to accept CGS' challenge to step outside their normal comfort zone and take risks to speculate in an informed way about the future and graduate education. While the papers do not necessarily represent the views of CGS, the first two provide informative and provocative research perspectives on two sectors with enormous implications for the shaping of graduate education: the economy and technology, and the third paper provides a unique perspective on the need for continued innovation and entrepreneurship among university leaders.

The next volume, which will appear in late 2009 or early 2010, will be devoted to a topic of increasing importance in the graduate community: global factors shaping graduate education. The papers in that volume will include several perspectives on higher education trends in Europe that will affect graduate education in North America, including one paper from the first annual Graduate Education 2020 symposium and two other perspectives from the 2008 annual meeting. As this project evolves, CGS will be developing an interactive forum to encourage broad national discussion on these and other topics. We look forward to the engagement of each of you in the developing conversation about our collective future.

Debra W. Stewart, President
Council of Graduate Schools

Graduate Education in 2020:
Forces Influencing Our Future

Debra W. Stewart, Daniel D. Denecke, Heath Brown

I. Introduction

A thriving system of graduate education is essential to national prosperity in the U.S. and around the world. In the U.S. context it is the leaders of our graduate schools who are the major stewards of the graduate enterprise. The term “steward” is used deliberately, here. Two literal synonyms of the word are: warden and park ranger. And while it is certainly true that aspects of the graduate dean’s job share common ground with both the warden (an official responsible for enforcing certain regulations) and the park ranger (one who provides oversight of a constantly growing and changing community, always on the look out for the random event that will bring harm to that community), the essence of the dean as “steward” goes beyond both. The term steward here is intended to connote the same meaning as Lee Schulman evokes when he talks of faculty as “stewards” of their disciplines: “The PhD is expected to serve as a steward of her discipline or profession, dedicated to the integrity of its work in the generation, critique, transformation, transmission and use of its knowledge” (Golde and Walker, 2006). The Graduate Dean as steward is dedicated to the integrity of the graduate education enterprise as it prepares students to explore and advance the limits of knowledge and define the state of the art in every field.

To designate graduate deans as stewards of the graduate enterprise is not to ignore its other significant stakeholders, both inside and outside the universities. Inside our institutions these are the presidents, provosts, other senior academic administration leaders, college deans, the faculty and of course the students. All of these people have invested their time, passions, and energies in the long term health of the enterprise. Likewise, outside the university our public “bankers,” which include state legislatures, governors, U.S. Congress and the Executive Office, collectively exercise the ultimate power of the purse string to ensure their investments in graduate education are serving the public. Increasingly, the graduate education enterprise also relies upon private “bankers”: from business and industry, who are interested in securing the long-term supply of talent, and private foundations whose broad missions may include strengthening education, fostering democracy,
and solving global problems and who recognize graduate education’s centrality to achieving all of these goals.

But despite the number, variety, and interest of stakeholders, it is the graduate dean who comes to work every day with the primary focus on the welfare of the graduate programs, their faculty and students. It is the dean who articulates a vision of excellence for the graduate community, provides ultimate quality control, maintains equitable standards across all academic disciplines, gives definition to graduate education, brings an institution-wide and interdisciplinary perspective, and serves as an advocate for issues and constituencies critical to the success of graduate programs.

As the stewards for graduate education on campus, graduate deans need to be vigilant on a daily basis for opportunities to advance the interest of graduate programs and students and for potential hazards that may threaten that interest. Such opportunities may arise within the university or they may arise outside. Graduate deans survey the present environment for opportunities to collaborate with other colleges, universities, and employers, regionally, nationally, and globally, because they understand that “in a rising tide all ships rise together.” But effective stewardship means also developing a robust understanding of the future and consciously urging or taking actions now on campus that will prepare the graduate community for the changes that inevitably will come.

II. Mental Models Required for Effective Stewardship

There are several mental models of the future that will equip graduate school leadership to fulfill their stewardship obligations. These models fall into three categories. First, mental models that capture what futurist and business strategist Peter Schwartz calls the “inevitable surprises.” The vast majority of these surprises are predictable because they have their roots in “the driving forces at work today” (Schwartz, 2003, p.3). These are things that we now could analyze based on the current drivers that will shape the process of graduate education in 2020. The problem is that there are so very many places to look. Our task is to shine light in the right obvious places. Labor force data provide one of the best examples. Projections of education supply and demand in the period 2002 to 2012 show an emerging deficiency in both bachelor’s degrees and graduate degrees in the U.S. Analyzing Current Population Survey (CPS) and Bureau of Labor Statistics (BLS) data, for example, researcher Tony Carnevale has projected a shortage of approximately 10,000 post-baccalaureate degrees by 2012 (Carnevale,
and solving global problems and who recognize graduate education's centrality to achieving all of these goals.

But despite the number, variety, and interest of stakeholders, it is the graduate dean who comes to work every day with the primary focus on the welfare of the graduate programs, their faculty and students. It is the dean who articulates a vision of excellence for the graduate community, provides ultimate quality control, maintains equitable standards across all academic disciplines, gives definition to graduate education, brings an institution-wide and interdisciplinary perspective, and serves as an advocate for issues and constituencies critical to the success of graduate programs.

As the stewards for graduate education on campus, graduate deans need to be vigilant on a daily basis for opportunities to advance the interest of graduate programs and students and for potential hazards that may threaten that interest. Such opportunities may arise within the university or they may arise outside. Graduate deans survey the present environment for opportunities to collaborate with other colleges, universities, and employers, regionally, nationally, and globally, because they understand that “in a rising tide all ships rise together.” But effective stewardship means also developing a robust understanding of the future and consciously urging or taking actions now on campus that will prepare the graduate community for the changes that inevitably will come.

II. Mental Models Required for Effective Stewardship

There are several mental models of the future that will equip graduate school leadership to fulfill their stewardship obligations. These models fall into three categories. First, mental models that capture what futurist and business strategist Peter Schwartz calls the “inevitable surprises.” The vast majority of these surprises are predictable because they have their roots in “the driving forces at work today” (Schwartz, 2003, p.3). These are things that we now could analyze based on the current drivers that will shape the process of graduate education in 2020. The problem is that there are so very many places to look. Our task is to shine light in the right obvious places. Labor force data provide one of the best examples. Projections of education supply and demand in the period 2002 to 2012 show an emerging deficiency in both bachelor's degrees and graduate degrees in the U.S. Analyzing Current Population Survey (CPS) and Bureau of Labor Statistics (BLS) data, for example, researcher Tony Carnevale has projected a shortage of approximately 10,000 post-baccalaureate degrees by 2012 (Carnevale, 2005). Projections about the future are always debated, but they are valuable because they are based on current enrollment trends and demographic realities. In his contribution to this volume (Chapter 2), Carnevale expands upon his projections of future employment needs and addresses some of the shortcomings of prevailing models for estimating future workforce demand. The bulk of this introductory chapter (section III, below) discusses an array of “inevitable surprises” in the areas of demographics, graduate reform initiatives, the changing balance of public and private support of graduate education, and the acceleration of global competition.

The second mental model of the future identifies important “unknown” domains—the things that might be foreseeable, and if they occur would result in “transformational events,” but are not already predetermined. The task here is to look far outside the box to factors that might radically alter our current practices in graduate education. Here the most accessible examples come from the work of technology futurists. For example, Ray Kurzweil argues that by the year 2030 accelerating technology will lead to “super human machine intelligence,” to the merger of biological and non-biological intelligence (Kurzweil, 2005). While 2030 is a decade beyond our proposed time frame, clearly such a development would radically alter the practice of graduate education as we know it today. Although the technologies that would make such a merger possible are just beginning to surface, the shape and implications of this merger are the unknowns, and the change would be transformational. Section IV below provides some of the possible outlines of our unknown domains.

The third model is the one that aids graduate deans and all academic leaders as they try to sort through this mélange of information, opinion and fact to develop a “futures management plan.” Such a model would provide some sense of the directions for future thinking, the conversations that need to be launched, the coalitions that need to be built, and some ordering of the actionable items from all of the issues surfaced above. This action plan should be accessible to and useful both for deans on CGS campuses and for deans acting collectively through CGS. Through this publication and as this project develops, we hope to generate ideas that will enable graduate education's stakeholders to respond to the future we anticipate and to shape the future we desire.
III. The Inevitable Surprises

A. Demographic trends

On the surface, the most inevitable feature of graduate school in America in 2020 is the composition of its population. We have a good notion of the possible ethnic, racial, and gender distribution and, given the demographic trends that enable us to predict these characteristics, of the limit to that population's growth. Assuming that some characteristics of the university remain constant, we have a reasonably good idea about the pool of future U.S. graduate students because all of the possible candidates were born in or before 1998.

If we were talking about projecting the number of college freshman, we could be a bit more specific. We know roughly how many students there will be to fill college freshman classes because the vast majority of college freshmen are 18 years old. Those 2020 college freshmen were born in 2002. The challenge with projecting graduate enrollments is that we can no longer assume a fixed age for the beginning graduate student. A decade ago, CGS research noted a sea change underway in graduate education from the traditional population of students moving from the bachelor's degree directly to graduate education to a population marked by older returning students (Syverson, 1995). Given the fact that the vast majority of American graduate students cluster between 20 and 54, and only about half are between the ages of 25 and 34, the "college freshman model" for predicting the demographic composition of graduate students is of little value. Age was not the only "inevitable surprise" in the changing characteristics of the graduate education population; the gender, employment status, marital status, number of dependents, and student loan debt of the new graduate student was changing as well. In 1996, Peter Syverson described the new American graduate student as "a woman in her 30s pursuing a master's degree on a part-time basis, with a full-time job and typically married, often with responsibility for children and likely to have some education-related debt" (Syverson, 1996). Syverson's analysis of the same data source in 2002 yielded a similar picture with more ethnic diversity and still growing participation by women (Syverson, 2002).

An alternative approach is to look at workforce data. Here data on the worker gap prove most informative and suggest a major demographic challenge for the graduate enterprise. The demographic projections of native-born Americans suggest that their representation in graduate education has plateaued, and that continued growth in graduate enrollment is unsustainable unless a substantially higher percentage of native-born students choose to go to graduate school than in the past. The proportion of native-born Americans between 25 and 54 in the U.S. labor force increased by 54 percent in the two decades between 1980 and 2000, but this same group is projected to have a zero growth rate between 2000 and 2020 (Elwood, 2001). This is simply because the replacement (fertility) rate has dropped significantly, and that drop is expected to continue. If this is the case, the only way to continue to increase graduate participation of the kind we have seen since 1976 is to either significantly increase the percentage of Americans who go to graduate school or increase international enrollment (Pavel, et al. 2006).

To put this finding into a global context, we note that global population growth is highly stratified (Peterson, 2008). While the world population will grow substantially by 2020, the vast majority of that growth will be in countries least capable of supporting it. Life expectancy and quality of life will remain key challenges in the developing world. By contrast, the population of the entire developed world is contracting while, at the same time, life expectancy is increasing dramatically. The U.S. Census Bureau projects life expectancy to increase from 75.9 years in 1995 to 79.5 years in 2020 [http://www.census.gov/population/www/projections/2008projections.html]. The ageing population of all developed countries will place substantial pressure on the younger generations to sustain economic growth in a highly productive workforce, an outcome only achievable if the younger generations are highly trained to be the innovators and creators such levels of productivity require (Peterson, 2008).

Given the projected population trends in native-born American replacement fertility and life expectancy, what are the prospects for increasing the proportion of Americans going to graduate school between now and 2020? Looking only at some demographic trends it is clear that the American population of 20 to 64 year olds in 2020 will be substantially more diverse than that of today. While the white working age population in the U.S. workforce is expected to decline from 82 percent to 63 percent between 1980 to 2020, the minority population during that time is expected to double (and the Hispanic Latino portion to almost triple, from 6 percent to 17 percent) (NCPHHE 2005). [By 2050, a study by the Pew Research Center projects, the Hispanic population will comprise 29% of the overall U.S. population, up from 14% in 2005.] The dramatic impact that we are likely to see in the composition of the college freshman class of 2020 is that it will be a "majority minority" population (where the majority of students
will be made up of so-called minority groups). Although the age range of the graduate population means that graduate education in 2020 will not reflect such a dramatic demographic shift, it is absolutely true that any growth that we see in native-U.S. participation in graduate education will have to come from minority growth. Recent trend data show that the participation of African-American, Hispanic, and American Indian groups in graduate education has grown at higher rates than those of white students over the last two decades.

Even with this dramatic growth of minorities in the college population, however, underrepresented minorities still participate in graduate education at a significantly lower rate than white Americans, for instance receiving less than 10 percent of the doctoral degrees. Without some substantial intervention, it is hard to believe that their proportional representation will increase beyond the rates we have seen over the last decade. This is compounded by the fact that the fastest-growing minority population in the U.S., Hispanics, also exhibit the lowest high school completion rates. If we do not devise an effective national strategy to increase access for minority students to graduate school beyond their current participation rate, overall participation in graduate education and the pool of potential domestic applicants will simply fall below where it is today.

One possible response is that, as unfortunate as this demographic story may be, the deficit of domestic students will be compensated for by a continuing growth in international student enrollment. For decades, the most talented students from around the world have flocked to U.S. universities. Graduate programs, nationally, receive on average upwards of five international applications for every available position, with many programs reporting application ratios of 30:1 to one. Of course, these international students contribute significantly both to U.S. graduate programs and to the U.S. research enterprise. Ultimately, they make vital contributions either to the domestic workforce or to the stature of American universities as “ambassadors” of U.S. graduate education abroad.

In 2004, however, a Council of Graduate Schools study found a 28 percent decline in international applications to graduate school for fall 2004. And this decline in applications translated into a 6 percent decline in first-time international graduate enrollment for fall 2005—the third straight year of declines. Findings from subsequent CGS annual surveys show that the decline in international applications has bottomed out and in fact is turning around, though the recovery is slowing down (applications were up 11 percent from 2005 to 2006, and up 8 percent from 2006-2007) [CGS, 2007; CGS, 2008]. The multi-year declines served as a loud wakeup call to those who assumed that U.S. graduate schools could always “fill-in” with international students. The growing capacity around the world to deliver graduate education (discussed below) will permanently change the competitive position of American graduate schools. By 2020, the standing of U.S. graduate education and its continued capacity to attract the best international talent will depend crucially on the success of the growth strategies of countries around the world.

B. Impacts of current reforms

A second “inevitable surprise” in 2020 will result from the flurry of efforts of U.S. graduate schools to “reform” graduate education at the end of the 20th and beginning of the 21st century. “A “quiet revolution” has occurred in U.S. graduate schools as graduate deans partner with other administrators and faculty. Stimulated by the publication of A Silent Success: Master’s Education in the United States (1993) by Clifton Conrad et al., which presented research commissioned by the Council of Graduate Schools, and by the publication of a National Academies of Science report on Reshaping the Graduate Education of Scientists and Engineers (1995), an ongoing conversation about reform in graduate education has been taking place for more than a decade (NAS, 1995). The conversation has been fueled by a series of studies finding that while students reported substantial satisfaction with their graduate degree programs—indeed, most reported that they would choose to earn their degrees again—they raised many issues and concerns with the process and outcomes of the graduate experience. Students specifically demanded process improvements in preparation for teaching roles, faculty mentoring, and cross disciplinary learning, as well as preparation in a series of life skills, such as communication, negotiation, and professional ethics. Students also called for more clarity about career outcomes and a greater match between their graduate training and the careers they are likely to pursue upon graduation.

In the last few years America’s graduate schools engaged in a number of experiments designed to improve the enterprise at both the master’s and doctoral levels. Two of the most comprehensive are the PhD Completion Project and the Professional Master’s Initiative. Through the PhD Completion Project, the Council of Graduate Schools, with support from Pfizer Inc and the Ford Foundation, is now in partnership with 46 universities as they work to implement a series of interventions designed to improve the quality of
the doctoral experience, and in the process dramatically decrease doctoral attrition especially among minority and women students. The Professional Master’s Initiative, with support from the Sloan and Ford Foundations, is enabling CGS to support graduate schools in their efforts to develop professional master’s programs in traditional arts and science fields. These programs are designed to give the students skills and perspectives to succeed in the jobs they will obtain in the business, government or non-profit sectors while simultaneously ensuring they have the deep knowledge of the field research typically associated with advanced training in the discipline. Through such activities, the reforms underway in graduate education should produce results even in the near term, but certainly by 2020. And the efforts in public accountability and transparency for students that are at the heart of these reforms promise to modify the culture of doctoral and masters education by 2020 in ways that provide an even greater reconciliation between advanced research training, social needs, and the public interest than we see today. That there will be some impact is inevitable, though the details of the direction of change remain unclear.

C. The social-public function of graduate education

A third inevitable surprise will emerge from the continuing struggle to articulate the vision of graduate education as a public benefit, not simply as a private good. The value of graduate education as a private good is more directly grasped by graduate education’s stakeholders than is the notion of graduate education as a public benefit. That graduate education is a private good is easy enough to demonstrate. We know for example that at the present time (compared to those with a bachelor’s degree) there is a $10,000 premium in annual salary on average to workers with master’s degrees, and an annual average additional increment of $20,000 for those with a doctorate (US Census Bureau, 2006, Table 9). Moreover, according the U.S. Census Bureau the wage premium paid for education is growing as evidenced by the earnings of those with high school diplomas, adjusted for inflation, remaining essentially unchanged over the last three decades ($29,389 in 1975 and $31,071 in 2006), whereas for those with advanced degrees (master’s, doctorates, and professional degrees) earnings are increasing ($62,672 in 1975 and $82,320 in 2006) (ibid., Table A-3). We also know that a variety of characteristics people associate with a good work life are also highly correlated with the acquisition of advanced degrees—such characteristics as autonomy, control over one’s career, and work satisfaction are all clear private benefits.

What is not so easy to document empirically is the public benefit of graduate education. Advanced degrees are highly correlated with public goods: volunteering, voting, and good health. In a society with the amenities that we all would like to see, the strong correlation suggests that citizenship is not only coincident with, but indeed fostered by graduate education. But most research has been unable, as of yet, to pinpoint the broader social and public benefits of graduate education specifically, in part because of the limitations of existing data sets, but also because the public benefits of innovation, invention, and scientific discovery are so long-term and diffuse. The public contributions of teachers, nurses, and social workers who earn graduate degrees are also considerable, but equally difficult to quantify.

In 2008, CGS published a national report on Graduate Education and the Public Good that highlights graduate degree holders whose far-reaching accomplishments in the sciences, business, government, education and the arts have positively affected millions of people, worldwide. This report served as the basis for a meeting hosted by CGS of graduate deans and senior legislators in the U.S. congress on the public benefits of graduate education. As important as the data in this report are the compelling anecdotal narratives of individual successes in the supplement to the report that provide irrefutable evidence of the broader public benefits of a graduate degree.

In part a result of the limited understanding of the full contribution of higher education, demands for “accountability” for public investment recur regularly in our state legislatures and range from alarm at the salaries of some highly compensated university administrators to concern over the extent to which particular political ideologies have overtaken our campuses. Accountability in graduate research funded by tax dollars is another area under greater scrutiny. As the number of research misconduct cases rises, universities are developing more active and more systematic educational responses to the issue. And accountability in responsible mentoring of students in graduate programs has also surfaced in public concerns about the average time students take to complete their degrees and the sub-optimal percentage of students who enroll in, but do not complete, their programs of study. While graduate deans are taking leadership roles in addressing each of these areas, there is still much work to be done to secure the public’s perception of graduate education’s broader benefits.

The strongest voices for the value of graduate education to society in the current environment come from segments of corporate America concerned with the future of the science and technology workforce. Recognizing that
long-term ready access to an international talent pool is less dependable than it once was, the Council on Competitiveness and other corporate consortia stress that we must develop U.S. talent if America is to prosper. Beyond the corporate sector, however, the U.S. federal government remains ambivalent about renewing its commitment to making the development of graduate education and of R&D a national priority. It remains to be seen whether a strategic investment in higher education on the order of the 1958-National Defense Education Act will be forthcoming.

A highly evolved society needs highly trained people not just in science and technology but in all fields—elementary education teachers with master’s degrees, social service professionals with advanced training, humanities PhDs who are positioned to interpret our past and help us think critically about our future. Significant constraint on the U.S. discretionary budget that has traditionally funded higher education may jeopardize those fields, however, for which private bankers in the corporate sector are not immediately forthcoming. In a world where the mobilization of bias is increasingly in the direction of private over public, the future training of scholars in the humanities, arts and some fields of social science will depend on a strong voice for the public benefit of their training.

Many recent studies of the national trends in education funding describe the current situation as a privatization of public higher education. Data demonstrate that real state and local support per student declined 12 percent over the period 1991-2004, with an acceleration to 16.8 percent in the last four years: “Public universities that used to cluster around the 50 percent public investment point a decade ago now typically have moved down toward 30 percent or less in public support, while other stakeholders have increased their share” (Lyall and Sell, 2006, p.8). According to SHEEO, from 2002 to 2007, per pupil education appropriations decreased 7.7 percent ($7,341 to $6,773) (SHEEO, 2008, Table 5). In 2007, total state expenditures for higher education had risen to 10.5 percent, but there will almost certainly be financial repercussions for higher education of the 2008 economic downturn (www.nasbo.org/publications.php).

One question, if such trends in privatizing public higher education continue, is: what are the implications of attracting a larger set of new “bankers” who value risk taking, but who also demand return on investment in the short term? What would a new infusion of private capital into graduate education and research mean for the enterprise? Over the last thirty years, industrial sector funding of academic R&D grew faster than any other source (federal, state/local government, non-federal) (National Science Board, 2006). Will such trends “commodify” the curriculum such that only programs with immediate market value equal to their cost will survive? Or rather, will a new enlightened private investor class emerge who opt to invest in the long-term, high risk and unpredictable human talent development that has been characteristic of the U.S. government’s investments in the past?

One can imagine two very different possible futures for the U.S. It may be that as global markets put even greater pressure on the innovation capacity of the U.S., business leaders will lobby even more aggressively to increase public investment in our universities as the source of the innovators and thought leaders of tomorrow. In this scenario, through some combination of public investment and private partnership, the infusion required for the U.S. to thrive may be forthcoming in 2020.

Alternatively, if such investment is not forthcoming, and since universities can survive a long time on past reputation, the decline may not be noticed until it is too late to recover. In such a scenario, the U.S. would fail to attract the most talented students from around the world, and even lose the top U.S. talent, because the academic programs, the faculty, and the quality of the laboratories have slowly eroded away. The U.S. in 2020 might still maintain a few stellar private institutions that are supported entirely by endowments, but they would simply not be adequate to educate the vast majority (70 percent) of doctoral students who were 15 years earlier trained in the great U.S. public research universities. At this point, it is not clear which of the two outcomes is most likely.

D. The acceleration of global competition

American graduate education is part of a global community in ways that go beyond the competition for international talent. From Brussels to Bangalore, and Beijing to Boston, conversations reflect common themes as universities plan to prepare the scholars and researchers of tomorrow. Among the themes that resonate in conversations across the globe: access and opportunity, quality assessment, mentoring, preparing a high tech workforce, interdisciplinarity, inadequacy of financial support for students, and competition from abroad. While it is certainly true that the U.S. has been looked to in the last 50 years as the leader internationally in graduate education, it is also true that many sectors of the world are moving thoughtfully and rapidly to close the gap, and as they do so they are encountering many of the issues that dominate the graduate education landscape of the U.S. In some instances, U.S. graduate reform initiatives are being imported,
replicated, and modified to meet other countries’ national or regional needs (Stewart, 2005).

The current debate in the U.S. seems concentrated on whether or not we really face strong competition from abroad. Some take the position that in fact the alarm being raised by American universities and the corporate world is really a kind of hype designed to simply increase support for funding the university research and training establishment. Critics cite the outcry in the early 1990s of impending shortages of faculty in certain fields that never materialized.

Others question why increasing demand has not forced up wages for scientists and wonder whether the call for increasing talent production is simply a mechanism to keep wages down by increasing supply. The argument is typically framed in terms of whether or not there is a shortage of particular types of scientists and engineers. Changes (including “inevitable surprises” and emerging “unknown domains”) in technology and U.S. market forces will likely require a greater number of new types of professionals to meet future workforce needs that will be very different than they were in the past. In some cases this may mean that, in the absence of future-looking policies, we are currently oversupplying a cadre of professionals for the jobs of the past (Lohr, Vanselow, and Detmer eds., 1996). But at the same time and for the same reason, it is also likely that we are undersupplying professionals to meet the workforce needs of the future.

However the current debates about relative shortages or surpluses impact the U.S. in the near term, there is general agreement that human talent development is the key to success for all countries in the future, and major countries and regions of the world are acting on that assumption to develop local talent and to recruit talent globally. By 2020 the “Bologna Process” in Europe will result in the integration and harmonization of higher education degree structures across old and new Europe. As Asian economies grow, their global demand for talent will far exceed the current supply or their educational capacity to supply that demand in the near future. China is rapidly expanding both its research centers and its graduate program enrollment, with the goal of doubling graduate enrollment in the next decade (Mills, 2006). One implication of the projected demand for talent and the global recognition of the importance of graduate education is that those educational systems that are best positioned to embrace international students and to prepare them for international careers in research will thrive. The U.S. is a current leader in this area, but others are now building capacity more quickly. Australia, for example, is anticipating that its current supply of international students (1.8 million in 2008) will grow to eight million by 2025 (Australian Government, 2005).

That the landscape for graduate study will be more competitive in 2020 is certain. What is less clear is whether it will be a relatively “spiky” or a relatively “flat” landscape. For Richard Friedman, technological advances, lowered trade protection, and political barriers have already resulted in a flat world in which there are almost no geographical barriers to the production of capital, thriving businesses, and the free flow of talent (Friedman, 2005). According to Richard Florida, however, the world is not flat but spiky, and the geography of major urban hubs, clusters of innovation, will continue to provide the key constraints on economic growth through science and innovation (Florida, 2005). In the flat scenario, graduate education in 2020 would function in a more broad-based landscape where technology and other factors lead to a wider distribution of both talent and talent developers. In the spiky scenario, Europe, the U.S., South Asia, and China will be the dominant players in the economy, and graduate education would be shaped accordingly.

E. Technology

There is every reason to believe that technology will influence the content and mode of delivery and thus may well influence as well the extent to which 2020 will be a spiky world of few or flat world of many major players in the graduate education enterprise. Technology is increasingly a central component of discussions of the changing graduate curriculum and modes of graduate instruction. The Sloan Foundation has conducted some of the most significant research on the subject. A recent report, ‘Growing by Degrees’ (Allen et al. 2005), documents the considerable growth in the number of students enrolled in programs with an on-line component—increasing 43 percent between 2002 and 2004. More than 40 percent of institutions (nearly two-thirds of research/doctoral institutions) offering master’s degrees also offer some of these programs on-line. Penetration of on-line instruction is weaker at the doctoral-level where approximately 16 percent of doctoral programs offered in person are also offered on-line.

On-line or distance education has the potential to greatly reduce costs while increasing access and opportunities. Asynchronous delivery of instruction reduces the temporal dimension of course work and allows graduate students in geographically remote locations and facing severe time or personal constraints to pursue graduate study. An unanswered question is
whether the promise of on-line graduate education, both in terms of cost and quality, will be realized. Large start-up costs and uncertain student demand have led to some frustrations in capitalizing on the well-publicized promise of distance education. For-profit institutions have been the most active in expanding on-line opportunities, raising a question of whether traditional universities can and will maintain their current portfolio of instruction or follow the lead of their for-profit colleagues.

Quality assurance, one of the central principles behind the historical successes of U.S. graduate education, also remains a concern for on-line instruction and is, as of yet, an under-researched dimension of distance education. Critical to maintaining quality will be conceptualizing ways to monitor on-line instruction, to promote sound mentorship of graduate students at a distance, and to promote research ethics. Not surprisingly, these are the same concerns of traditional delivery of graduate curriculum. If on-line instruction can generate significant student demand, it is imperative for graduate education to begin preparing the next generation of faculty scholars who will operate in this new domain.

Technology has already challenged graduate education to revise its expectations about the culminating products of graduate student work. The bound doctoral dissertation or master’s thesis are now things of the past. The electronic dissertation and thesis (ETD) project is a major initiative of Pro Quest-UMI. In the future, graduate education must grapple with encouraging new outputs such as three-dimensional models, video footage, and non-linear research projects. It is likely that in the future these and other innovative forms of the presentation of research will come to dominate graduate education. Digital imaging and new publication formats will likely raise new ethical questions and make some old ethical challenges such as image manipulation and plagiarism more prevalent. At the same time libraries and future researchers will continue to require ready access to such materials, and libraries and graduate schools will need to grapple with new demands of the technological infrastructure required to promote the wide diffusion of knowledge.

Graduate education also will be challenged to respond to the ethical dimensions of new areas of technology, such as stem cell, genomics, nanotechnology, and climate research, where regulatory pressures may conflict with innovative research pursuits. Our policies and research activities on these fronts will not occur in a global vacuum, and other countries may well adopt policies that foster innovation in areas where U.S. researchers are constrained. It is quite likely that the regulatory environment for scientific research will play a larger role in countries’ abilities to adjust their national competitive position in the global research economy.

F. Cooperation required for success

Many of the measures of research productivity (patents, publications) traditionally used as indices of national economic competitiveness may prove inadequate in an increasingly global research environment where traditional borders and boundaries are giving way to new collaborative and international networks. Even our conventional definitions of field, program, and institution, each as discrete entities, may be challenged by changes in the content of graduate education and the process through which it is delivered. Interdisciplinary research, for example, is often conceptualized in terms of the content knowledge it yields, while cooperation is thought of as a relatively independent context or process for pursuing knowledge in and between traditional fields. But we are increasingly coming to understand that, just as the fact of collaboration may shape the content of knowledge, interdisciplinarity is an independent variable that shapes the quality and process of graduate education.

The research of Barry Bozeman, for example, suggests that the social forces involved in knowledge creation may play a much greater role in motivating and shaping content and process than traditional, economic market-based incentives. The importance of social, organizational frameworks for the production of knowledge is important locally, through interdisciplinary collaborations, and globally, through joint and dual degree structures. Understanding that the problems and available talent of the future require greater time and investment in collaborative relationships may mean that institutions will need to devote more effort to thinking beyond traditional disciplines and traditional degree structures. The successes of collaborative interdisciplinary partnerships fostered by programs such as the National Science Foundation’s Integrated Graduate Education and Research Traineeship (IGERT) program, and the Professional Science Master’s program, between universities and private non-academic employers, may ultimately call for a reconceptualization of the ways in which we measure and evaluate research productivity, which may ultimately lead to new and innovative structures for the funding of research.
G. Economic integration

As has been widely reported, the globalization of production is no longer viewed as a trend of the future. In fact, in addition to the so-called ‘off-shoring’ of many manufacturing jobs, the rapid globalization of service sector jobs is also a reality today. Economists contend that a significant portion of the productivity growth in U.S. manufacturing over the 1990s was driven by a second phase of ‘service off-shoring’ (Amiti and Wei, 2006). Given that manufacturing and service are now fully globalized sectors of the economy, one looming question for economists is not whether but when the final frontier, the research and innovation sector will be off-shored. The rapid growth of undergraduate and now graduate education in many developing countries, notably China and India, means that the same comparative advantage these countries now possess in low-skilled areas may in the near future be found in high-skilled areas. Rather than simply competing over manufacturing and service jobs in a global economy, the future competition will take place over knowledge jobs involving creativity, innovation, and scientific discovery.

The globalization of R&D will have dramatic effects on the U.S. economy, both positive and negative, but its impact on graduate education is an unknown. Such globalization could open new “markets” for U.S. graduate programs seeking to attract and recruit the next generation of the best and brightest students. If such globalization leads to the advancement of developing countries, new sending countries such as Turkey, Mexico, and Vietnam could emerge as traditional sender countries in Asia and India rapidly build their capacity to attract their own top talent. Turkey sent only 6,700 students to the U.S. in 1994, and just decade later has nearly doubled the number of students (12,474) coming to the U.S. to study. Recently, Vietnam has doubled and Mexico grown by 50 percent the number of students coming to the U.S. to study. These countries represent real opportunities offered by globalization and development.

From another perspective, this type of globalization might place wage and cost pressures on U.S. high-skilled workers, employers, and graduate schools. The traditional wages of home-grown scientists and engineers could diminish as lower-wage scientists and engineers abroad become more plentiful, and as lower-cost labs and facilities proliferate around the world. To remain globally competitive, U.S. graduate schools may have to respond in ways now familiar to U.S. businesses, compelled to focus more on cost savings, economies of scale, and return on investment. Universities may become increasingly reliant on electronic delivery technologies to expand their tuition base and increase marginal revenue to subsidize or replace traditional residential graduate programs. Additionally, pooling services, mergers, and outsourcing to reduce costs through economies of scale are some of the techniques that universities could borrow from the corporate experience with globalization.

What remains to be seen is how the various political and social contexts around the world will interact to accommodate or impede the globalization of innovation. It is possible that some of the conditions that characterize a democratic society may not be hindrances to a thriving manufacturing or service sector, but turn out to be crucial stumbling blocks for the emergence of a culture of innovation and scientific discovery. In the U.S., a robust graduate education, research, and science enterprise have emerged in the context of a complex set of interrelated factors such as: substantial governmental and private support, a sound legal infrastructure that promotes property rights, and the free and open exchange of ideas. The democratic underpinnings of national and university governance have likely played a large role in the story of U.S. international competitiveness in the second half of the twentieth century. These conditions, and the principles behind them, are not universally shared by all countries and regions who are now asserting their presence in the global R&D marketplace. Nor are these conditions and principles guaranteed to remain unchallenged or unchanged in the U.S., particularly under the influence of growing concerns about terrorism, espionage, and national security. The next decades may provide a test case both within the U.S. and in other countries about the extent to which there is a direct relationship between the conditions of democracy and a culture of research and innovation.

IV. Unknown Domains

A. Technological advances

Kurzweil’s projection that by the year 2030 the merger between human and machine intelligence will be a reality may take several forms. One possibility that was once the domain of science fiction is that some of the hardware and software that we now carry as portable devices (iPods, blackberries, and cellphones) will be increasingly incorporated into our bodies. Medical devices and smart technologies to regulate various formerly natural processes, following the example of the pacemaker, will increasingly
blur the line between technology and biology. These medical uses, as well as the leisure and cosmetic uses of such technologies, will raise important new ethical concerns and issues as well as new opportunities and challenges for graduate education.

New virtual equipment and virtual laboratory software (pioneered in medical education) may challenge our conventional notions about what aspects of graduate education require “hands on experience” in a physical laboratory environment, thus synergistically driving the appeal and efficacy of online distance education. One could imagine a world in which much of the work currently performed in the lab by Research Assistants is performed either by RA’s in a virtual environment or by the software itself. Software may also free up curricular content in graduate education by absorbing some of the more mechanical and route thought processes. Stefan Wolfram’s software program Mathematica, for example, can now instantaneously perform complex equations that once took mathematicians hours to perform, Just as common search engines can now make what was once an important mechanical aspect of nineteenth-century philology obsolete, Mathematica and similar programs can liberate scholars to focus on the more abstract and/or problematic aspects of a mathematical and scientific issue, and spend less time on “mechanical” labors that would otherwise be essential to the solution of definition of a problem. Kurzweil’s “law of accelerating change” (whereby even “exponential growth is growing exponentially”) in the area of artificial intelligence will have perhaps the most profound effects on graduate education in 2020. Not only will artificial intelligence impact curricular content and the daily cognitive activities of individual scholars, the technological absorption of formerly human cognitive tasks holds massive implications for redefining laboratory work and academic knowledge, potentially rendering some disciplines obsolete as it makes new ones possible.

Just as software may someday render the “Research Assistant” a relic of the past, technological innovation may radically redefine the “Teaching Assistant.” In one such scenario, for example, curricular initiatives similar to MIT’s “Open Course Ware” and “Open Knowledge” to make graduate curricular content and assignments available to the public for free, might generate a secondary, parasite industry of specialized teachers and tutors. Ultimately, a for-profit teaching industry could provide a cadre of outsourced “TA’s,” a natural extension of the for-profit online industry of writing tutors, exam coaches, and dissertation coaches that has already emerged. One role for the university in such a scenario could ultimately be to abdicate its social/teaching function and to become a pure research engine, to generate content, but not to oversee its transmission as knowledge. The long-running conflict between the research mission of the university and its teaching and faculty-preparation mission could be resolved, as it were, by “spinning off” the social responsibilities, with potentially serious consequences for quality and oversight.

The long-term results of such technological developments on research and talent productivity, and on the vitality of the disciplines, are truly unknown domains. Also unknown are what impact such developments might have on the quality and character of the relationships that are currently central to the graduate experience and that provide the scaffolding for the learning that ensues. Michael Schrage of the MIT Media Lab makes the point that, “When graduate students talk about the quality of their experience at a university, they tend to describe the quality of the relationship they have had.” They loved of hated their advisor, they liked the camaraderie of conferences, etc. Research on graduate degree completion, for example, has shown that social integration is one of the most important factors contributing to students’ tendencies complete their degree, and the feeling of loneliness is one of the main factors contributing to graduate degree attrition; this is especially the case for underrepresented minority students. In the new technologically mediated world of 2020, it is critical to attend to these relationship issues and to understand how the needs they meet will be addressed through technology in these years.

B. Science: life expanding treatments.

In many ways, we have a system of education at the verge of incompatibility with the changing life span. Given the average lifespan today, it may be appropriate to focus college and graduate preparation at the early stages of life, lasting at the longest into an individual’s early 30s. Such training may now prepare individuals for their career without considerable need for additional rigorous training later in life.

However, if scientific advances expand the average life span to 90 years or more, our existing system may not be effective. If an adult’s productive/working life expands further into their 80s, 90s, and beyond, third and forth careers will be dependent on re-training and lifelong learning. The productivity of this population would be all the more important if the current fertility rate falls below replacement levels. Rather than marginal participants in the graduate enterprise, this newly productive and engaged
older cohort of individuals may demand course-work and graduate programs oriented to their interests and needs. And the life and career experiences that the 60 year-old corporate lawyer or banker brings to doctoral study in a field will stretch the boundaries of current faculty talents and disciplinary configurations. One can imagine whole new domains and interdisciplinary characteristics emerging from this new and more expert learner.

C. Culture—belief systems—democracy

Is it possible that the rise of religious fundamentalisms (Islamic and/or Christian), or some other cultural transformation, will reverse the basic principles of the enlightenment that are at the foundation of graduate education as conducted in the west? A national Harris poll in 2005 revealed that “a majority of U.S. adults (54 percent) do not think human beings developed from earlier species, up from 46 percent in 1994” (http://www.harrisinteractive.com/harris_poll/index.asp?PID=581.) With increasing demands for public accountability in higher education, and increasingly vocal support of the position that, while many public universities are funded by American tax dollars, university faculties are unrepresentative of the beliefs of most Americans, is it possible to imagine the introduction of curricular content in our public institutions determined by belief as much as by knowledge? What form this or the more likely scenario of a stand-off on such an issue would take is an unknown domain.

It is possible that so-called “western values” will permeate university governance and graduate education systems abroad even if those universities are located in countries whose political systems do not share those values. One perspective is expressed in Erik Peterson’s statement that: “Four of the top five countries sending students to the U.S. are in Northeast Asia, and their next generation will experience unprecedented exposure to western values” (Peterson, 2005); but whether the relationship between academic and political belief systems will be one of mutual support or constant tension remains to be seen.

This debate is focused now on certain countries that are making substantial investments, yet at this point some of those countries lack the democratic institutions that Americans believe essential to effective development of human talent. Can progress be made when there is an imbalance between economic globalization and political globalization? Recent analysis of the situation in China suggests the Chinese think they can accept economic globalization without explicit change in their political system. In fact the main features of the market economy seem to be working; the Chinese have taken a very pragmatic approach to doing what works in the economic sphere. But it appears that the leadership in China rejects the assumption that economic integration into the global economy will lead to the establishment of institutions of western democracy (Sidelsky, 2005). Whether and to what extent such belief systems place a cap on the effectiveness of a country’s graduate education enterprise remains an unknown domain.

D. Global politics

The motivation for the American government’s current international strategy is that all nations and all people will thrive in a world where the principles of democracy have the widest sway. Just as Thomas Friedman used the metaphorical device of a “flat world” to imagine a world where economic opportunities are no longer constrained by regional and national borders, one could imagine a scenario in which economic globalization, technological developments, and global policies that actively seek to promote democratic processes flatten the political world in which differences are now so pronounced across the globe.

On the other hand, if the post-Cold War era continues to be dominated by small-scale factional wars, failed states, and terrorism, we may be at the start of a new era of heightened military activity and security concerns. One possible scenario is that an escalating series of terrorist attacks and subsequent global instability causes a “fortress America” mentality around the world. Rather than witness the unfolding of globalization as a force of connectivity, we may find that the global force that comes to dominate is one of provincialization—with local definitions of national security trumping the long term requirement of openness to ideas and mobility of student and faculty. In this environment, maintaining the principles of ‘open laboratories’ and ‘open research’ would be one of graduate education’s major challenges. What kind of graduate school would be necessary to respond to such transformational events?

Similarly, a foreseeable scenario is that in response to “American competitiveness,” legislators adopt a policy not of greater openness and greater hospitality to the world’s top talent but rather of closed doors that emphasizes “domestic students first.” In this scenario, international students, who currently comprise 50 percent or more of many U.S. graduate STEM programs, are increasingly discouraged from coming to the U.S. to pursue fields identified as key competitiveness areas (e.g. STEM fields). “Deemed
export” policies become stricter and more prolific, binding the hands of all but the most resource intensive institutions, and international students find it increasingly difficult to gain access to U.S. graduate degrees. What would the impact of such a short-sighted economic competitiveness scenario be on graduate institutions?

Conclusion

This essay began by describing the graduate dean as a “steward” of graduate education in the sense of both the enforcer of rules and the scanner of the environment. The 2020 project is founded on the belief that the latter aspect of stewardship will play a significantly larger role in the future than it has in the past. But, as often noted, “the trouble with the future is that it usually arrives before we’re ready for it.” So how are we to prepare our graduate deans and university leaders to be ready for the transformations that will come?

Thinking about the future of graduate education must begin by acknowledging that some things are knowable if we look in the right places, and some things are simply unknown and can’t be anticipated, but must be watched. Activities in both domains are required. But thinking about the future doesn’t imply that graduate leaders remain inert until the future is revealed to them. On the contrary, they must act now, albeit with limited knowledge, in an effort to position their institutions to meet and shape the future for graduate students and programs.

This essay introduces an effort by the Council of Graduate Schools to enlist experts in the broad categories that we identify above as both “knowable” if we just look, such as demographic trends, and “unknowable” in detail, but hugely important to the future of the enterprise globally, such as transformations in culture and belief systems. It is in probing the “knowable” and exploring the “unknowable” that we are most likely to build a cadre of academic leaders who will be able to ensure that the future is not just some place they are “going to” but rather a destination they are creating. The Graduate Education 2020 project essays are designed to provide deans with the conceptual tools to build that future.

Works Cited


FORCES INFLUENCING OUR FUTURE


DEBRA W. STEWART, DANIEL D. DENECKE, AND HEATH BROWN


References

1 Debra W. Stewart is President of the Council of Graduate Schools. Daniel Denecke is Director, Best Practices for the CGS. Heath Brown, formerly CGS Director of Research and Policy Analysis, is currently Assistant Professor of Public Affairs at Roanoke College, Virginia.

2 All website URL’s retrieved on March 12, 2009.

3 Global Perspectives on Graduate Education (CGS 2008) includes proceedings, reflecting this wide range of topics, of a Strategic Leaders Summit on Graduate Education convened by CGS in Banff, Alberta, Canada in 2007.


5 Attributed to Arnold H. Glasow.