

MSU Research Focus Areas

MSU is the state's leading research university, with research strengths across all colleges and research centers that have led to the institution being the only Mississippi university categorized as a Carnegie Very High Research University. As we plan for the future, the university must be strategic in the approach we take to future research investments. Based on existing strength areas and identified future opportunities, the following priority areas have been identified. These priorities will be used in directing future investments such as new faculty hires, infrastructure development, and resource allocation. They will not be to the exclusion of other important academic, research and service areas on our campus. Rather, they will be used as a factor in decision-making for future investments.

The intent in identifying these focus areas is to be inclusive. They are broadly defined intentionally, and each should be viewed across many colleges and disciplines, with both basic and applied research. We anticipate an interdisciplinary approach to these research areas that could, for example, include teams of faculty from science, engineering, and the humanities working together. They are intended to include research in its broad definition, to include all forms of scholarship and creative endeavors.

MSU will periodically re-evaluate these research focus areas, and will be open to support research areas that become targets of opportunity for MSU and perceived wise investments due to circumstances that cannot be predicted today. Periodic assessments will be made by university leadership when an opportunity arises to work in an emerging scientific area at the request of a sponsoring agency or a partnering organization, when faculty-led initiatives create new interdisciplinary areas of expertise, or when a national/international priority emerges in which unique expertise exists at MSU.

Environment and Energy

- **Energy and Sustainability:** This research focus area includes development of new energy sources, alternate forms of energy, feedstock development, advances in clean energy, innovation in energy acquisition (e.g., new fossil fuel extraction techniques), green technologies, demography, and the development of environmentally and economically sustainable energy sources, both regionally and nationally. Multiple factors influence the development and commercialization of energy technologies, including not only the science and engineering efforts, but also others such as education, history, geography, and public policy.
- **Water:** Mississippi has vast water resources which are fundamental to the state's economic development, agricultural productivity, and citizen's wellbeing. At the same time, Mississippi is facing unprecedented challenges from declining water tables, surface water

quality, and flooding. Research in this focus area includes conservation, development, management, and use of water resources to assist planning and regulatory bodies at the local, state, regional, and federal levels, water conservation and use planning and management, development of best management practices for water protection and conservation, development and demonstration of novel and innovative treatment technologies and approaches for small public drinking water systems, and safety of water resources.

- **Food and Fiber Production and Safety:** As a land-grant institution with a major agricultural mission set forth in the Morrill Acts of 1862, Mississippi State University research in the area of food and fiber production and safety is fundamental to our obligation to the citizens of Mississippi and the Nation. Similarly, food and fiber production has a direct impact on economic development activities within the State which leads to better quality of life for its citizens. Food and fiber security has enabled the U.S. to take a true global leadership role. Examples of research in this area might include biofuel feedstocks, sustainability and environmental stewardship, enhanced agricultural and forest productivity, agricultural history and policy development, food distribution systems, anti-terrorism strategies related to food safety, food-borne diseases, and the distribution of and access to food supplies.
- **Natural Resources and Environmental Sustainability:** The Nation's and Mississippi's forested, grassland, agricultural, and wetland ecosystems produce a myriad of environmental goods and services, including: forest products; biofuels; human and animal feeds; biological control; water filtration and storage; flood control; aquifer recharge; nutrient retention; carbon sequestration; pollination; and abundant, diverse wildlife populations. These services improve the human condition, enhance the sustainability of managed landscapes, and are valued in billions of dollars. Increasingly, natural systems face a myriad of stressors, including development, conversion, competing land uses, and changing climate. Within the context of these environmental challenges, interdisciplinary research focused on sustained harvest of renewable natural resources; conservation of ecosystems and the myriad services they provide; and mitigation and adaptation to change, enhance quality of life, stimulate economic activity and support essential ecological functions for the residents of Mississippi, the region, and the nation.

Health and Education

- **Health and Education Disparity:** Access to high quality health care and educational opportunities in a rural state such as Mississippi is lacking when compared to more populous areas. Mississippi has very high rates of obesity, heart disease, diabetes, infant mortality, teen pregnancy, illiteracy, birth defects, and other health and education problems. Mississippi State University is uniquely positioned to address these pressing issues, and has the opportunity to use the unique and unfortunate position of Mississippi to best address these issues. Research that results in better understanding of the root causes

for health and education disparity, mitigating strategies, quality of life improvements, curriculum development and delivery, and quality of life initiatives would be examples of research opportunities supporting this area. It also involves access to goods (including food), mental health, and services and education for minorities or disadvantaged populations whether ethnic, socioeconomic, cultural, disabilities, linguistic, race and gender.

Knowledge Management Systems

- **Data to Decisions:** Given the vast amounts of data available in today's world, there is a need to acquire, organize, interpret, and deliver information for decision makers in a timely and secure manner to improve the speed and quality of decisions. This is a research field pervasive throughout many aspects of the Federal, State, and local economies and is critical to national security. This can include nearly every area of science and engineering at the university. Research examples in this area includes computational biology, information analysis, human machine interaction, data sharing, cognitive science, correctness of data, socio-economic analysis, and modeling the decision process.
- **Homeland Security:** Safety and security of the Nation's citizenry has emerged as a national priority. This is most certainly an area that is inclusive of nearly every academic discipline at MSU and can involve interdisciplinary approaches to the vast problem set that is present in this focus area. Research topics include critical infrastructure protection and monitoring (e.g., water, power, emergency services, financial/economic, communications), remote and in situ sensor systems, public policy, communications and cyber security, transportation system monitoring, law enforcement support, first responder training, natural disaster response and recovery.
- **Public Policy:** This is a second area that is cross-cutting across all other focus areas for research. It encompasses a purposive and consistent course of action as a response to a perceived problem of a constituency (stakeholder-citizens/voters, political reps), created by a specific political process, and adopted, implemented, and enforced by a public agency. All colleges and centers at the university have strengths in policy assessment, analysis, and development.

International Development

- **International Development:** Universities must work like never before within a global context in a modern society. Research activities in this focus area reflect Mississippi State University's commitment to international partnerships and impact on a global scale. In the area of international development, one would generally expect that the outcome of the research activity would be targeted toward and most beneficial to communities or

stakeholders outside the national borders of the United States. This focus area will be cross-cutting across all of the other focus areas. Examples could include enhancement of quality of life for citizens in a specific region or country, improved public services, increased food production and security, increased national security, disease mitigation strategies, and technology development and adoption.

Mobility Systems and Materials

- **Mobility Systems:** This interdisciplinary area includes all research involving transportation systems (air, sea, and land based). Research topics within this area would include transportation planning, safety, and security, unmanned aircraft systems development and utilization, transportation policy, military transport systems, automotive, human factors research applied to mobility systems, ergonomics in transportation systems, robotics, and modeling/simulation of mobile systems. It also encompasses physical transportation of goods and people, and system optimization for improved transportation infrastructure.
- **Material Sciences and Engineering:** MSU has strong and broad-based expertise in understanding the relationship between the structure of materials at atomic or molecular scales and their macroscopic properties, nanoscience and nanotechnology, fundamental properties and characteristics of materials, bio-based design, metallurgy, forensic engineering and failure analysis, composite materials, and polymers.