a one-stop shop, providing assistance in study design, development of standard operating procedures, implementing activities, and returning results.
- There are pros and cons to the CRO model. Institutional risk is mitigated by having highly trained staff involved in all areas of the study. By centrally managing the process, studies are carried out with greater confidence in regulatory and ethical integrity. CROs provide cost savings and a reduction in administrative burden for principal investigators. A negative aspect is the loss of teaching opportunity. A financial investment in the model must be made, and may not be recouped for some time, though with proper changes, the CRO will be self-sustaining, and provide a greater level of service to investigators.

The Value added of Education at a Public Research University

April C. Mason, Provost and Senior Vice President, Kansas State University

- The classification system for universities is important, and Kansas State is a very high research university. Its rankings are monitored by growth in research dollars and faculty are nominated for national awards by this category. Universities value the success of students and faculty and staff work to help students. In addition, these universities have many programs in place to help students succeed.

- Kansas legislature recently passed a law that requires public universities make available the cost of an education, time to degree, and expected salary, to determine the return on investment of an education. Although the data is flawed in most cases, the return on investments for degrees from research publics in state compared to lower research universities are not favorable. Public research universities will need to compete on the value added of an education at a public research university.
- Strategic thinking, planning and action are more important than at any other time in history of public research university education. These universities are going to have to demonstrate why an education from a research university is important, and this will include clearly communicating what they are and are not. They will need to ask what can be done to make the educational degree from the public research universities mean more, value more, help more and better prepare students.

Assessing Research Productivity

Sara Thomas Rosen, Dean of Arts and Sciences, Georgia State University

- Research universities aspire to excellence in research and scholarship, which creates additional responsibilities for administrators. The best decision for research and scholarship should be data-driven. This paper demonstrates the value of data about faculty activity by working through data from the University of Kansas. It extends on recommendations by Dr. Steinmetz at the 2014 Merrill Retreat, and shows how to use productivity data to identify factors that influence productivity.
- This paper examines eleven measures of faculty scholarly productivity. It compares the University of Kansas (KU) to ten peer institutions. Additionally, nine departments were selected for analysis. Tables and graphs summarizing faculty productivity within nine departments at eleven institutions were created and the examination of the results found three KU departments for which the results pointed to interesting patterns of productivity.
- The analysis of the Academic Analytics data for one department out of the KU social-behavioral sciences (SSI) sector indicate the need to identify and correct the hiring and promotion practices that have led to non-productive faculty. Analysis of the data show that faculty in one of the departments of KU's natural science (NSI) sector are active in publishing and grant activity, but the work has a minimal impact on the field. This finding suggests the need for an external review team to examine the NSI department's research activity and determine why the research impact is low. The individual data from the third KU department out of the humanities (HI) sector, reveal that half the faculty have been producing the majority of the department's output.
- The data shows that, with one department exception, KU faculty have put their time, effort and resources into articles that are rarely cited. The University's efforts to raise citation's scores include hiring foundation professors who bring their citation with them, and having

faculty provide open access to their publications, which generally increases citations. Although these are useful, increasing citation scores will require centrally led, department-by-department analyses of how KU hires, mentors, and promotes its faculty.

Planning for Institutional Core Research Facilities in Uncertain Times

Joseph A. Heppert, Associate Vice Chancellor for Research, Professor of Chemistry
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- Public universities are challenged with creating a sustainable system of core research laboratories that serve the largest possible group of investigators. In spite of capital costs and support for research personnel, core research laboratories enhance the university's research efficiency. Federal agencies have also come to realize the advantages of centralizing core resources.
- KU began to build core labs in the early 1970's and KU research currently supports and administers ten core laboratories. Building a culture around the development and use of institutional core laboratories requires an institutional commitment for support, principal investigators' support, and a strategy for optimizing laboratory function. Suggested best practices for creating a robust system of core research laboratories include cost effectiveness, sustainability, adaptability, responsiveness, engagement and outreach.
- At the University of Kansas in Lawrence, the understanding of these best practices in management of the core research labs was applied in the conceptualization and design of the new multi-user nanomaterials clean room core facility. Initially, KU had project plans of clean room spaces at three sites on campus. Instead, KU chose to close the existing facilities and build a single 5,000 square foot multi-user space and an associated 2,000 square foot dedicated cleanroom space centrally located. The state-of-art facility will be widely used by KU researchers and marketed for use by private sector partners. Professor Steve Soper, recently hired by KU, will make heavy use of the new clean room core with his research programs for cancer and other human diseases.

Enhancing University Research Through Innovations in Graduate Education

Sarah C. Larsen, Associate Dean, Graduate College, Professor, Department of Chemistry, University of Iowa

- Graduate education plays a key role in university research infrastructure at universities in the United States. Research experience is essential to the doctoral degree and is connected to the university research enterprise and faculty productivity, particularly in Science, Technology, Engineering and Mathematics (STEM). Graduate students are a critical component of the human capital supporting university research and innovation.
- However, graduate education is not immune to the challenges faced by all of higher education. Challenges in graduate education include financial support, diversity and inclusion, career training and transparency. Financial support is a critical factor contributing to degree completion. There remain concerns about completion, climate, and inclusiveness for underrepresented minorities. About one-half of doctoral graduates go onto to careers outside of academia, where their employers believe they have the research skills, yet are deficient in other skills necessary to succeed.
- Recommendations to meet the challenges are offered. Universities should engage in discussions with private donors, federal funding agencies, and industrial partners to provide financial resources of support for students. In addition to recruiting and admissions considerations related to diversity, there is a need for increased retention and completion efforts to support underrepresented minority graduate students. With decreased tenure track academic positions available for those earning doctoral degrees, there is a need for graduate colleges to provide students with early exposure to career pathways and enhanced professional development opportunities to better prepare students for academic and non-academic careers. Through these innovations in graduate education, the research mission of the university will be increased.

Infrastructure Planning and Implementation for Transformative and Incremental Research

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- Transformative research provides the most prestige to the researcher and the institution, but it is very unpredictable, and results are long term. All serious research institutions aspire to transformative research outcomes; the question is how institutions build the infrastructure for unpredictable, long-term research results, especially in view of academic traditions like promotion and tenure, hiring practices, and institutional productivity metrics.

- Predictability of infrastructure needs is an important element in the planning of infrastructure. Yet, research is a creative act. Because it is a creative activity, capturing the needs of doing something that has not been done before is problematic. Research takes many forms that vary according to disciplines. An important difference that cuts across all disciplines is transformative versus incremental research.
- Given the broad perspective on infrastructure, high-level infrastructure is likely to be in areas of special institutional strength. The University of Missouri has several major facilities and assets that support both incremental research and provide recruitment opportunities to attract those interested in transformative research in those areas. This paper presents five unique initiatives: a very strong nuclear reactor, a research center closely linked to the functions of the reactor, an interdisciplinary group that does research and clinical services, an institute that deals with research on the future of “journalism,” and a creative facility for independent senior living. Another initiative with a focus on issues of democracy, anchored primarily in the humanities and social sciences is discussed.
- The six initiatives at the University of Missouri have potential, five having moved far along the transformative research continuum. Most important is the broad range of contributions these highly successful initiatives have produced. Infrastructure has been the key element of success for each of the initiatives. Without significant infrastructure, these initiatives would not have come to where they are. These initiatives would not have achieved the necessary infrastructure without significant external resources, and in one case, institutional commitment to bring a transformative research program to the University.

Seed Funding Programs in a Comprehensive Liberal Arts and Sciences College

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- Seed funding is crucial to the success and growth of a college of liberal arts and sciences. This paper explores commonalities and differences in seed programs within and across universities, reviews a case study from the University of Maryland, and discusses key considerations in implementing a seed fund program.
- Based on a survey of ten college deans to address how seed funding is undertaken at similar institutions, we identified common features of seed-funding programs. Two common rationale for seed funding include building interdisciplinary bridges and supporting single investigators. The survey results show that seed funding had an impact on faculty morale. There was a greater focus on seed funding for the sciences, and some

deans suggested separate allocations to ensure support for the art and humanities. Survey results also indicate that there is not one common way to administer a seed fund program and the allocation of funds vary.

- The case study of the seed funding program at the college of behavioral and social sciences (BSOS) at the University of Maryland provides an analysis of a seed funding initiative. Though the initial BSOS seed funding investment had a positive influence on research funding and faculty morale, the program lacked structure and strategic direction. Carl Lejuez, the paper's first author and former associate dean for research at the University of Maryland, revamped the BSOS program to strengthen and clarify goals, categories and allocation, selection process, metrics, and reporting and evaluation. The overhaul of the program had a dramatic impact on the return on investment, in terms of research output, staff and students hired and receiving significant development experiences, and the overall prestige of the unit.
- When developed and conducted in a strategic manner, seed funding can be an essential part of the research mission of a comprehensive liberal arts and sciences college. In times of budget uncertainty, creative strategies may be necessary to raise funds to develop seed programs. In fundraising efforts, it is important to articulate how research builds the prestige of the institution and has an impact on the education mission for students. There can be value in integrating nontraditional seed funding approaches into more traditional seed programs.

Staying Strong and Healthy: Minimizing Cardiovascular and Metabolic Effects of Androgen Deprivation Therapy: A Study in Transition

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- This paper describes the NIH-funded randomized controlled trial of intervention to minimize cardiovascular and metabolic risk for Latino men on androgen deprivation therapy (ADT), used to treat prostate cancer. The method for the study included recruiting Latino men who initiated ADT within the past three months and randomizing the men into control and intervention groups. The procedure included taking baseline measures that were repeated at 6 and 12 months.
- Participants assigned to the intervention group received smartphones, as well individualized exercise and nutrition plans and goals. These men and their significant others received weekly calls from the study nurse and cultural liaison for three months that included an educational, activity and nutrition component. During the next three months, men received monthly calls from the cultural liaison to monitor, assist and

coach the nutrition and activity plans. There is no contact between six and 12-month data collection visits.

- Subsamples from each group were interviewed about their choices for food selections and exercise. Interviewers asked the men in the intervention group about their experience of the interventions. A constructivist grounded theory approach is being used for this portion of the study to explore differences in decision-making processes related to nutrition and activity between the two groups. Analysis will include both quantitative and qualitative techniques.
- At this point, the study is in transition between two major universities, which is a lengthy and complex process. In the transition, several issues needed to be identified including resources, technology, and recruitment of participants. Mechanisms for transfer of data collection procedure, documentation, tracking, storage and management had to be developed. Additionally, study equipment had to be moved to the new institution. Close and open communication amongst all parties, including NIH and the universities, has been important to a successful grant transition.

Attracting and Retaining Competitive Faculty – Startups, Core Facilities, and Investment Strategies...Oh My!

Peter K. Dorhout, Vice President for Research, Kansas State University

- A key factor in meeting Kansas State's goal of a Top 50 Public Research University by 2025 is the ability to grow the research enterprise through focused investments in core facilities and institutional support structures that will enable faculty to be competitive for extramural funding, particularly in interdisciplinary and inter-institutional grant programs. Startups, core facilities, and investment strategies for research are the keys to attracting and retaining competitive faculty. In an environment of diminishing state appropriations for higher education, it has become critical to develop strategies to fund startups that will support new hires or retain key members.
- Startups, core facilities, and investments...oh my. This was a recurrent chant for the Vice President of Research at Kansas State during his first six months on the job. He was reminded of a famous journey for a young girl in Kansas, and the challenges facing the film studios in the making of the movie, *The Wizard of Oz*.
- When leadership changes, as it did when the Director of *The Wizard of Oz* left, some questioned the "screenplay", which can be compared to the strategic plan at the university. The Strategic Plan for transforming any organization, like the screenplay for *Oz*, is only as good as the talent it guides and the leadership that embraces creativity and finds a path forward.

- Investments are unique to each institution, but they reach back to the screenplay and ultimate goal. For Kansas State, that goal is to be at Top 50. The research enterprise at K-State can be enhanced by embracing industry partnerships, which also aligns with the land-grant institution mission to bring knowledge to the public. With diminishing state resources, investing in core facilities and recruiting and retaining faculty is challenging. A change to a shared facilities model can be for the good.
- The journey of the making of *The Wizard of Oz* serves as a good metaphor for the coming-of-age for the research enterprise. The journey at Kanas State is one that is focused on improving our part of the world, changing for the better so students and faculty will prevail, because there really is no place like home.