INTRODUCTION

The University of Missouri-Kansas City is the leading urban campus within the greater University of Missouri System. As such, our university is counted on to meet the challenges and educational needs of Kansas City, the State of Missouri and the bi-state region.

Within UMKC reside programs that reach deeply into the community, engaging local and regional leaders in virtually every aspect of community life. As such, our community leaders view UMKC as a leading urban university, bearing a responsibility to provide value and guidance to our region.

In 2006, The Greater Kansas City Community Foundation made public a study entitled ‘Time to Get it Right: A Strategy for Higher Education in Kansas City’. Among the many issues addressed in the study, the following excerpts from their report highlight the importance of Science and Technology research and education.

“In a time when knowledge is the basis for wealth and when the foundation of freedom and opportunity is education, there is no more important question for any community than to define the higher education capacity it needs....”

“As the source of new products and services, innovation is responsible for the most dynamic sectors of the US economic growth.[and]..the driving force behind the 21st Century economy...”

“The skills of a region’s work force, the knowledge they produce and the innovation and entrepreneurial energy characterizing their activities provide the capacity to compete in the new world economy....”

“Creating and adequately supporting institutions capable of providing advanced education, research, and technological innovation of world class quality is the most important investment that Kansas City [and UMKC] can make to secure its future.”

The committee has used the above to guide its work and the recommendations forwarded here.
EXECUTIVE SUMMARY

The foundation for expanding a sound Science and Technology (S&T) program depends on three key components. In this report, the committee attempts to identify and explain these components and describe how a Science and Technology focus is vital to the University of Missouri – Kansas City.

Science, Technology, Engineering & Mathematics (STEM) Pipeline Development. Education at the pre-university, university and post-graduate levels must be thoroughly interwoven throughout the educational offerings to create the workforce of the future.

Research & Innovation. The economic engine of the University and the Kansas City region is contingent upon nurturing cutting edge research and innovation. Imaginative thinkers must be rewarded for creative ideas and techniques that are commercially viable.

Product Development. Ultimately, our community is enriched through commercial participation, access to skilled workers and an expanding tax base. Successful implementation of STEM within the culture and infrastructure of UMKC should generate marketable products that can provide revenue streams that feed the system and allow new cycles of education, exploration and development to emerge and sustain our enterprise.

As our Committee considered the value of Science and Technology to UMKC’s mission, it became evident that our current Mission Statement fails to clearly express and prominently highlight the centrality of Science and Technology. The Committee felt that by revising the UMKC Mission Statement, a stronger commitment to the strengths and needs of our community and our vision for the future could be more clearly articulated and achieved.

By harnessing the talents and creative energy of UMKC, the full potential of our region’s intellectual, financial and entrepreneurial contributions to society may be realized. Towards this end, we propose that the following changes to UMKC’s mission and vision statements, as highlighted in bold, be considered.

Mission

- Lead in Life and Health Sciences
- **Stimulate Innovation through Engineering, Science and Technology**
- Deepen and Expand Strength in the Visual and Performing Arts.
- Develop a Professional Workforce Through Collaboration in Urban Issues and Education.
- Create a Vibrant Learning and Campus Life Experience.

Vision
UMKC will become an innovative urban research university characterized by signature professional programs, a dynamic undergraduate population, a highly diverse faculty, staff, and student body, and active engagement with its city and region.

Congruent with a revision of the UMKC Mission Statement, the Committee felt the following priorities need to be emphasized:

1. Vigorously invest to fill the STEM Pipeline.
2. Leverage key areas of strength.
3. Invest in our human capital.
4. Build the S&T Infrastructure necessary to stimulate creativity and foster Innovation.
5. Enhance interdisciplinary collaborations and strong community partnerships.
7. Approach Workforce Development as a strategic opportunity.

The recommended revision in the UMKC Mission Statement will focus the organization and its constituents on the important opportunities and benefits outlined in this report in the next 3-5 years and, as we expand our outlook to 10 years and longer, beneficial outcomes will result that extend beyond our current capacity to visualize, articulate and achieve. Implementing our recommendation requires no additional funding, no additional space, no additional resources but by adopting the recommendation additional funding, space, and resources will surely follow.

This report provides the basis for these recommendations.
RECOMMENDATIONS & RATIONALE

STEM & Basic Science Pipeline Development

**Education:** There is a need for strong leadership and broad commitment to step into the community and lead the effort of vigorously investing to fill the science, technology, engineering, and mathematics (STEM) workforce pipeline in Kansas City. [In a timely coincidence, there is encouragement from the Governor’s Office. As part of the proposal to implement President Obama’s economic stimulus plan, Governor Jay Nixon outlined the Transform Missouri Initiative, “a program designed to develop Missouri’s human capital, enhance our transportation and information infrastructure, and spark scientific and technological growth in the state.”]

In light of these needs, one of UMKC’s strategic goals should be the development of the STEM pipeline, thereby laying the foundation for each of the Governor’s three main objectives. To develop the STEM workforce, UMKC must implement a comprehensive educational program in the STEM fields spanning all educational levels. Additionally, an active STEM workforce pipeline will support other Science and Technology goals by increasing innovation, leveraging UMKC’s geographic location in Kansas City, and fulfilling UMKC’s responsibility as an urban university.

Higher education is a major component of economic competitiveness in the knowledge-based global economy. The Organization for Economic Cooperation and Development, in an international review of converging lines of research, found that students with postsecondary education had much higher rates of employment, earnings, job satisfaction, training and skills. The OECD report also recognized the growing dependence of the world economy on workers in STEM fields, and the need to move students from the secondary to the postsecondary level to increase this workforce.

Another obstacle in the STEM fields, and an enduring crisis in U.S. education, is the underrepresentation of minority and women students. Although there were some successful efforts in the late 1960’s and early 1970’s to educate and train underrepresented students, the number of these students graduating with STEM degrees is still low. Validation for attracting more women and people of color to the engineering programs can be found in the *The Time To Get It Right Report*:

“The second deficit that might limit Kansas City’s ability to compete in the global information economy was “Kansas City’s dismal history of educational failure for its African-American and Latino populations, the fastest-growing segments of the city’s population.”

Another stumbling block is the fact that not all students who enter the college STEM pipeline will make it through. This coming and going is both expected and accepted. However, the numbers of students leaving the STEM fields remains disproportionate by race/ethnicity and gender. It is assumed then that these students are unprepared for university studies and that their previous schools are to blame for this deficiency in readiness. Therefore, a common response is to remediate minority students – particularly in basic mathematics, an absolute necessity for even the most introductory STEM courses.
One problem with these remedial programs is that they increase the financial burden on students. Financial support is a primary factor for minority students in university attendance. Without it, underrepresented student participation quickly drops. Full or partial scholarships for these students are still limited, suggesting that universities and corporations remain hesitant to invest financial resources in minority participation in the STEM fields. This is where UMKC can make a difference.

Partnerships with urban schools can address students' lack of preparation. UMKC can provide expert support for urban teachers in the STEM areas through professional and curricular development. This should help with the shortage of urban teachers certified in STEM areas, and slow the tide of high teacher turnover.

Urban students do not consider STEM career options. Yet 65% of high school students who completed the introductory engineering course through Southern Methodist University's Infinity Project said they wanted to be engineers. Urban students can benefit from university programs that introduce them to the STEM fields.

Four national surveys revealed that poor and minority children have less access to computers at school and home. UMKC can collaborate by helping write grants for technology support to the urban schools.

Educating Kansas City students in science can address problems relevant to the community, creating meaningful learning experiences for the students while increasing community involvement by both parents and students. A recent story in the Kansas City Star described a new after-school environmental program at DeLaSalle Education Center, sponsored by Green Works, that has urban teens recycling, keeping the streets and sidewalks clean and volunteering at a state conservation center.

If students discover the power of science to improve conditions where they live, they may become more interested in continuing their education. And as Governor Jay Nixon pointed out at his press conference, if the way to move the economy forward is through science and technology, we must interest our people in scientific matters.

(References are available at the end of the document.)

### Research & Innovation

**Infrastructure:** Given the importance of Science and Technology to almost every aspect of modern life, a first-rate university must have a first-rate S&T program. Support of such a program requires the proper infrastructure, made up of three main components.

- **Facilities:** Existing buildings and their contents need maintenance and upgrades, and new buildings with classroom and laboratory space will be necessary to meet increased enrollment and research demands. An immediate need is a Health Sciences Research building on the Hospital Hill campus.
Action: A committee should be established to survey existing laboratory space, equipment and use, and to identify future needs. Funding for improvements would be led by the newly created office of Vice Chancellor for Research and Development.

Outcome: There would be increased research output, more facile attraction of new researchers and increased success in grant acquisition. Also, improved facilities would encourage partnerships with industry, including STTR grant efforts.

Equipment: The availability and condition of equipment is spotty. Faculty members operate largely on their own when preparing proposals for equipment funds from sources such as the National Science Foundation. Administrative help and oversight of grant writing, sharing equipment and foundation and business contacts would help the process.

Action: Establish support for grant writing An effective grant writing support office at UMKC would enhance the funding success rate of submitted applications. The office would require the participation of senior faculty as mentors and pre-submission reviewers.

Outcome: This office should increase the number of grant applications submitted as well as the success rate for funding.

Organization: The research office and its ancillary operations need a major reorganization. Problems include the lack of a central shared resource laboratory operation; responsibility for centers with marginal research activity; and fragmented compliance operations.

Action: Reorganize the Office of Research to accommodate the dramatic increase in the volume and variety of UMKC’s research activity. Certain operations currently under the OR would function more effectively if placed under a different office. The following are examples of centers with limited research:

- Addiction Technology Transfer Center – National Office
- Mid-America Addiction Technology Transfer Center
- Mid-America Trade Adjustment Assistance Center
- Missouri Enterprise

Other operations could be moved into the OR because of their research focus:

- Institutional Biosafety Committee
- Radiation Safety

Outcome: Efficiency of research support would lead to improved productivity.

Action: Improve Intellectual Property and Tech Transfer Support. Additional support is needed for the initial stage of the IP disclosure process; and proper management of disclosures will require the UM System to implement planned improved procedures. Effective Marketing support at the System level also is needed.

Outcome: Communication and cooperation between the IP section and the economic development offices at UMKC, such as the UMKC Innovation Center managed by Maria Meyers and Carmen DeHart, will speed Tech Transfer and increase investigator participation. Increased support and better treatment for the investigator during the IP and Tech Transfer processes will increase disclosures, the number of patents and consequent revenues.
UMKC & KC as Partners in Science, Engineering & Technology

As the major research university in Kansas City, UMKC needs to establish itself as a valued source for workers in the science, engineering and technology fields. We must also promote our technical expertise, research capabilities, aptitude for product development & commercialization and our k-20 education readiness.

UMKC has the only full-time school of engineering in Kansas City. Fittingly, through its collaboration with the other science, technology, and entrepreneurial UMKC schools and departments, UMKC’s School of Computing and Engineering has the opportunity to become the first choice as a source of scientists, engineers, technologists, entrepreneurs, and business personnel for the Kansas City business community.

UMKC can enhance its stature by producing well-prepared STEM professionals, by increasing and marketing its research, and by stimulating its technology transfer and commercialization of research. The potential for increasing research, technology transfer and commercialization is best achieved by true interdisciplinary collaboration. Specifically, the committee identified the following areas of opportunity:

A. Leveraging Key Strengths

Life Sciences and Health Care. UMKC already has tremendous strength in the life sciences through the Schools of Medicine, Dentistry, Nursing, Pharmacy, and Biological Sciences and their relationships with area hospitals and research institutes. These strengths can be greatly enhanced through the inclusion of the School of Computing and Engineering, the Educational Development Center, and the departments of Physics, Chemistry, Geosciences and Urban Planning.

Science, engineering and technology are closely related to and supportive of the life science mission of UMKC. Collaborative STEM curricula, research, and product development will provide outcomes greater than the sum of its parts, and will bring distinction to these units and UMKC. Bioinformatics, biomaterials, nanotechnology, robotics, sensors, nuclear medicine, nuclear chemistry/physics, imaging modalities, biomechanics, personalized health care and drug delivery systems are just a few research fields explored through the collaborative efforts of scientists, medical professionals, engineers and technologists.

NEEDS:
1. UMKC STEM and Life Sciences Research Czar
2. Means for collaborative use of equipment. (inventory, location, usage) on UMKC campus
3. Means for pairing STEM and life science researchers on campuses
4. Tech Transfer and commercialization education for researchers

B. Urban Education

UMKC also has strength in its Institute for Urban Education (IUE) and Kansas City has strength in its Project Lead the Way Chapter (PLTW), a program offering high school engineering courses. UMKC and its science, engineering and technology
faculty and researchers need to work with these groups to provide STEM outreach opportunities for students and their teachers in Kansas City’s urban core.

UMKC has an opportunity to impact diversity in the STEM fields by creating pipelines for these same students to then pass from the k-12 schools to the community college system or technical schools and ultimately to UMKC or a local liberal arts college. By increasing diversity in our STEM departments and matriculating these students, UMKC could be recognized as a source for diversity in the STEM arena, professional workforce and graduate education. Funding agencies can help make this a reality if UMKC makes a genuine commitment to increase diversity in STEM.

**NEEDS:**
1. Coordinated outreach – inventory, location and purpose (possibly a Czar)
2. Scholarship support for minorities (identify in hs –guarantee financial assistance for CC though BS)
3. Work with PLTW for college credit in hs
4. Work with CC for dual enrollment in CC and UMKC
5. Work with local liberal arts colleges … dual degree programs

**C. Entrepreneurship**

UMKC has promising business strength through its Institute for Entrepreneurship and Innovation (IEI), its Innovation Center and its relationships with the Kauffman Foundation. The UMKC science, engineering, medical and technology faculty and researchers need more entrepreneurial guidance and encouragement.

The campuses have tremendous amounts of significant and sustainable research being performed, yet few STEM researchers are trained to turn their discoveries into products. Collaboration between the STEM and business professionals will benefit the researchers, the business community and ultimately UMKC. The university can leverage this type of relationship with start-up companies, marketing for development purposes and recruitment of top-quality faculty and graduate students.

**NEEDS:**
1. Educate students, administrators and faculty about IP, tech transfer and commercialization
2. Encourage commercialization – develop an office of tech transfer
3. Increase collaboration with IEI in curriculum, research, and commercialization

**D. Kansas City Engineering Community**

UMKC has an obligation to the Kansas City community to provide a STEM educated workforce. As the 4th largest engineering community and a community based in life sciences, it is imperative that UMKC produce valuable scientists, engineers, technologists, managers, educators and entrepreneurs sought by the Kansas City engineering and life sciences community.

To this end, UMKC needs to commit to k-20 STEM education. The k-20 educational effort can be seen as a pipeline with k-12 as the input and a wide variety of outputs. The outputs could be 1) a high school graduate that is STEM savvy, 2) a technologist
with an Associate’s Degree, capable of working in a STEM field, 3) a scientist or engineer, 4) an advanced scientist, engineer or researcher with a masters degree, 5) a research scientist or engineer who has completed a doctoral program, or 6) a professional lawyer, entrepreneur or musician who understands and can apply STEM principles.

In order to affect the K-12 STEM education, the science, engineering and technology based schools and departments must team with the School of Education and IUE in outreach and educational efforts. Kansas City has one of the strongest PLTW groups in the nation, and the School of Computing and Engineering partners with them for federal funding.

At the college level, UMKC has available the KC engineering and life science community for internships, co-ops, and part-time employment for our students; equipment grants, development opportunities, endowed scholarships, curricular guidance and adjunct faculty for the university and schools; and undergraduate, continuing education, and advanced degree programs for their employees.

NEEDS:
1. KC needs to recognize and invest in UMKC as the city’s university
2. UMKC needs to provide STEM education that serves KC businesses
3. UMKC needs to provide help in urban STEM education
4. UMKC needs to encourage urban youth to enter STEM fields
5. UMKC STEM researchers need to collaborate with IUE for UMKC based funded STEM outreach, education and training

E. Kansas City Life Sciences Community

UMKC has an additional strength in the Kansas City Life Sciences Community through the UMKC Medical Campus, KU Medical Campus, MU Medical Campus and the Kansas City Area Life Sciences Institute (KCALSI). The UMKC science, engineering and technology faculty and researchers need to connect with these groups and find commonality in research interests.

Additionally, UMKC needs to develop an office that can address IP, royalties, commercialization and collaborative exchanges of faculty, graduate students, equipment and curricula. KCALSI is the hub for this type of activity, but the UMKC science, engineering and technology professionals should be more involved. A central repository of information on equipment, technical support, research expertise, research funding and collaboration among life science, science, engineering and technology researchers in the region is needed.

NEEDS:
1. The region needs a centralized database of equipment, researchers, experts, and facilities for STEM and life science researchers and professionals.
2. The region needs to find more ways to foster collaborative efforts between institutions, hospitals, researchers, etc.
3. The region needs to find ways to promote the successes of these researchers
Product Development

Workforce Development as a Strategic Opportunity: Many experts view the aptitude of the United States to maintain its standard of living on its ability to claim its share of the global marketplace, thus generating economic growth. Scientific and technological advances are important for this growth because they contribute to the creation of new goods, services, jobs, capital and increased productivity.

Recently, both the Federal and State Governments have recognized the strategic importance of a competent S&T workforce and have begun incentive programs similar to those that worked so well in the race to put a man on the moon. Portions of the introduction to this report, taken from "Time to Get it Right," clearly identify innovative technological products and services as the basis for the KC region to compete in the twenty-first century.

Moore’s law says that the half life of new technologies is often less than 18 months. Kansas City is in a unique position to succeed within that narrow margin of opportunity, occupying an enviable place in the engineering community with the 4th largest concentration of US consulting engineering firms and the largest number of engineers per capita. Moreover, its telecommunications, transportation, software, bio-med and financial services industries demand a workforce proficient in science and technology.

Currently, however, our S & T workforce is approaching retirement age. These demographic, economic, and competitive realities – along with the clearly-defined mission of UMKC to be the UM System’s Urban University – provide the basis for S & T to be prominently incorporated into our Mission Statement, thereby empowering all constituencies to renewed action.

To meet the workforce needs, UMKC must take the following steps:

1. Promote the School of Computing and Engineering as the premier engineering school in Kansas City
2. Attract and prepare more women and minorities into our S&T workforce
3. Facilitate the placement of new S&T grads into the KC workforce
4. Offer continuing education to keep our degreed workers competitive.
5. Make it easier for S&T workers to enroll in interdisciplinary graduate programs; and assist workers with non-technical undergrad degrees who want to pursue advanced degrees in S&T disciplines.
6. Help S&T undergrads gain acceptance to MBA, Law, Medicine and other professional programs in order to provide the critical S&T foundation needed in these professions.

We must establish relationships with corporate and institutional partners possessing laboratory and research facilities where our students can gain experience. Next, we must help students get career-focused employment, such as internships, while in school; this is especially important for our students who are not traditionally well-represented in the S&T workforce.
Finally, UMKC must take advantage of the acknowledged importance of an S&T proficient workforce to drive philanthropy to UMKC; to leverage government-sponsored scholarships, fellowships and loan forgiveness programs; and to access to sponsored research from government and industry. In that way, UMKC will be positioned to educate technologically proficient workers who can compete in the rapidly changing world of scientific advances.

**Technology Transfer and Economic Development**: Crucial to the achievement of the UMKC mission will be the capacity to transfer and commercialize our ongoing research and development activities into marketable products and services. Accomplishing this goal will require a different mindset from the faculty, administration, and students. Furthermore, major organizational changes will be necessary to handle the logistics of this effort.

Thus, Technology Transfer and Economic Development must be included in any discussion of long term growth and technology forecasts. It is clear that a robust technology transfer organization is essential to the successful achievement of the UMKC mission. Appropriate UMKC offices will need to be to become actively engaged in the following:

- Developing funding sources such as grants, corporate investment, and royalties, for the ongoing support of research and development
- Developing patentable research and development projects
- Teaching expertise in negotiating technology licensing agreements
- Participating in product realization and marketing

UMKC must recognize the critical nature of this effort, as it is an ideal opportunity for generating sufficient revenue to sustain operations. In addition, it is critical for the University to develop a reward structure for faculty researchers whose discoveries are commercially successful, whether through revenue sharing or equity distribution.

Even something as low key as a monthly presentation by a faculty member who has received a grant or published in a respected journal would allow interaction. A monetary award could commemorate the occasion, and teleconferencing could allow for wider participation. Reinstituting the Research Day would draw a large number of persons from a range of disciplines, and area science, engineering and technology firms could be invited. A following reception would encourage collaboration.

Over time, the majority of innovative ideas flowing through the TECHNOLOGY pipeline will be homegrown – generated by UMKC faculty, students, staff and the Kansas City community. Revenue retained by the University may be used to support both additional research and special student awards, thus fueling a cycle of marketable innovation and creativity.

Economic Development can be defined as those efforts that create or retain jobs, thereby supporting and increasing incomes and the tax base. Economic Development from technology transfer can have a notable affect in the Kansas City region, powerfully influencing the economic, political, and social well being of its people.
CONCLUSION

As a result of our work the committee makes one simple recommendation which the Strategic Planning Committee is fully empowered to adopt. Implementing our recommendation requires no additional funding, no additional space, no additional resources but by adopting the recommendation additional funding, space, and resources will surely follow.

The recommended revision to the UMKC Mission Statement will focus the organization and its constituents on the important opportunities and benefits outlined in this report in the next 3-5 years and, as we expand our outlook to 10 years and longer, beneficial outcomes will result that extend beyond our current capacity to visualize, articulate and achieve.

Recommended UMKC Mission

- Lead in Life and Health Sciences
- **Stimulate Innovation through Engineering, Science and Technology**
- Deepen and Expand Strength in the Visual and Performing Arts.
- Develop a Professional Workforce Through Collaboration in Urban Issues and Education.
- Create a Vibrant Learning and Campus Life Experience.

Respectfully Submitted By:
UMKC Science & Technology Strategic Planning Sub-Committee

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REFERENCES


In this dataset, we have included a variety of references covering different aspects of educational research. These range from studies on the success of minority students in science and technology, to initiatives aimed at increasing awareness about engineering careers. The references are organized to reflect the diversity of topics, from policy implementation and teacher education, to specific discipline-focused outcomes. Each reference is cited in APA style, ensuring clarity and consistency in the documentation of sources.