

GRADUATE EDUCATION AND RESEARCH IN THE YEAR 2000:

FASHIONING HORIZONTAL FLEXIBILITY IN A VERTICAL WORLD

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Public research universities face many of the same challenges today that American businesses faced in the 1970's and 1980's—adapt and change or sink beneath the weight of outmoded, inflexible bureaucracies and practices. The private sector was remarkably successful in accomplishing its transformation; one need only view the unprecedented U.S. economic prosperity of the 1990's for confirmation. Time will tell whether those employed in the tradition-clad Ivory Tower can be so insightful.

It is crucial that universities focus their limited resources on enhancing areas of strength and emerging importance, not shoring up areas of weakness or, even worse, distributing insufficient resources equally across the academic spectrum. Equal suffering helps no one—not even the equivocating bureaucrat/administrator in the long run—yet this tends to be the norm in many university settings.

How did American businesses accomplish their remarkable metamorphosis? For one thing, companies were forced to do a comprehensive operational assessment, then change their way of doing business ... not an easy task. Some of the most common changes are shown in the adjacent insert compiled by Kansas State University Professor

CHANGES IN TODAY'S ORGANIZATIONS:

- **Less Hierarchy/More Flexible Structures**
- **Focus on the Customer (Quality)**
- **Teams, Teams, Teams**
- **Seeking Competitive Advantage**
- **"Value-added" Philosophy**

Brian P. Niehoff, Business Management, KSU:
From the Provost's Lecture Series for 1998-99.

Brian Niehoff. It's interesting to speculate on how these might be applied to research universities. Would they work institution-wide? Can they be used in innovative ways in graduate education and research?

Less Hierarchy/More Flexible Structures

Clearly, the most difficult parameter to implement is the first: less internal university hierarchy/more flexible structures. Universities, with their disciplinary boundaries, are inflexible by design, and their hierarchical structure is unwieldy more often than not.

At last year's Merrill Conference, Professor Richard Schowen argued that "measures that depress the roles of territorial feeling and territorial reasoning (while preserving the benefits we derive from our much-loved disciplines) should advance the cause of institutional flexibility in meeting research challenges."¹ Identifying those measures would, of course, be beneficial, but universities have a long way to go before achieving horizontal flexibility in their historically vertical world.

One common approach to overcoming campus territoriality involves the formation of centers and institutes and interdisciplinary research and graduate education programs. Unfortunately, cumbersome upper university bureaucracies create impediments for such endeavors far too often. And these interdepartmental structures may still be too rigid for timely responses to emerging opportunities in today's explosive information age. New horizontal models or, at the very least, substantially greater flexibility are needed.

Focus on the Customer (Quality)

Most universities would contend that they already focus on the customer—their students—and that they deliver a quality product—a first-class education—to those customers. Many do; that's clear. But, that really isn't the private-sector lesson with regard to focusing on the customer. The lesson is to *listen* to the customer and understand the customer's needs. In that regard, many universities don't measure up. There are still too many remnants of the elitist, "intellectuals know best," attitude lurking about.

For universities, their customers are not only the students they serve, but also the employers who ultimately hire those students. Employers in the private sector, especially, complain that today's college graduates lack many of the skills necessary for success in the workplace: communication skills, real-world problem-solving skills, the ability to work in teams, etc. To answer these criticisms, universities need to open meaningful dialogs with their customers (students *and* employers), then provide quality services that respond to their customers' needs.

There's a reason for the growing competition in the advanced education market: traditional universities aren't listening to their customers . . . others are.²

Teams, Teams, Teams

Many research universities do an outstanding job of teaching independent problem solving to their students. Then the students graduate, go out into the real world, and discover that problem solving occurs in teams. Most graduates aren't prepared to work that way.

Academic teamwork, when it exists, too often involves solving a problem in some narrow discipline. Some classes do employ group exercises, but how broad are the issues they address? Most often, not very. Even in academic programs defined as "interdisciplinary," few students actually work as part of a team, solving their part of a larger, complex problem. Some "real-world" models are crucial here.

A broader, systems engineering-style approach is needed. Ideally, this might include natural scientists working with social scientists, working with engineers, working with business analysts, and so forth. Disciplinary constraints of problem solving would be removed, and everyone would benefit from the breadth of the experience, especially if some private sector expertise were thrown into the mix.

One highly innovative graduate program with this sort of blend was launched in 1993 in Maryland. The "From Lab to Market" project at the University of Baltimore, in partnership with the state's economic development agency, brings together teams of master's degree students from business, law, publication design, and engineering to formulate fully developed commercialization strategies for technologies from federal laboratories. Teamwork is an absolute requirement, but too few such examples exist.

Seeking Competitive Advantage

The comprehensiveness of academic programs is an important component of the competitive landscape in higher education, but the meaning of that descriptor is changing. The vast majority of American research universities, public and private, have now recognized that being "comprehensive" doesn't have to mean being all things to all people. Few institutions can afford such exorbitance in this day and age. Consequently, most universities have developed strategic plans to focus their efforts on areas in which they excel or hope to excel.

Typically, these strategic plans include an assessment of institutional strengths and weaknesses in an effort to identify areas of competitive advantage. However, all too often universities become married to the plan itself, forgetting Dwight D. Eisenhower's advice: "Plans are worthless, but planning is everything."³ The institutions that will win-out in the information age are those that combine institutional strengths and vision with *ongoing* strategic planning. Fixed plans won't work in a rapidly changing environment.

Building strategic alliances offers another valuable approach. Universities in America's heartland have faculty on par with the top-rated research institutions in the country, but often, the number of faculty in any particular sub-discipline are few in number. As a result, partnering with other public sector and private sector entities provides an invaluable means for leveraging resources and creating a competitive advantage.

"Value-Added" Philosophy

If the first item on Professor Niehoff's list is the most difficult for public research universities to implement, the last is unquestionably the easiest. "Value-added" is what higher education is all about. That philosophy is integral to the tripartite mission. Teaching adds value. Research adds value. Service adds value.

Higher education institutions don't necessarily market their wares as value adding, but that's certainly the outcome. If you check the Census Bureau data for average annual earnings based on level of education, you will see that income goes up at every step; value is added. Similar conclusions can be drawn from the economic impact of university research and service.

Of course, "value-added" can mean different things to those delivering a product or service and those receiving a product or service. However, for those institutions focused on their customers (i.e., those listening and responding), value-added should resonate as a "win-win" outcome for both parties.

Graduate Education and Research at Kansas State University

A number of new graduate education and research initiatives have been launched at Kansas State University, many of which should allow us to take advantage of the lessons learned from the private sector. Most of these endeavors are still in their formative stages, so data are lacking as to their long-term impact. Still, we are hopeful that at least some will yield the anticipated positive outcomes.

Graduate Certificate Programs: Policies and procedures have been developed which are intended to allow the proliferation of graduate certificate programs, a core cluster of courses in some specialty area. These programs have the potential to expand our capabilities in graduate education in a variety of ways. For example, more than 50 percent of the science and engineering doctoral degree recipients nationally take jobs in the private sector.⁴ A graduate certificate in business could prove to be invaluable for these individuals. Many students should be able to pursue such certificates concurrently with their regular graduate program; others may find them useful for professional development after entering the job market.

For students pursuing graduate study on a part-time basis (a common occurrence in a hot economy for some disciplines), it will be easier to earn a post baccalaureate credential—a graduate certificate. If the certificate is part of the core curriculum for a master’s or doctoral program, this may then serve as an incentive for certificate recipients to undertake full-time graduate study at some later time (e.g., when the economy cools).

Examples of some existing, developing and potential graduate certificate programs at K-State are shown at the right. These and other graduate certificates are expected to serve a variety of innovative purposes. Many of them are easily adaptable to multimedia and distance delivery, thereby expanding the customer pool. Others will build more horizontal flexibility into the graduate curriculum.

GRADUATE CERTIFICATE PROGRAMS	
<u>Existing/Developing:</u> Air Quality Business Administration Complex Fluid Flows International Service Material Science Occupational Health Science Communication	<u>Additional Examples:</u> Agribusiness Bioengineering Bioinformatics Crisis Communication Food Safety Genomics Graphic Design

A recent article about graduate certificate programs can be found in *CHANGE* magazine,⁵ and it is clear that many of the private-sector lessons discussed above are applicable to such programs, i.e., they can enhance flexibility, address customer needs, provide competitive advantages, and add significant value. Moreover, it may also be possible to use them in creative ways to provide experience working in teams.

Graduate Student Recruitment: Competition for graduate students is fierce in many disciplines, especially in the face of declining graduate school enrollments nationally.⁶ While the individual graduate programs usually

accomplish graduate student recruitment most effectively, there may be institutional attributes that can provide competitive advantages as well.

At K-State, the graduate school has launched a broad-based *Military Graduate Student Recruitment Program* to capitalize upon the military-friendly, veteran-friendly atmosphere that prevails on campus. Many college campuses are unfriendly toward the military and military veterans, an attitude that has prevailed from the campus-based antiwar movement of the 1960's and 1970's.⁷ Few, if any, remnants of those prejudices are apparent at K-State.

The *Military Graduate Student Recruitment Program* has four main focus areas: (1) ROTC students, (2) active duty military personnel, (3) members of the National Guard and reserves, and (4) transitioning personnel (those soon to attain veteran status).

A deferred entry option is being developed which will allow qualified ROTC students applying to graduate school to be admitted, but with delayed entry into their specified graduate program. This should be of value to individuals making a career of the military, as well as the majority who get out after one tour of duty.

Career military officers are required to pursue post baccalaureate education to be promoted, so efforts are underway to recruit significant numbers of these individuals to graduate school at K-State. Additionally, national security experts are concerned that terrorists could introduce biological or chemical agents into the food chain or water supplies in this country,⁸ and National Guard and reserve components will be among the first responders to such an emergency. K-State is well positioned to provide advanced education in food safety, environmental remediation, and a host of related areas.

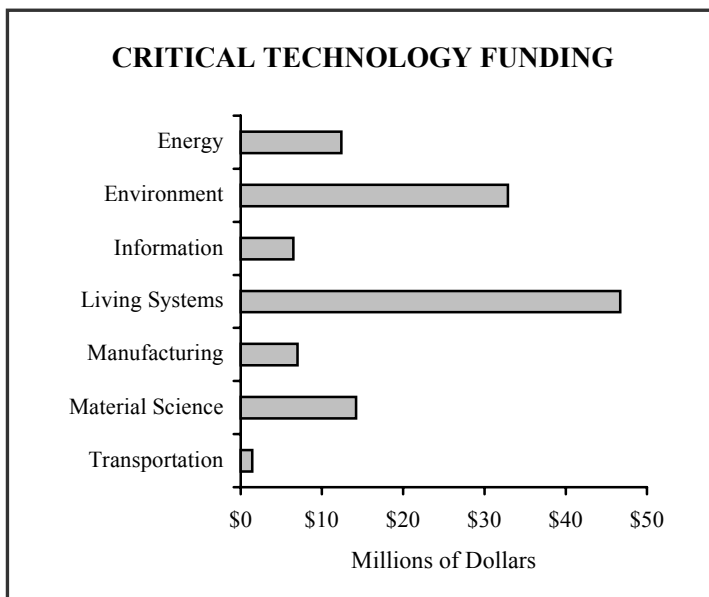
Also, for those leaving the military, graduate school is not normally among the transition assistance options from which they select. This provides an opportunity for K-State to establish a national pilot program working with the appropriate federal and state agencies providing the assistance. These efforts are underway.

Strategic Technologies: The Kansas Technology Enterprise Corporation (KTEC) recently asked the research universities in the state to identify their strategic research thrusts for the future. As part of that effort at Kansas State University, an assessment was undertaken of our core research competencies, an assessment we chose to link to the nationally designated critical technologies.

The federal government defined seven broad national critical technology areas several years ago: energy, environmental quality, information and communication, living systems, manufacturing, material science, and transportation.⁹ A summary of extramural funding in those areas at K-State in recent years yielded the results shown in the figure below.

As can be seen, living systems and environmental quality far outdistanced the other areas. Furthermore, the federal critical technology subcategories of biotechnology and agriculture/food under living systems and environmental remediation under environmental quality made up the vast majority of the funding. These three subcategories can all be considered components of agricultural biotechnology, and this is an area where K-State should be able to leverage a competitive advantage.

The concerns of national security experts over agricultural and environmental terrorism (mentioned above under *Graduate Student Recruitment*) present an opportunity for biotechnology research to address the emerging threat. Various programs—most inter-disciplinary in nature—are being formulated to meet future needs in this area.



Of course, even with a focus on agricultural biotechnology, we do not plan to forgo research opportunities that might arise in other areas. K-State leads a 10-state, 14-university hazardous substance research consortium for the Environmental Protection Agency. Research in this area will continue as a priority. An engineering research center proposal is also being

developed which links K-State expertise in energy research with that in another U.S. critical technology, material science.

And the KTEC Center of Excellence at K-State, the Advanced Manufacturing Institute (AMI) with its innovative Manufacturing Learning Center, provides an integrated model linking teaching, research, and service.

AMI is gaining ever-increasing support and recognition from federal and non-federal sponsors, and manufacturing remains one of K-State's primary strategic technologies, serving a major sector of the Kansas economy.

Technology Transfer/Entrepreneurship: Commercialization of university intellectual property is a significant activity at many public and private research universities. In some instances, it has been linked directly to the institution's mission.

At Kansas State University, we have allied research and graduate education directly to the institution's technology transfer activities carried out by the KSU Research Foundation (KSURF). Moreover, KSURF has established formal linkages with the Mid-America Commercialization Corporation (MACC), which is charged with facilitating technology-based economic development. MACC, based in Manhattan, is one of three commercialization corporations in the KTEC network.

The horizontal organizational structure has removed hierarchical impediments in the transfer of technology from university research laboratories to the private sector; it employs a team-oriented approach. Naturally, each element has a primary role to play: the research office at K-State handles, quite obviously, faculty research matters; KSURF manages the disclosure and protection of university intellectual property; MACC facilitates commercialization activities, whether licensing to external entities or launching local start-up initiatives. However, decisions and meetings with faculty and other stakeholders may well involve personnel from all three units, plus others.

Entrepreneurial initiatives based on university intellectual property provide a compelling economic development opportunity, and possibilities for external licensing tend to be more limited in remote, non-urban areas like Manhattan, Kansas. Therefore, at K-State, we consider local start-ups to be a preferred mode for technology transfer in many instances. Of course, finding sufficient resources to start them is another matter.

The federal Small Business Innovation Research (SBIR) awards and other business-oriented grant programs provide a means for launching new start-ups, and we have established procedures to allow university faculty to participate in these programs. That being said, no two ventures are ever the same, so few generalities can be made—another indicator of the importance of less hierarchy/more flexible structures.

One key element though is MACC's ability to provide the initial financial, management and business expertise for a new start-up. More

technology-based companies fail because of shortcomings on the business side of the operation than on the technology side. MACC can provide assistance until the company has matured to the point of hiring its own management team. Moreover, KSURF may be able to bear the initial costs of patent protection for the technology, saving another potential drain on a new company's limited assets.

While our efforts in entrepreneurship are relatively recent, we are hopeful that significant successes will be forthcoming. Indications to date are very favorable. Nantek, our first true start-up, has received multiple phase I and phase II SBIR grants, as well as other awards. Nantek already employs a number of KSU graduates. Kansas Advanced Technologies, our newest start-up, has recently received award notices for two phase I SBIR grants. Progress is being made.

We also see additional opportunities to involve K-State graduate and undergraduate students in these initiatives, although student interns are employed to some extent already. Nevertheless, it would be helpful to have technology transfer and entrepreneurship as larger components of the curriculum for students, especially in the sciences and engineering. Various means are being examined to make this happen.

Cashing-in or Crashing in Y2K?

Higher education is at a crossroads in America, but internal pressures to maintain the status quo can be monumental. Those universities that recognize the similarities to the state of U.S. businesses in the 1970's and 1980's and apply the lessons those businesses learned are more likely to prosper or "cash-in" in the next millennium. Those that don't may be facing a significant Y2K problem.

Universities must streamline their operations and create more flexible, horizontal elements in their tradition-bound vertical mold. This will lay the foundation for truly interdisciplinary teamwork and partnering to solve the complex issues and problems of the coming century. Universities that do these things while listening to their customers—all their customers—will automatically have a competitive advantage. What's more, they will likely be adding additional value at all levels in teaching, research, and service.

At Kansas State University, we are attempting to adapt some of the private sector organizational changes to graduate education, research, and technology transfer. Time will tell how successful these efforts will be.

Notes

¹ Richard L. Schowen. "The End of Interdisciplinary Research." In Proceedings of the Merrill Advanced Studies Center conference *Mobilizing for Research Opportunities in the Next Century*, vol. 102, pp. 51-60, Lawrence, Kansas: University of Kansas, July 1998.

² Jeffrey Selingo. "Businesses Say They Turn to For-Profit Schools Because of Public Colleges' Inertia." *The Chronicle of Higher Education: Today's News*, 14 July 1999.

³ Dwight D. Eisenhower. Statement made in a speech at the National Defense Executive Reserve Conference, 14 November 1957.

⁴ Committee on Science, Engineering, and Public Policy, National Academy of Science, National Academy of Engineering, and Institute of Medicine. *Reshaping the Graduate Education of Scientists and Engineers*, National Academy Press, Washington, D.C., 1995.

⁵ Alice J. Irby. "Postbaccalaureate Certificates." *Change*, pp. 36-41, March/April 1999. Also, note the editorial in the same issue by Ted Marchese entitled, "The Certificates Phenomenon," p. 4. In it, Mr. Marchese states: "Unlike so many developments we feature in *Change*, the certificates phenomenon seems almost entirely good news."

⁶ Peter D. Syverson. "Data Sources: Early Returns of 1997 CGS/GRE Survey Reveal Second Year of Graduate Enrollment Decreases." *Council of Graduate Schools Communicator*, 31 (10): 7, November/December 1998.

⁷ Jay Mathews. "No Glory, No Parades, No Jobs?" *The Washington Post*, 29 April 1995. Or, for a review, see: R.W. Trewyn and James A. Stever. "Academe: Not so Hallowed Halls for Veterans." *Journal of the Vietnam Veterans Institute* 4 (1): 63-75, 1995.

⁸ "U.S. Could Face New Terror Tactic: Agricultural Warfare." *The Philadelphia Inquirer*, 22 June 1999.

⁹ National Critical Technologies Panel. *Report of the National Critical Technologies Panel*, U.S. Government Printing Office, Washington, D.C., 1991. Subsequent reports have also been published, but with essentially identical critical technologies.