Graduate Education for Global Career Pathways

CGS COUNCIL OF GRADUATE SCHOOLS

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Proceedings of the 2012
Strategic Leaders Global Summit
on Graduate Education

September 4-6, 2012
Kloster Seeon, Bavaria, Germany

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ISBN-13: 978-1-933042-40-4
ISBN-10: 1-933042-40-0

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FOREWORD

"Brain Drain" and "Brain Gain" have been topics of ongoing discussion in the global graduate education community, particularly as countries make new investments in graduate education and research. In recent years, however, a more optimistic model for the circulation of global talent has been put forward. Many argue that as research networks become more global, so do career pathways. Global R&D networks, along with new technologies for communication and collaboration, now make it possible for academics and research professionals to work in and between international locations, stimulating research that benefits multiple economies and institutions. How relevant, then, is the concept of "Brain Drain" in a world where the careers of most highly educated workers are likely to have an international dimension?

The 2012 Global Summit provided the occasion for an international group of graduate education leaders to examine this important question as well as current student mobility trends and their implications. The overarching goal was to share and compare ways in which graduate institutions are supporting new pathways of brain circulation and preparing future researchers and professionals to create and share knowledge across local and global contexts. Readers of this volume will find both fresh ways of thinking about student mobility and migration as well promising practices for supporting global careers for current graduate students.

Debra W. Stewart
President
Council of Graduate Schools

ACKNOWLEDGMENTS

The planning of an international forum requires the skill and effort of many talented individuals. I am pleased to acknowledge the work of those who played a major role in the success of the 2012 Strategic Leaders Global Summit.

I first must thank the Technical University of Munich (TUM) for its role in co-hosting the summit, and in particular, Ernst Rank, Dean of the TUM Graduate School at the time of the summit. Many other talented staff members supported his excellent leadership: the visionary TUM President, Wolfgang Herrmann; Michael Klimke, Managing Director of the Graduate School; Media Relations leaders, Undine Ziller and Patrick Regan; and TUM's highly professional organizational support staff: Vera Minoux, Mario Garcia, Zlatina Cheva, and Annagret Merkl.

I am equally grateful to the members of the international Steering Committee, who played an important role in shaping and refining the summit agenda and moderating panel sessions. Their contributions ensured that the program represented a breadth of international perspectives on the topics of "brain circulation" and global career pathways for graduate degree holders.

A number of dedicated members of the CGS Staff were key to the planning of the summit and the preparation of this volume. I thank Julia Kent, Editor of the summit proceedings, and Jeannette Remington, Assistant Editor; Daniel Denecke, who made substantial contributions to the panel summaries contained here; Nate Thompson, who supported both summit media and the preparation of the proceedings for publication; and Cheryl Flagg and Maureen Terese McCarthy for taking on key tasks at critical moments.

I reserve a very special thanks to a long-standing summit sponsor, ProQuest UMI, and its CEO, Kurt Sanford. ProQuest's continued sponsorship of the summit is a testimony to the company's deep

commitment to graduate education and research and to its understanding of the importance of graduate education in a global context.

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INTRODUCTION: GRADUATE EDUCATION FOR GLOBAL CAREER PATHWAYS

The Strategic Leaders Global Summit on Graduate Education, now in its sixth year, is a unique event in the global graduate community. The only annual, international forum for leaders in graduate education, the summit provides an opportunity to engage in an ongoing dialogue about issues that affect all countries and institutions in a globalizing world. The Council of Graduate Schools (CGS) first convened the summit in Banff, Canada, in 2007. That first meeting was inspired by the belief that the globalization of graduate education and research merited the close attention of a diverse range of international leaders in graduate education. Many parallel national organizations of graduate deans and other university leaders participated in the summit, which concluded with the ambition to make the summit an annual tradition. I am pleased to say that after six years, we have achieved that goal. Not only has the summit endured, it has become more diverse: including this year's event, the summit has included participants from a total of 27 countries.

Following the first meeting in Banff, CGS has worked with organizations and universities around the world to convene theme-based summits on topics of pressing importance to graduate leaders worldwide. In 2008, in Florence, Italy, the summit addressed an issue that concerns both graduate student training as well as research quality, *Research Ethics and Scholarly Integrity in a Global Context*. In 2009, in San Francisco, we addressed both the challenges and opportunities of joint and dual degree programs and research exchanges in a summit titled *Graduate*

International Collaborations: How to Build and Sustain Them.

As the summit has grown in size and diversity, CGS has enjoyed the privilege of convening the summit with a number of international partners. In 2010, CGS organized the event with the support of the Australian Group of Eight (Go8) and in partnership with the Deans and Directors of Graduate Studies in Australia (DDoGS). The meeting, held in Brisbane, took on the important topic of *Measuring Quality in Graduate Education*. In 2011, in collaboration with the University of Hong Kong (HKU), we met in Hong Kong on the occasion of HKU's centenary. The topic, *Career Outcomes for Graduate Students: Tracking and Building Pathways*, was chosen to further a goal shared by many institutions worldwide: to learn about the diverse range of career pathways that graduate students seek and to better provide them with the skills and training needed for successful careers both inside and outside the academy. The 2011 Global Summit was an important foundation for the topic of the 2012 summit, *From Brain Drain to Brain Circulation: Graduate Education for Global Career Pathways*.

CGS was greatly honored to co-host the 2012 Summit with the Technische Universität München (TUM) to examine this complex and compelling issue. The global mobility of graduate students and researchers is not a new topic, but one that is changing rapidly with the forces of globalization. The problem of "brain drain," the unidirectional flow of talent and education away from one country toward multiple others, is still a reality today, and one with uneven negative impacts. At the same time, globalization has cast the issue of "brain drain" in a new light: if the careers of all researchers and professionals are likely to become "global" in some fashion or another, how are the flows of talent likely to change? Will today's graduate students have careers that take them to different international locations over the course of a lifetime and a career, and what are the impacts of this scenario for different countries and regions? And how is the development of graduate education in a growing number of countries affecting the patterns of mobility we have seen in the past?

These are questions that look to the future, but the 2012 summit also examined the present. The program for the global summit allowed participants to share ideas for promoting positive models of "brain circulation"—flows of talent that benefit multiple countries—and to exchange promising methods for preparing graduate students for global

careers. At stake in these conversations was the quality and relevance of graduate education, but also the success of our efforts to foster cultural exchange and international research in our institutions and countries.

As in all past convenings, the summit began with presentations by members of the international steering committee, who addressed the broad summit theme from the perspective of institutions in their countries. Following this opening session, participants tackled more specific themes in panel discussions, corresponding to parts 2-6 of this volume. In Panel 2, "Understanding and Shaping Global Careers," presenters offered examples of successful strategies for supporting global career pathways for graduate students in graduate school. Panel 3, "Defining Global Skills for Future Researchers and Professionals," focused on how best to articulate the specific global skills needed in Science, Engineering, and Medicine fields as well as the Social Sciences and Arts and Humanities. In Panel 4, "Supporting Transitions on a Global Career Pathway," panelists shared information about good practices in supporting graduate students during transitional periods, such as preparing to research abroad or preparing to enter into a career. Panel 5, "Leveraging Local and Global Research Networks," considered the many ways that sharing resources across disciplines, sectors, and nations can move research forward on a global scale. Panel 6. "Opportunities for Global Collaboration," offered space to consider ways that stakeholders external to a university, such as national organizations, governments, and the public, might contribute to meaningful action on global career development.

The final session of the summit provided the occasion to stand back from the focused topics of each panel and to reflect on the common values and principles that emerged in our discussions. While it is impossible and inappropriate to create principles for all countries and contexts, it is my hope that establishing common ground provides direction for future work—both in our local contexts and in future global conversations on this topic. To read the final consensus document, please refer to Appendix A.

This year's summit continued in the tradition of deep and wide-ranging leadership representing diverse perspectives on graduate education. I am confident that the extensive expertise shared at the 2012 Strategic Leaders Global Summit on Graduate Education will make these

proceedings an invaluable resource for many graduate communities worldwide.

Debra W. Stewart
President
Council of Graduate Schools

I. THE FLOW OF GLOBAL TALENT: TRENDS AND IMPACTS FOR COUNTRIES AND REGIONS

Summary of Papers and Discussion

The opening panel of the 2012 Global Summit invited participants to analyze national structures and policies influencing the mobility of current and future graduate students. A diverse group of speakers representing seven countries—Australia, Brazil, Canada, China (Hong Kong), Hungary, Malaysia, and the United States—presented papers addressing four major themes. Presenters were asked to reflect on the following sets of questions:

- *Mobility Patterns:* What do you know about mobility patterns for current or prospective students in your country and region? How do governments and educational institutions actively support/control mobility to or from your country or region?

- *Current Impacts:* How has "brain drain/brain gain" affected institutions in your country or region? What are the implications of brain drain/brain gain on national and regional societies and economies?

- *Emerging and Future Trends:* Have more positive models of "brain circulation" emerged? What are their impacts for local governments, economies, institutions, and students?

- *Roles of Institutions:* What structures (political, economic, and institutional) reinforce a one-directional or a multi-directional flow of global talent? How can institutions in your country promote models that benefit multiple countries and stakeholders?

These questions were developed to capture mobility trends from a long-term perspective and allowed presenters to discuss current and past trends as well as future projections and aspirations. In the papers and discussions that followed, three dominant discussion threads emerged, each summarized below.

Global Mobility Initiatives

Many speakers highlighted initiatives to promote the global mobility of students to and from their countries, efforts which typically aligned with broader workforce development strategies. Examples of recent major programs highlighted in the papers included Brazil's "Science without Borders" initiative, launched in 2011 to promote the mobility of students and to enhance innovation and workforce development; Malaysia's Talent Corp program, which seeks to maintain and recruit global talent, including highly educated Malaysian expatriates; and in Canada, the Federal Skilled Worker Program for International PhD Students, which offers permanent residency to 1000 international doctoral students annually. Wide-scale institutional strategies in China and Hong Kong, including collaborative degree programs that facilitate the mobility of students to and from national hubs for graduate education, were also highlighted.

The goals driving such programs are explained in greater depth in papers by **Vahan Agopyan**, (Universidade de São Paulo), **Rose Alinda Alias** (Universiti Teknologi Malaysia), **Jay Doering** (University of Manitoba) and **Paul Tam** (The University of Hong Kong). Since national initiatives are often focused on all levels of postsecondary education, these papers outline specific goals and expected outcomes for graduate students and alumni.

The "Brain Circulation" Model

Speakers and discussants in the opening session agreed that the concept of "brain circulation" is increasingly relevant to a globalizing world. Citing data from international sources, **Zlatko Skrbis** (The University of Queensland) argued that the terms "brain drain" and "brain gain" no longer effectively describe the patterns of global migration or the mobility of international students. Australia, for example, has seen a "net gain of skilled persons" in spite of significant outflows of high-level professionals. Dr. Skrbis was joined by Dr. Alias and **Liviu Matei** (Central European University) in noting that the term is often preferable to "brain drain" because it is based on a long-term view of skilled migration. Alias emphasized that Malaysia's strategy of long-term investment in building and recruiting knowledge professionals looks beyond historical patterns of one-directional outward migration and their current effects. These observations lend support for the brain circulation model, which suggest that highly educated individuals may choose to return to their countries of origin or participate in collaborative activities that benefit multiple nations, including their home countries.

The panel discussion raised questions about space as well as time. **Graham Carr** (Concordia University) urged fellow participants to consider whether the location of highly educated professionals matters in a world where technology is facilitating the exchange of ideas across geographic boundaries. This question is relevant both to current graduate students as well as future knowledge professionals. In her presentation on Malaysia, Alias underscored the value of knowledge networks beyond Malaysia's borders that are contributing to the country's development. Participants returned to this topic in Panel 2, which included a discussion of the impacts of technology on global career pathways.

These positive examples of brain circulation were accompanied by a thoughtful examination of the negative effects of deeply entrenched one-directional flows of human capital that require serious and immediate attention. **Ihron Rensburg** (University of Johannesburg) underscored the fact that some countries experience "shock" during difficult and prolonged transitions and urged colleagues to play a leadership role in calling attention to the needs of countries in dire circumstances. One example

of how graduate leaders might attend to the concerns of specific nations, he added, is to support international training experiences for graduate students in regions where capacity building is urgently needed.

The Role of Universities

Participants also addressed the role of universities in responding to uneven flows of global talent and highly educated workers. **Patrick Osmer** (The Ohio State University) and Dr. Matei noted that universities are part of a complex environment of potential actors that play a role in shaping mobility patterns—from governments, to non-profit organizations, to private-sector employers, to deans and faculty at institutions. In a paper on the U.S. context, **Lisa Tedesco** (Emory University) called attention to the "legacy structures" that have prevailed at Western higher education systems and argued that the globalization of graduate education will demand that institutions remain open to new and emerging structures for learning and research.

One particularly difficult and far-reaching question—the extent to which universities should compete or collaborate in the market for international students—also emerged in the discussion. No easy or clear answer to this question emerged, but examples provided in the session suggested that competition and collaboration are often simultaneous responses to the increasing mobility of graduate students.

Conclusion

The papers and discussions for Panel 1 raised broad questions about the role of graduate deans in promoting student mobility, highlighted points of difference and shared concerns, and laid the groundwork for more focused discussions in Panels 2-6. The session also uncovered a range of other topics that participants were eager to discuss: the role of language proficiency in determining students' opportunities for global careers, barriers to international credential exchange for alumni of professional graduate programs, and the broad skills needed to succeed in diverse international settings, to name only a few. Readers will find examinations of these and other topics in the papers and introductions that follow.

Brazilian Perspectives

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In order to better understand the Brazilian perspective on brain circulation, a short description of the country background is useful. In Brazil, the majority of the large industries and other companies are historically international ones; therefore research and development is mainly carried out in companies' home countries while the research necessary to adapt the product or service for the local customers and conditions is usually developed in Brazil. This is called *tropicalization*. For the large Brazilian companies, with few exceptions, including Petrobrás, Embraer and Vale, the practice has been to buy or adapt foreign know-how because the cost of developing new technology was considered high due to the inherent risks. Hopefully this approach is changing, since the economy's stabilization 20 years ago, especially in medium and small enterprises where knowledge is the tool for competitiveness. On the other hand, with the expansion of tertiary education, more trained faculty members are required to develop future innovators.

It is not surprising that the majority of Brazilian doctorate holders are engaged in academic activities, and based on the available data from the Ministry of Science and Technology, fewer than 10% are working in economically productive sectors (Centro de Gestão e Estudos Estratégicos, 2010). Within this context, Brazilian universities are still in the process of making a transition from simply preparing human resources for academic positions to preparing them for companies or non-academic general sectors of production. The University of São Paulo (USP) is trying to change this scenario by presenting to the students the large number of possible opportunities outside of academia, as the economy of the country has improved and large numbers of well-qualified human resources are needed. Although higher education faculty positions require a doctoral degree (PhD), universities must also prepare their students for leadership, research, or consulting positions in a variety of fields and demonstrate to the companies the benefits of hiring PhDs to improve their performance.

For a Brazilian student who has just finished a doctoral degree

abroad or is engaged in an international joint doctoral degree scheme, the majority of available positions in Brazil are still mainly in the universities or research institutions where the salaries are not as competitive as in the private sector. However, "brain drain" is not calling the attention of the Brazilian authorities, even though the exact data on brain circulation are not available.

As a new and developing economy, Brazil is a challenging place for young PhDs seeking to devise new opportunities and possibilities for self-realization, even when they are in the universities. A talented faculty member can easily be involved in fascinating consulting activities in R&D sectors of industry. This is the real attraction that the country has for new PhD holders, which means that "brain drain" is not a major question, as we manage to attract PhDs from other nationalities working in Brazil ("brain gain"). The major challenge for the universities is to convince society of the need for PhDs and to demonstrate how they can collaborate for the development of the country, benefiting society and the economy.

The few Brazilians who remain abroad are actually very important ambassadors for the country. If they are employed in the university system, they are usually pleased to host our students and faculty as well as to carry on joint research projects. Furthermore, if they work in industry, they facilitate internship positions for the students and also share research opportunities with Brazilian universities. Therefore, they cannot be considered a loss for the country, but a very good investment for the internationalization of university activities.

It is possible to state that in Brazil, promoting the internationalization of our students is a strategic tool for the improvement of national institutions and for the development of the students' and supervisors' skills. With this purpose, last year the Federal Government decided to intensify this action by sending 100,000 students abroad for the next five years, approximately five times the number of students who went abroad during the previous five years. The Brazilian government's *Science without Borders* program provides scholarships for 75,000 students abroad that will be supported both by the Ministry of Education and the Ministry of Science and Technology, with a specific budget defined annually. During this first year, the program is keeping the objective, and almost 15,000 students will be experiencing some period of academic training in a foreign university. The results will

be analyzed annually beginning next year. The Federal Government policy is very well received by the Academy; however it does not include all of the areas of knowledge and it is mainly a one-way scheme in that it does not yet consider the ability of Brazilian universities to absorb more foreign students.

The University of São Paulo, which is not part of the Federal system, supports this program and is selecting students for all of the Federal Government offers. However, the university approach to internationalization is quite different. It is a priority for us, but only when it is based on research partnerships developed by faculties and with assured academic quality with consequences for post-docs, graduate and undergraduate involvement. With this approach, it is possible to promote a multi-directional student flow. USP is encouraging foreign students to engage in its courses, both in undergraduate or graduates studies. The foreign students are welcomed to São Paulo for internships (a short period of time), split degrees (degrees provided by the institution of his/her country) or double degrees (the degree is provided by both universities). As far as graduate studies are concerned, USP is also encouraging the creation of international graduate programs, a single joint program established by two or more universities from different countries.

Unlike U.S. universities, where 33% of doctoral students are foreign-born (according to recent National Science Foundation figures) (National Science Board, 2012), most of our doctoral students are Brazilian and do want to stay in Brazil. Our effort is directed to providing high, academically qualified human resources and simultaneously fostering more opportunities and conditions for the private sector to integrate the culture of scientific innovation. For this innovation to be properly exploited, our country needs a strong administration`s commitment to creating jobs and new industries through science and innovation.

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Trends and Impacts for Malaysia and Southeast Asia (SEA) Region

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Mobility Patterns of Malaysia

According to the Malaysia Economic Monitor's *Brain Drain* Report (World Bank, April 2011), almost 1 million (3.6%) of Malaysia's population of 28 million are part of the 215 million people (30% of the world population) who live outside their country of birth. The Malaysian diaspora is large, significant and concentrated in 8 main countries; namely, 46% are in Singapore, 12% in Australia, 9% in Brunei, 8% each in the U.S. and in Britain, 3% in Canada, 2.5% each in Hong Kong and India and 9% in other countries. There is a geographic and ethnic component, with about 88% of the Malaysian diaspora in Singapore being of ethnic Chinese origin. "Brain drain" is defined as the number of people within the Malaysian diaspora who are high-skilled, aged 25 or more, with an academic or professional degree beyond high school, who have the intention of holding permanent employment outside of Malaysia. Southeast Asia (SEA) has the most pronounced brain drain in Asia, alongside other regions in the world, namely the Caribbean, the Pacific, the sub-Saharan Africa and Central America. Many work as professionals in banking, construction, engineering, medicine, legal and ICT services. The Malaysian brain drain, about a third (30%), is not overwhelmingly large when compared to the overall size of the diaspora, with Singapore, Australia and the US accounting for almost 80% of the brain drain. The top three drivers for brain drain were career prospects, compensation and social justice.

Current Economic Impacts of Brain Drain

Relative to the narrow skill base, Malaysia's intensity of brain drain (i.e. skilled emigration rate) is high, with Malaysia's high skill selectivity being the main driver of the emigration rate. The impact is aggravated because Malaysia's skill base is narrow. This is inherently related to the challenges

Malaysia faces in its education sector and connected to Malaysia's domestic human capital development agenda. However, the exponential expansion of Malaysian tertiary education has managed to lower the intensity of brain drain, even though it still remains at a high level. Although traditional literature posits that brain drain depletes a country's human capital and has negative impacts on the economy, recent literature has shown that its net effect on development may be either positive or negative. However, diaspora can be a valuable source of talent, as those who have worked abroad in key sectors may have learned valuable skills or gained access to advanced technology.

Emerging and Future Trends

As Malaysia moves towards becoming a high-income nation, the country needs to leverage the Malaysian diaspora in other ways than enticing PhDs to physically return-migrate to Malaysia. Brain circulation introduces technology transfers, trade and capital flows that eventually bring benefits to the economy. Malaysia's stock of tertiary-educated people appears not to have been eroded by brain drain. Brain circulation has promoted the engagement of diaspora to contribute to trade and encourage high-tech industries to increase foreign direct investment. Diaspora members also act as bridges between foreign technology and markets and local entrepreneurs, helping Malaysian companies market their products overseas. The Malaysian diaspora can act as intermediaries for Malaysian companies to penetrate foreign markets along the value chain. They can also counter the negative and inaccurate portrayals of Malaysia, for example regarding palm oil and the environment. They are encouraged to join local chambers of commerce and bilateral business councils to keep abreast of developments at home.

Roles of Institutions

Malaysia needs to ensure talent availability to support growth and economic transformation. Talent Corporation Malaysia Berhad (TalentCorp) was established in early 2011 by the Malaysian government as a focal point with a mission to build effective partnerships and make a difference in

addressing Malaysia's talent needs to enable the country to become a high-income nation. Talentcorp's Talent Roadmap 2020 identified three strategic thrusts for talent interventions to optimize Malaysian talent, attract and facilitate global talent and build networks of top talent. Three approaches were outlined to attract and facilitate global talent, including reaching out to the Malaysian diaspora, facilitating returning talents, and enhancing expatriate facilitations. The Returning Experts Program (REP) is an initiative to facilitate returning talent to contribute to the nation's development. In the first half of 2012, more than 500 REP applications were approved, compared to 680 approvals for the whole of 2011. In comparison, only 1,130 REP applications were approved over the 10 years (2001-2010) before TalentCorp was established. Whereas previous applications were made by the returning individuals, now applications can be made by companies for the Malaysian professionals they target to recruit from abroad. Over 100 companies are already participating. TalentCorp will also leverage social media tools, including the Virtual Career Fairs platform hosted at its talent engagement portal MyWorkLife. It is hoped that with continued support and effort, more global Malaysian talents will return and contribute to the growing momentum of Malaysia's Economic Transformation Plan (ETP).

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Brain Circulation: A Canadian Perspective

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Context

It is important to remember that there is no federal agency in Canada that oversees post-secondary education. It is the responsibility of each province. Ten provinces. Ten strategies. There are about 100 recognized degree-granting institutions in Canada, with a combined enrolment (undergraduate and graduate) of 1.2 million students. About 73 institutions have graduate programs, 36 of which offer doctoral programs. There are about 200,000 students enrolled in graduate programs in Canada.

Two organizations help to unify provincial approaches to post-secondary education: the Council of Ministers of Education, Canada (CMEC), and the Department of Foreign Affairs and International Trade (DFAIT) Canada. The Canadian Association for Graduate Studies (CAGS) and the Association of Universities and Colleges of Canada (AUCC) help to unify academic institutions.

National Mobility Initiatives

CAGS has facilitated the development of two initiatives to improve graduate student mobility in Canada. The first is the Canadian Graduate Student Research Mobility Agreement (CGSRMA, 2005), which establishes a protocol for institutional recognition of visiting graduate research students; there are 37 signatories to this agreement, including all of the U15 universities. The second is the Canadian Universities Graduate Transfer Agreement (CUGTA, 1998), which provides students the opportunity to take graduate course(s) at another member institution(s) for (transfer) credit to their program.

Universities have formed consortiums to facilitate the movement of graduate students. The largest of such consortiums is known as the

Western Deans' Agreement. It involves all graduate schools in Western Canada and permits students to take courses from any university in Western Canada without charge. A smaller consortium of universities, which facilitates graduate course mobility, also exists in Ontario.

Global Mobility Initiatives

There have been a number of global initiatives. One of those initiatives is a collaboration between CMEC and DFAIT to develop the "Imagine Education in/au Canada" campaign, which is designed to promote the many reasons to study in Canada; these include (but are not limited to): internationally recognized qualifications, affordability, multicultural society, exciting campus lifestyle, and immigration possibilities.

In fall 2011 Citizenship and Immigration Canada (CIC) (2011) introduced changes to the Federal Skilled Worker program. The program aims to accept up to 1,000 international doctoral students per year as permanent residents on an annual basis. The Minister of State (Science and Technology) noted, "Doctoral graduates play a unique role in the economy. They drive research, encourage innovation and pass on their knowledge through teaching. And quite simply Canada needs more of them." To be eligible, students must have completed two years of doctoral level studies. These are encouraging words but not surprising given Canada has been turning to international marks to meet its demand for international doctoral students (importing about 5,000 per year). Canada also imports about 25,000 master's degrees per year, but a program has been put in place to fast-track permanent resident status for these degree holders.

The Science Technology and Innovation Council, which advises the Government on matters related to science and technology, advocated the creation of the Vanier Canada Graduate Scholarships (2012) to attract and retain world-class doctoral students and to establish Canada as a global centre of excellence in research and higher learning. Their value at $50,000 per year for three years is not insignificant in a Canadian context.

And then there are the Banting Scholarships (Vanier Canada Graduate Scholarships, 2012), which were implemented to "attract and retain top-tier postdoctoral talent, both nationally and internationally."

What is also noteworthy about the Banting scholarships is they are specifically focussed on developing an applicant's leadership skills to prepare them as leaders of tomorrow!

A lesser-known body is the Federal-Provincial Consultative Committee on Education-Related International Activities (FPCCERIA), established in 1986, and of late has focussed on foreign students in Canada, recruitment of international students to Canada, and making Canada an attractive destination to study.

Four of Canada's provinces (British Columbia, Saskatchewan, Manitoba, and Newfoundland) offer free health care to foreign students to make these provinces attractive choices.

Canada has focussed more heavily on attracting foreign talent to come to Canada than encouraging Canadians to get an international experience. If Canada wants to encourage Canadians to study abroad we should take a "page" out of the EU book!

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The Flow of Global Talent: Trends and Impact for the Countries of Central Europe

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Mobility Patterns and Emerging Trends

When talking about global processes, it is important to recognize regional and local aspects. Considering expressly the global flow of talent and trends impacting "global career paths" of graduate students, it is possible to point out experiences, problems, and sometimes even distinctive success stories specific to Central Europe. In fact, as "the global attention" seems to be focusing currently on other parts of the world, there are interesting developments in Central Europe that tend to be ignored.

In order to understand the developments in higher education in Central Europe (and in the larger Central and Eastern European region), including with regard to specific aspects in graduate education, it is important to understand what has been taking place in Europe more generally. I propose to consider three aspects that are relevant in this context:

1. Higher education reforms in Central Europe followed a stable path beginning in the early 1990's, making the whole process look logical and comprehensible, almost to the point of defining it as somewhat "predictable." At present, however, we are living through times of new changes and we witness the emergence of what could be different trends in higher education. I would state that the overall higher education landscape is becoming a lot less stable and "predictable" than it was for the last 20 years.

2. Countries of Central Europe operate in a trans-national framework for higher education; they are part of the European Higher Education Area that has been built through the Bologna process. The existence of this larger area affects directly the flows of talent in graduate education, and also policies and practices

with regard to graduate education, in all its aspects. Some EU initiatives, in particular the European Research Area, also contribute significantly to shaping this trans-national framework.

3. There are almost no nationally-initiated policies in Central Europe regarding the flow of talent, and almost no home-grown initiatives. There is very little that exists in terms of institutional initiatives and policies. Central Europe has followed and responded to developments and initiatives coming from Europe rather than proposing and promoting its own solutions. There are exceptions to this, however, including some elements of innovation.

The two decades since the fall of the Communist regimes in the region (1989-1990) represent a distinct period in the history of higher education in Central Europe, including with regard to the circulation of talent. Several identifiable factors have affected the flow of talent from, within, or to the region. On balance, this set of factors contributed to a net loss of talent. At present, significant changes are taking place in mobility patterns and the factors that explain them. Below is a rapid synopsis of some of the major trends during this period, with factors that help to explain them and elements of impact.

1. The fall of the Communist regimes and the transition to liberal democracies created new freedoms for all actors in higher education. A major aspect of this development was the possibility for young people to freely apply for a place of study abroad, a quasi-legal impossibility during the long Communist decades (with differences from country to country). Many young people, usually from among the most qualified and gifted, took advantage of this possibility and went to Western Europe and the U.S. The visa regimes, including preferential visa treatments applied by some Western European countries, placed restrictions on this possibility and also generated certain particular flows, with certain receiving countries being targeted rather than others. This was also influenced by ethnic, cultural,

political affinities or by tradition (Romanians would go to France, Moldavians would go to Romania, ethnic Hungarians from Romania to Hungary, Bulgarians would go to Germany rather than to other countries, etc.). The "end of the transition" and the accession of all former Communist countries of Central Europe to the EU makes it currently possible, at least legally, for students from these countries to go to other EU countries. While preferential destinations remain, the picture is a lot more diverse. For example, Romanians now go in large numbers not only to France, but also to England, the Netherlands or Germany. What has not changed, however, is the direction of the overall flow, which remains from East to West.

2. Once the project of the European Higher Education Area started in 1999 with the signing of the Bologna Declaration, a transnational framework was created that aimed among others at organizing, even ***directing*** intra-European mobility patterns (organized mobility with a clear agenda). The main instrument for this has been the Erasmus program, funded by the EU, which has several components. Intra-European student mobility (and to a lesser extent the mobility of academics) has been very high on the European **political agenda** during this time. Student mobility has been perceived and promoted by European policy makers **and politicians** as a major tool to support the creation of an integrated European labor market, to increase "employability prospects of students" (by exposing them to different academic, professional, and cultural experiences in more than one country within the Union). In fact, student mobility has been promoted programmatically as a tool to promote the creation of both a European ***demos*** and a European ***ethos***. The Erasmus program has developed as a tool to create a formal framework so as to go beyond "spontaneous mobility in Europe." It currently has an "external" dimension as well, aiming at facilitating mobility from and to non-EU countries, also with a specific agenda. Countries of Central and Eastern Europe took active part in this program. It is well known, however, that Erasmus mobility remains very

low in general, and there are particular problems with it in Central Europe. For this part of the world, for example, Erasmus meant **sending** more students to the West, rather than **receiving** students. The European Union set a very ambitious target as part of its 2020 Strategy, aiming for 20% of all students in the EU to spend time at another university during their studies. Some financial means are being mobilized to support this objective. It is not clear however whether this will succeed, despite the quasi-unanimous commitments of European governments. An extremely successful program started and funded by the EU clearly in order to attract talent from outside Europe is the Erasmus Mundus program. This program involves consortia of universities from within the EU; it is well funded and manages to attract outstanding students (mainly from outside the EU) who will study in at least two universities from two different EU countries. Some universities from Central Europe participate in this program and they were able to take advantage of the particular academic dynamic created by this project. The European Union, along with European professional and other organizations, have recently put in place mechanisms to systematically track student mobility, doubled by a massive effort to clarify conceptual aspects of student mobility in Europe. It should be said, however, that mobility outside Erasmus remains largely unmonitored.

3. Several countries from the region were able to compensate to some extent for the loss of talent resulting from students or graduates going west by receiving students or professionals from neighboring countries (e.g., ethnic Hungarians from Slovakia and Romania went to Hungary, Romanian-speaking students from Moldova went to Romania). For many such students this was perhaps the only possibility to go abroad. Most fluxes of this kind have largely dried out given that students now have the possibility to go to economically better-off countries further west.

4. Current demographic developments in the region (not different from other regions of the world) indicate a downward trend in the age groups who traditionally go to university, while efforts to reach out to non-traditional groups remain marginal. It is therefore expected that higher education enrollment will decrease in absolute numbers. The fact that many good students and young graduates continue to leave, may therefore become an even greater problem.

Current Impact

Practically all countries of the region are net losers of talent, be it promising students or qualified professionals. These countries' capacity to retain talent, let alone to replace lost talent, by taking part in the global competition, or by positioning themselves favorably in the global flow of talent, remains low. Efforts are being made, sometimes with government support or stimulated by the government to attract students from the Far East, or other regions of the world, in a variety of fields, but with very limited success. Some rare disciplines, like medicine, attract significant numbers of foreign students, from both East and West, with almost all of them leaving the countries in which they studied after graduation.

Brain drain from the region occasionally takes dramatic proportions. Such is the case of students in medicine, who leave for the West in large numbers. Medical education in the region usually provides good quality at lower cost than in the West. After graduation, poor career prospects at home coupled with better prospects abroad (in the West) result in many young medical professionals leaving, to the point where this has become a very prominent social and political issue in countries like Hungary, Poland, or Romania. The Hungarian government recently acted to increase significantly the salary of young doctors, although this measure still appears insufficient to stop them from leaving.

Since the fall of the Communist regimes, action by government, higher education institutions or other actors to stop brain drain has been rather scarce and with limited effects. There has been little innovation. As an exception, and in a kind of desperate effort, the Hungarian government tried this year to impose a legally binding contract to starting undergraduate

students in public universities (the overwhelming majority in the national higher education system) by which they would be forced to stay in the country for a certain period (i.e., double of the period they studied) or pay huge fines. The decree was contested on constitutional, procedural and other grounds (as going against the right to study and the freedom of movement) but it may still be enforced. In any case, a perverse effect is that many parents and high school students are now afraid that they would have to stay in Hungary after graduation if they start higher education here and are now even more than before considering going directly abroad. A kind of new "study-abroad" advisory industry emerged immediately after the announcement of this new initiative.

There are very few successful initiatives in the area of helping students from the region to return after having studied and/worked abroad. They are usually limited in scope and almost always promoted by non-governmental and non-university actors. Higher education institutions themselves have only rarely been able to play a significant role in this area. The most prominent of such initiatives are the institutes of advanced studies. Usually, they use innovative models adapted to national realities. Operating in Budapest, Bucharest, or Sophia as non-governmental initiatives, they manage to attract back or offer a chance to stay in the country to outstanding junior scholars (and sometimes senior too). Moreover, they also succeed in attracting scholars who are not from the region to spend time here and work with local teams or individuals, thus creating a unique dynamic that positively impacts not only research output but also career paths.

Trends and Impacts for Countries and Regions

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Educational Mobility

The flow of global talent has most often been described within the "brain drain, brain gain" paradigm, where one country or region recruits professionals and intellectuals (brain gain) at the expense of their country of origin (brain drain). In my view, this paradigm is problematic because in the current era, the increased circulation and mobility of talent represent an unavoidable consequence of globalisation which is reshaping the economic, political, environmental and social foundations of society. Education and research activities are now well and truly globalised undertakings. This is primarily because the way in which knowledge is generated and transmitted is becoming substantively globalised and ever-increasingly dependent on information sharing, collaboration and functioning networks. Education and research are critically dependent on our capacity to think beyond local and particular, and to source talent from the global rather than local pool of opportunities. This very same argument can be extended to businesses, countries and regions, in terms of strengthening their knowledge base and building different forms of capital.

Patterns of Mobility

Migration and mobility are the key features of contemporary globalised society and have for decades served to facilitate the continuous flow of global talent. At the aggregate level, the estimated number of people living outside their country of birth increased two-fold in 50 years to 191 million by 2005 (UNFPA, 2006). This increase in migration is driven by a number of factors including political and economic factors, demographics, the cheapening of transport and the increase in information and communication technologies. Education and research are rapidly becoming a source of major population mobility across the planet. It is estimated that in 2007

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there were 3 million students in the tertiary sector studying outside of their country of origin (a large increase from 0.8 million in 1975) (OECD, 2010). The UNESCO statistics shows that international student numbers around the globe continue to increase at 12% annually (Caughlan, 2011). The international mobility of doctoral students has also increased dramatically over the past decade, with non-citizens representing 40% of the doctoral population in Switzerland, New Zealand and the United Kingdom (OECD, 2010). In the U.K. alone, almost one million students are undertaking British degrees (Samuel, 2012), and in Australia in 2011 over half a million international students were undertaking higher education or vocational training (Australian Education International, 2011).

As a proportion of total tertiary-level enrolments, Australia attracted the highest percentage (19.5%) of international students in the OECD countries followed by the United Kingdom (14.9%), Switzerland (14.0%), New Zealand (13.6%) and Austria (12.4%) (OECD, 2010). For Australia in particular, the international flow of talent has produced a net gain of skilled persons. The net inflow of professionals in the eight year period from 1995/1996 to 2002/2003 was 112,547 including 4,069 university lecturers. During this period, Australia also experienced a significant outflow of professionals with 95,000 professionals leaving Australia for other countries including 2,964 university lecturers (Dobson, Birrell, Rapson, & Smith, 2005). This illustrates the ever moving flow of highly trained professionals.

Problematizing Brain Drain

In the context of globalised educational and research endeavours, any metaphor suggestive of one-direction flows is likely to be misleading. Due to the increase in migration and the continuous circulatory flows of global talent, the idea of brain drain no longer fits. This is not to deny that some societies and countries are disproportionately experiencing "drain." In countries like Somalia and Seychelles over 50% of nationals with a university education are living abroad (Kapur & McHale, 2005). The effect of these large scale migratory departures of skilled professionals range from economic disadvantages to loss of opportunity and a diminished capacity of country to build or enhance institutions which consequently

inhibits future growth.

The "brain drain" phenomenon implies one dimensional movement of the workforce from developing to developed countries and the negative effect discussed above is particularly pronounced when we assess this process from a short-term perspective. I strongly argue that the global flow of talent should be more accurately viewed in the medium to long term. For example, the IT sectors in India and China have shown that often the "export" of students and professionals can represent a long-term investment for countries through networks that link expatriate researchers to their home countries, allowing them to take advantage of this knowledge when circumstances require it.

As illustrated by Saxenian (2005), the U.S. educated engineers, IT professionals and entrepreneurs from Silicon Valley have in the past decade transferred technical and institutional knowledge to professional and business networks in both China and India and transformed these two countries in the process. While in the early 1990s China was known for small scale copy-cat internet ventures and India was seen as a source of labour-intensive software coding and maintenance, both countries today play a lead role in developing technologies and software for leading global corporations (Saxenian, 2005). This is possible through the educational and social capital gained by these professionals through their movements outside of their homeland and the networks that they maintain once they return. Similar examples could be given in relation to post-socialist economies of Eastern Europe, which attracted a considerable number of foreign-educated nationals after the break-up of the Berlin Wall.

Conclusion

It is important to problematize the idea of "brain drain." The flow of global talent has increased significantly due to the improved ability of professionals to travel overseas and network globally. This has accelerated the speed at which talent circulates around the world. While it is important to understand this process it is equally as important not be alarmed by it. As shown in the example above, the interaction between the expatriates and their home country can, when examined in the medium and long term, have a positive effect on the development of the home country.

The metaphor of "brain drain" no longer adequately represents the actual movement of academics or the needs of the global education enterprise. A circulatory metaphor is a much more appropriate description of current migratory flows of a highly a trained workforce. From the point of view of the modern research educational enterprise, this unprecedented mobility of students and academically trained workforce provides immense opportunities in terms of composing international collaborative teams, opening opportunities for professional and career planning, providing scope for more global impact of research, and most importantly, thinking of these developments within long-term opportunity horizons.

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Brain Circulation in Chinese Contexts: International Mobility of Postgraduate Students

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Introduction

The international mobility of tertiary students has markedly increased from 0.8 million in 1975 to nearly 3.7 million students in 2009 (OECD, 2011).[2] About 77% of these students study in OECD countries. The most popular destination countries for international university students in 2009 were the United States (U.S.) (18% of all students), the United Kingdom (U.K.) (10%), Australia (7%), France (7%), Germany (7%) and Canada (5%). Against the background of the burgeoning global mobility of students, I will consider issues related to the flow of talent with a focus on the People's Republic of China (PRC) and the Hong Kong Special Administrative Region. I will consider (i) destination countries of outbound students and (changing) push factors; (ii) the role of governments and tertiary institutions in attracting international students; and (iii) emerging and future trends in mobility patterns for outbound and inbound international students. For the sake of brevity, I will not consider Singapore and Macao, which are also Chinese societies with many internationally mobile students. My paper will discuss the PRC and Hong Kong separately given the differences in their education systems. However, they are both Confucian-heritage societies wherein academic achievement is highly valued and regarded as the path to upward social mobility.

People's Republic of China

The People's Republic of China is the source of the largest number of outbound international students in the world. Indeed, 30% of international students in 2009 were from either China or India (Choudaha, 2011,

1 This paper was written with the assistance of Professor Nirmala Rao, Associate Dean and Director of Graduate Studies, Graduate School, The University of Hong Kong.
2 There was an increase of 6% from 2008 to 2009.

2012). In 2009, China had 510,314 students enrolled in higher education institutions outside China. The top destinations for students from the PRC in 2009 were the U.S. (124,225), Japan (79,394), Australia (70,357), U.K. (47,033) and Republic of Korea (39,309) (UNESCO Institute of Statistics, 2012).

"Push Factors." Why do so many Chinese students go overseas for higher education? The State does not in any way hinder the flow of talent and a combination of factors related to the education system and the family (increasing wealth and the one-child policy in urban China) has fueled the growth of international mobility among Chinese students.

The Chinese education system is highly competitive and many students cannot get admission to the institution of their choice. Further, the rapid expansion of higher education in China has left concerns about its quality. These concerns coupled with increasing economic prosperity mean that tertiary students have the financial resources to study abroad (Choudaha, 2011). According to the 2011 World Wealth Report (Capgemini & Merrill Lynch Wealth Management, 2011), the number of High Net Worth Individuals (HNWI's) [3] increased by 12% from 2009 to 2010 in China. This translates to an addition of 58,000 HNWI in one year. A recent survey, the Hu Run Report (2012), conducted by a Chinese magazine, found that 85% of HNWI plan to send their children to study overseas. According to the survey, the most popular destination was the U.S. (27%), followed by the U.K. (22%), Canada (15%), and Australia (7%).[4] Thirty per cent of HNWI reported wanting to send their children overseas for high school, 30% for undergraduate education and 4% for postgraduate education. If children are studying abroad by high school, they are likely to continue further education overseas so it could be that over 60% of children from HNW families will be international students. The main reasons cited by these parents for sending their children abroad were to promote their all-round development (46%), to receive higher quality education (41%) and to enhance their creativity (23%).

Attracting International Students. The Chinese government has been

3 HNWIs have net investable assets of over US$1 million or more.

4 Other popular destinations were Singapore (5%), Switzerland (5%), Hong Kong (4%), New Zealand (4%), France (3%), Germany (3%) and Japan (2%).

encouraging the flow of talent into China. The number of international students studying in China has risen more than 400% since 2000 to 223,499 in 2008. Among these, 35.8% of these were studying in a degree-granting programme. While about 64% were studying the Chinese language, the rest were enrolled in degree programmes with Medicine, Business, Economics, Management and Engineering programs being the most popular. Among degree-seeking students, over 40% are pursuing an undergraduate degree with progressively fewer students enrolled in Masters and doctoral programmes (Sinograduate, 2012). In 2010, the largest number of international students came from South Korea, followed by the United States and Japan (Xinhua News, 2011). The Chinese government encourages mobility of international students through scholarships.[5]

Other strategies to encourage international students are the offering of English language degree programmes and the overseas Confucian Institutes. For example, the Chinese government is encouraging foreign students to study medicine in China in 27 institutions including Fudan University, Zhejiang University, Sun Yat Sen University that offer the MBBS curriculum in English. Students can either meet the Chinese language requirement and do their internship in China or go back to home country for their internship (CUCAS, 2012). This scheme particularly targets Indian students (China Education and Research Network, 2012). Another approach followed by the Chinese government to promote Chinese language and culture and perhaps higher education in China is through the Confucius Institutes. In 2009, there were 282 Confucius Institutes and 272 Confucius Classrooms in 88 countries and regions.

Emerging Trends. I posit that we will see a continuing increase in the number of Chinese students going abroad for the next few years despite the expansion of the local system and the demographic transition. Chinese parents will seek high-quality, all-round education for their children. The U.S. will perhaps continue to be the most preferred destination. Recent research by the Council of Graduate Schools found that that the number of applications from Chinese students to U.S. universities increased significantly and steadily between 2009 and 2012, notwithstanding a 5% decline in preliminary application numbers for the period 2012-2013

5 Over USD130 million is provided by Central and provincial governments in 2010

(Gonzalez, Remington, & Allum, 2012). The total number of Chinese students in the U.S. doubled from 62,523 in 2005 to 127,628 in 2010 (Institute of International Education, 2011). We will possibly continue to see an increase in the percentage of women going abroad for higher education. There is a well-documented son-preference in Chinese families but with single-child families and increasing affluence, parents will be as likely to invest in overseas education for a daughter as for a son. The National Outline for Medium and Long-Term Education Reform and Development (2010-2020) targets expansion of international cooperation and exchange among higher education institutions and we will continue to see an expansion in the number of inbound students.

Hong Kong

"Push factors." In 2009, 32,944 students from Hong Kong went to study abroad and the most popular destinations were Australia (12,925), the U.K. (9,600), the U.S. (8,192) and Canada (1,578) (UNESCO Institute of Statistics, 2012). The push factors in Hong Kong are similar to the PRC. Parents are willing to invest in an overseas education for their children.

Attracting International Students. With a population of seven million, Hong Kong has eight government-funded universities and eight private degree-awarding institutions. Overseas students, particularly those of Chinese origin and those from other parts of Asia are attracted to Hong Kong. A testimony to the quality of the universities is that four are ranked in the top 200 in the world by Times Higher Education (2012). There is also good funding for research postgraduate education and there were 9,245 inbound students in 2009. About 90% of these are from the PRC. Other places of origin of these students include Malaysia, Macao, South Korea, the U.S. and India. The Hong Kong Government launched the Hong Kong Postgraduate Fellowship in 2009 Scheme to attract the best and brightest students in the world to pursue doctoral education in Hong Kong's institutions.

Emerging Trends. Hong Kong is developing into a hub for tertiary education. The quality of postgraduate students in Hong Kong is improving

as indexed by the intake ratio and students are attracted by competitive tuition fees and scholarships. The government has also allocated new places for research postgraduate students. It is likely that Hong Kong will face tough competition from Singapore as the destination of choice for Asian students particularly in the light of "glocal" initiatives such as the Yale-National University of Singapore program. However, we do see Hong Kong as becoming an increasing popular destination for tertiary education particularly for students from Asia.

Universities in Hong Kong encourage their brightest undergraduates to go abroad for their postgraduate studies before returning to Hong Kong. I do think that the PRC and Hong Kong will continue to promote the international mobility of postgraduate students. At The University of Hong Kong, we have an international body of students. While about 53% of our MPhil and PhD students are from the PRC another 12% are from other countries. Our policies support joint PhD programs (e.g., with King's College London and Imperial College London) wherein students spend half their time in each institution also promote international student mobility. We see Hong Kong as having a "brain gain" rather than a "brain drain" and as a territory which promotes brain circulation.

China is expected to become the world's second largest economy. There has been a massive increase in investment in research and China is expected to lead the world in the production of scientific research by the end of the decade. Hong Kong, the gateway to China, will continue to be a desirable place to study for postgraduate students from the Chinese Mainland and further afar.

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Trends and Impacts for Countries and Regions

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"We still seem to use an apprentice system in which being a student of so and so is good enough. But we live in world where we can be a student of anyone we want, even if they are not teaching where we are learning."
—Ivan Karp, personal communication, 8/21/10

With this Summit's convening, we, the gathered leaders in graduate education find ourselves *in medias res* of an epic conversation on globalization's meaning, reach and understanding. By focusing on global career pathways and addressing the crucial need for "brain circulation" through graduate education, we are well placed at the heart of our story and our work.

The questions on mobility, impact, emerging trends and roles of institutions are at the same time subtle and conspicuous. The conspicuous aspects are informed with data. Institutionally and internationally we can chart distributions of student applicants and enrollments, placements post-graduation, and the sectors and industries in which they are represented. How our institutions interact, relate, and collaborate to create one-way and/or bi-directional exchange and support of talent is as well easily observed, with disciplined collection and sharing of data.

We might best start our conversation on the more subtle aspects by asking whether we have a common understanding and/or meaning for international and global. From a North American perspective, for decades and decades, perhaps most of the last century, we have created structures and pathways that defined our role as providing graduate education ***for*** the world, mostly based on the Germanic tradition and apprentice model for graduate education. This perspective and the way it was developed in North America beyond the German 19th century tradition may well be considered an ***international*** one. And, by international I mean to say that North American standards and structures were primary, that students were attracted to work that drew its strength from content and structure defined

by what was in place. A contemporary approach, with understandings of content, structures, and processes for graduate education will mean that we, in North America, must define ourselves as participants of graduate education ***in*** the world. This perspective, then, might well be considered a more or less global one.[1]

The global then, by necessity must be understood in a fuller complexity. This means the curriculum, pedagogy, boundaries defined by discipline and field, faculty collaborations, and institutional policies need adjustments, indeed innovations, beyond the existing flexibility for international exchange or participation of students and faculty. In terms of the questions posed at this Summit, the ***role of institutions***, then, is perhaps one of the more central. The flow of global talent in a global knowledge economy will be tied to transformations that bring us beyond the international, beyond the linear or even bi-directional exchanges. Situating graduate education in global contexts means understanding structures for learning and research that are pluralistic rather than harmonizing, that advance collaborations without dominating legacy structures, while at the same time upholding highest standards for scholarship and scholarly integrity and research and the responsible conduct of research.

Defining the global structures needed, discovering the innovations to curriculum, pedagogy, use of new media, technologies, the role of libraries, and transforming the boundaries between nations and states is at the heart of advancing "brain circulation and talent flows." The categories we use to discuss, study, and analyze what we do are akin to a type of "global legibility"[2] described by MJR Montoya (2010), for new structures and processes that go beyond our legacy institutions.

It is fair to ask at this juncture, "what is it then that we should be doing?" The answer is that there is no easy or apparent answer. The ***process*** of figuring out the systems that improve the flow and support the circulation of global talent and prevent the "inter-nation" drain of talent is part of the answer. Process is, in part, what gives us the sense of the possible, the achievable. Having the right individuals convened, asking the right questions, with access to some of the right resources will bring

1 This idea, of the distinction between graduate education **for** the world and graduate education **in** the world, is attributed to Dr. Debasish Dutta, Dean of the Graduate College and Associate Provost, University of Illinois, Champaign-Urbana.

2 The term global legibility is from the work of MJR Montoya (2010).

answers – the productive innovations and interventions – for advancing graduate education in global contexts and for global good.

How can graduate education be flexible and bold and maintain the highest standards for discovery and imagination, for technological and scientific preparation, for prevention, care-giving and cure? Where do we start in examining the boundaries and limits before us? What political economic structures, policies and practices will we need in order to minimize brain drain and maximize the fuller circulation of talent?

The author thanks Professor Corinne Kratz, Emory University, Department of Anthropology and Melissa Gilstrap, Laney Graduate School for their contributions.

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II. UNDERSTANDING AND SHAPING GLOBAL CAREERS

Summary of Papers and Discussion

The second panel of the Global Summit focused on the role of graduate schools in supporting global career pathways for graduate students. Particular emphasis was given to successful strategies for information-gathering and communication, two essential ingredients of any campus-wide effort to understand the aspirations of students and support their transitions to successful careers. Presenters addressed three topics and sets of questions:

- *Institutional Efforts:* How does your institution understand the future career pathways of graduate students in the global knowledge economy? Is this understanding informed by data, university mission, government, or other stakeholders? How does your institution support cultural diversity? Does your institution take measures to support brain circulation instead of brain drain and gain only?

- *Career Expectations of Students and Faculty:* To what extent do students and faculty at your institution see their future career opportunities as restricted to a particular location? Do they have ambitions to work in, or serve, countries or regions outside their home country? How can institutions help students to consider

a broad range of opportunities for achieving global impacts in their careers?

- *Impacts of Technology on Global Career Pathways:* How is technology changing the way your institution conceives of a global career? In what ways can technology support global networks between institutions and external stakeholders? How can institutions use technology to help students develop global skills, create global networks, or participate in global research and development projects?

Many participants stressed that efforts to orient graduate students to professional training and career opportunities are most successful when they involve the diverse groups that shape students' experiences on their paths through graduate school and into careers. Such groups include, but are not limited to, leaders of international offices, faculty involved in research collaborations and joint and dual degrees, alumni, and future employers. The following summaries of each sub-panel outline a range of possibilities for engaging these groups and others.

Institutional Efforts

Helping graduate students to imagine career prospects that go beyond their national home or institution is an effort that must be reinforced and supported at many institutional levels. **Patrick Osmer** (The Ohio State University) explained that his institution has developed a number of initiatives that directly or indirectly encourage the two-directional flow of students and faculty, a goal aligned with the university's international mission. On campus, these include promoting diversity through the campus Office of Diversity and Inclusion and supporting the development of joint and dual degree programs. Off campus, Ohio State has developed gateway offices in China and India that facilitate connections between the university's undergraduate and graduate programs, alumni, and corporate partners that share business interests with the state of Ohio. Successful international partnerships, Dr. Osmer noted, are long-term relationships in which each side contributes to the success of the collaboration.

Career Expectations of Students and Faculty

To be successful, institutional activities to support global careers must be based on an accurate understanding of student and faculty career ambitions. Robert Augustine (Eastern Illinois University) sought to learn more about these groups by inviting faculty leaders to reflect on the ways in which they formed their own expectations for a career involving international research and travel. Dr. Augustine noted two particular factors that have inspired his institution's faculty to embark on globally-oriented careers: international experiences, including study or internships abroad, and the development of global networks. First-hand experiences with the benefits of a global career often inspire faculty to get involved in international recruitment and to initiate international partnerships with graduate programs abroad.

Understanding graduate students' aspirations for a global career also requires a close look at students' career ambitions within various employment sectors. The paper by **Brenda Brouwer** (Queen's University) addressed the dual challenges of encouraging students to orient themselves to global career opportunities and encouraging them to consider non-academic pathways.[1] Dr. Brouwer observes that, in spite of national efforts in Canada to demonstrate the need for PhD graduates in a range of positions supporting knowledge production, most Canadian graduate students continue to view tenure-track academic positions as the preferred career pathway. Citing data from her own university, she notes that this student view may be reinforced by faculty who present academia as the only or the preferable career track. Dr. Brouwer's paper describes a "three-pronged approach" for addressing these challenges at Queen's University.

In discussion, participants gave particular attention to the need to integrate professional skills training into graduate programs. While many programs introduce students to a broad range of skills, professional training programs often do not address the full range of challenges that students will encounter in their careers. **Ernst Rank** (Technische Universität München) invited participants to rethink the value of generic skills like "leadership" or "team-work" in a global context, emphasizing the "need to train [future leaders in society and academia] not only how to work in

1 Dr. Brouwer's paper was delivered in abstentia.

these international teams, but also how to run these international teams."

Impacts of Technology on Global Careers

The ability to support graduate students in their transitions to global careers requires an increasing awareness of the impacts of technology on the ways in which graduate students learn, conduct research, and develop professional networks and identities. Participants identified two major ways in which technology is shaping the career choices of graduate students and alumni. First, technology-enabled tools are changing the thinking, expectations and social processes of current and future graduate students, a well-known trend that also changes the way students approach their educational and research opportunities. Second, many of these tools are creating new opportunities for students, faculty and institutions to participate in collaborative research and educational programs.

In a presentation exploring the current and future impacts of these technologies, **Rodrique Gauvin** (ProQuest) identified a number of trends that both universities and employers are facing today. New technologically-enabled learning tools such as Massive Open Online Courses (MOOCs) and collaborative research tools have great potential to "extend the university into the global environment" and "place the student in a global network where they will develop the sort of communication, collaboration and problem-solving skills that will position them for success." At the same time, universities have an important role to play in preparing graduate students to engage with such tools responsibly, and in a way that enhances their learning and preparation for careers. As Mr. Gauvin put it, universities provide the "context and understanding" that makes the content of technologically-delivered information more meaningful.

The presentation sparked a discussion of benefits and risks that graduate leaders must consider as they consider the impacts of technology on programs and faculty. Participants also urged the need to find the right balance of technologically-enabled communication and collaboration and "face-to-face" contact. Meeting in person is still a crucial part of professional collaboration, Dr. Osmer noted, since communication involves both verbal and non-verbal cues. He added that face-to-face conversations can provide the basis for communication through email and other communication

platforms such as Skype. **Martin Bendsøe** (Technical University of Denmark) suggested that one way of assessing the value of technology to student learning is to use a skills qualifications framework to determine whether technologically-enabled tools are appropriate modes of teaching all skills and attitudes, including those associated with social awareness and attributes.

Conclusion

Globalization has clearly changed the career opportunities of graduate students and future knowledge professionals, but understanding these options often requires significant shifts in thinking. Communication and engagement by graduate leaders is critical to ensuring that the graduate community supports "brain circulation" in its most positive sense. This view was reflected in the first consensus point developed by summit participants[2] and developed in subsequent sessions.

2 See Appendix A.

Promoting Global Career Pathways at The Ohio State University

Patrick S. Osmer
Vice Provost and Dean of the Graduate School
The Ohio State University

In this paper, I describe institutional efforts at The Ohio State University to promote global career pathways. Ohio State is a public, land-grant research university and is one of the largest and most comprehensive universities in the U.S. Its total enrollment, including 10,000 graduate students, is 64,000 students, and its main campus comprises the activities of its largest college, arts & sciences, six professional colleges, and seven health-science colleges together with a large academic medical center. Ohio State is in the midst of a major strategic effort to strengthen its international programs.

How does your institution understand the future career pathways of graduate students in the global knowledge economy?

At Ohio State we are giving high priority to understanding the range of career pathways available for our graduate students and improving our support for students to pursue them. The recent CGS/ETS reports on the future of graduate education and on pathways through graduate school into careers provide fundamental information and recommendations for our efforts.[1] In parallel, strengthening international partnerships at the graduate level is also a high priority for our graduate school.

Developing strong, effective international partnerships for graduate education and providing high-quality, meaningful international experiences for our graduate students has become an essential part of graduate education at our university. Furthermore, these international experiences must involve flows of people and information in both directions, i.e., to Ohio State from our partners and also from Ohio State to our partners. In many areas of international activity, the flows of people during the latter part of the 20th century from abroad to the U.S. dominated flows in the opposite direction. In the 21st century, though, I am convinced that flows must be balanced to achieve the most valuable outcomes.

1 See www.fgereport.org and www.pathwaysreport.org

As other nations invest in and build up their graduate programs, as many multinational companies direct outside the U.S. investments for research and development and increase their international business efforts, and as career opportunities for graduate degree holders increase outside the U.S., I have realized that many of our graduate programs must adapt and develop international components for their students if they are to prepare them to succeed in today's globalized world.

Some of our specific activities are: improving career services for our graduate students; supporting the development of new, professionally oriented master's programs; supporting options for alternative careers at the doctoral level; working with our graduate programs to track the placement and careers of our graduates; supporting the development of international dual degree programs at the graduate level, e.g., in translational plant sciences with the University of Sao Paulo; and participating in Ohio State's new international gateway offices, which also involve our alumni and collaboration with Ohio's international business activities.

Is this understanding informed by data, university mission, government, or other stakeholders?

This understanding is informed by data on admissions, enrollment, and job placement and activities of our graduates. It is also informed by Ohio State's developing international mission and the resulting activities, such as the opening of our gateway offices in China and India. We are also mindful of governmental initiatives at the federal and global level for graduate education, e.g., Brazil's Science Without Borders program, and China's fellowship and scholars programs. We also work with national and international corporations on international programs that connect with Ohio.

This understanding has developed as part of the university's strategic decision to make internationalization an important part of its mission and by data that show both where our strengths are and where we need to improve if we are to become a stronger international university.

Ohio State is expanding its global reach by:

> Developing an international experience for undergraduate, graduate and professional students; Promoting scholarship on major global issues; Increasing the percentage of international faculty and students; Creating international dual degree programs; Developing an international physical presence; and Promoting collaboration with Ohio's international business ventures. (The Ohio State University Office of International Affairs, 2012)

How does your institution support cultural diversity?

Ohio State has a longstanding tradition of support for tolerance and diversity. Its activities at the university level are led by its Office of Diversity and Inclusion. The Graduate School's program of recruiting and diversity is the university's hub of resources and activities for diversity at the graduate level. The Ohio State's Office of International Affairs provides a broad range of support programs for international students and scholars. With over 6,000 international students from over 100 countries in attendance during the academic year and with more than 1,600 international scholars on campus, Ohio State has a truly global environment on campus.

Does your institution take measures to support brain circulation instead of brain drain and gain only?

The above mentioned points are examples of goals that support brain circulation as opposed to a simple flow of brain drain or gain. Successful international partnerships are built on long-term relationships in which each partner makes complementary contributions. At the research and doctoral level, such partnerships normally begin with faculty-to-faculty collaborations on research topics of mutual interest. Then, graduate students begin to participate as the research activities increase. The partnerships are strengthened through exchange visits in both directions and often with workshops that bring the partners together to present results of their research and to discuss future directions for their research programs. At this point, exploration of dual or joint graduate degree programs can begin, and from these discussions eventual agreement is reached on establishing a dual or joint degree program. This in turn provides a basis for solidifying the partnerships on a long-term basis.

Under the leadership of William Brustein, vice provost for Global Strategies and International Affairs, Ohio State is developing a broader institutional approach to its international activities through the establishment of gateway offices, first in Shanghai and most recently in Mumbai.[2] These offices are intended to serve as portals and hubs for Ohio State's activities in China and India for graduate, undergraduate, and alumni programs and for the business and corporate sectors that connect with the state of Ohio's business interests. These gateway offices thus offer broader opportunities for Ohio State students and alumni that can tie in directly with their career development. For example, Ohio State alumni working for companies in the countries where we have gateway offices can facilitate the development of internship and training programs for our students. Conversely, the offices provide links to our research programs and graduate students who may be able to work on projects needed by corporate partners in the foreign country.

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2 More information on the gateways is at http://oia.osu.edu/gateways.html

Experiences for Launching Global Careers

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Dean of the Graduate School
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Eastern Illinois University (EIU) is a master's focused public institution serving approximately 11,000 undergraduates and 1,500 graduate students. The University currently offers 27 graduate degrees and 8 post-baccalaureate certificate programs. Although domestic career pathways continue to outpace global career pathways at Eastern, an expanding nucleus of graduate students and faculty have resumes that include careers abroad and many have strong ambitions to launch their careers outside of the United States or to extend their careers to those opportunities that are available globally. In order to research the question posed by the Summit leaders, I held a seminar with selected leaders of graduate education and invited them to share key factors that shaped their own ambitions to seek a career beyond the United States and to identify critical experiences that encourage our current graduate students to pursue the most promising career pathways anywhere in the world. Below is a summary of my findings.

Faculty who have resumes that include a career experience abroad studied disciplines that require world-wide focus to launch and advance a career, and this is integrated into the culture of educational experience. Faculty from certain disciplines were most likely to have completed a career opportunity globally. These disciplines at Eastern include the fine arts, business administration, technology, family services, kinesiology and sports studies, economics, and biological sciences. Not only have some of the domestic faculty in these programs enjoyed careers abroad, the current faculty in these programs include a rich international diversity that promotes an integrated culture of global integration into the graduate education experience. Faculty who had held positions outside of the United States offered these experiences as essential to helping them find and secure positions abroad.

- *Global Experience:* A key factor for promoting the launch of a career or extension of a career abroad for current faculty included

the requirement or expectation to engage in the discipline outside the United States. Typically this took the form of an international experience, such as an internship, which provided guidance on how to transition from the global experience to a global career. For example, Dr. Marilyn Coles, Professor and Graduate Coordinator of Music, explained that studying abroad in Paris and two summer vocal institutes in Graz, Austria led to auditioning for her first professional position in Germany. Her 10-year career in opera and her mastery of the German language provided access to a network of professionals from across the globe, further enhancing her career. Her global resume now serves the graduate program at Eastern as Dr. Coles uses her multiple international experiences to initiate an international partnership in Salzburg. Furthermore, she is also intentional about recruiting graduate students in music from around the world and actively promotes how a career abroad is an essential part of a musician's experience. She and other faculty emphasized the value of international experiences such as study abroad, institutes, or internships as key pathways toward achieving a global career.

- *Global Networks:* Another key factor for promoting globally-focused careers includes a globally networked faculty. Graduate study in economics offers an excellent example of how faculty members with global networks motivate globally-focused careers. The program hosts a dual graduate degree with the College of Economics in Jinan University, China. The dual degree option includes faculty and student exchanges so faculty obtain valuable experience teaching in China and students learn how to engage in international life. In addition, students and faculty have joint research projects and opportunities to hone their language and cultural knowledge of China. Faculty noted that developing a network of global colleagues and strengthening their language and cultural skills are keys to a pathway toward a global career. Similarly, students who complete the program now view China as a pathway toward a career in economics.

Achieving significant progress for expansion of global career opportunities for current Eastern students requires short-term and long-term investments. Those listed below were among an impressive list of actions we may take to enhance career expectations for both globally-focused programs and programs that are not yet considering global career pathways.

- *Enhance Global Integration:* Graduate program leaders would benefit from more intensive development programs that offer best practice models for integrating global career pathways into the curriculum. Study abroad, global internships, global networking, globally-focused research opportunities integrate globalization into graduate education. The University has examples of existing best practices that may serve as a starting point for broad campus participation. Developing an annual program or online resources to share these practices among the leaders in the graduate community would expand consideration of global career opportunities for our students. Hosting a campus-wide global summit could be an effective first step toward achieving global integration that would better serve our graduate programs.

- *Expand the Global Ambassadors Program:* Eastern currently hosts a Global Ambassadors program to recognize outstanding achievements of international alumni who have launched careers abroad that made significant contributions to their disciplines. We should now expand that program to include recognition of domestic alumni who pursued global careers and have made equally impressive contributions to their disciplines. Sharing the career pathways of both international and domestic alumni who have advanced ideas globally would provide strong support for current students to consider a global career. In addition, the Graduate School might consider ways to share the careers of faculty who have experience working outside the United States with the entire graduate community.

- *Global Mentors Network:* The University enjoys a close relationship with faculty members on campus who have professional colleagues and mentors abroad. Likewise, the University enjoys strong ties to global internship supervisors and advisors who work abroad. Creating an EIU Global Mentors Network that students and faculty pursuing careers abroad could use as a support system when moving to an international location would strengthen their support for considering a global career.

- Globalization of Professional Credentialing: Eastern hosts many professionally focused masters' programs such as the Master of Science in Counseling. These programs culminate in American certification and licensure that has not yet been broadly duplicated abroad. As a result, a student who wishes to pursue a career abroad in one of these disciplines is discouraged from doing so because of the negative career impact of failing to achieve or maintain certification and licensure. Colleagues suggested that the disciplines need to create reciprocal credentials globally in order to create seamless pathways to global careers.

- Language and Cultural Training: Currently, Eastern is not offering enough opportunities to graduate students to improve their foreign language and multicultural knowledge. In addition, while 70 undergraduate classes are visited each year to promote study abroad, graduate opportunities are less emphasized. Enhancing language and cultural knowledge, integrating international experiences into graduate study, and using technology to further enhance cultural knowledge will further support a student's desire to consider a global career.

In conclusion, the leaders' seminar assisted with identifying both short-term and long-term actions that the Graduate School at Eastern will consider in order to promote global circulation of graduate talent.

Global Career Pathways: Do We Really Understand Career Expectations of Students?

Brenda Brouwer
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The truthful answer is probably no, though we might think we do. Terms such as global engagement, leadership and/or impact are ubiquitous in university vision statements and consistent with such goals is the growing emphasis on internationalization and mobility. Opportunities for faculty and graduate students to participate in international collaborations, to gain global perspective and experience in their scholarly pursuits in the context of a culturally, economically, and politically diverse world are highly valued and strongly endorsed by senior administrators. The global demand for talent and innovation motivates universities to develop global citizens and graduates who demonstrate a high degree of "global mindedness" which at a very practical level, should enhance their employability in various domains. Furthermore, it seems to have been accepted that because of the growth in student demand for international experience, the increase in funding opportunities for internships and research exchanges abroad, and the rise is student mobility (Association of University and Colleges of Canada, 2007) that graduates would embark on more global career pathways. In fact, there is little evidence that career expectations or planned mobility post-graduation has shifted in any substantial way in over a decade.

The majority of those enrolled in doctoral programs in Canadian universities plan on landing a tenure-stream position; it remains the career path of choice. In fact, the proportion of PhD candidates aspiring to join the professoriate has increased by about 10 percentage points from 2000 to 2005 even though the proportion of PhD holders employed as university professors continues to decline (Tamburi, 2010; Desjardins, 2012). The media, academic publications, and government reports are rife with statements advocating the need for PhD trained workers to advance

knowledge in a global economy, yet the message does not appear to have trickled down to the aspirations of our graduates.

Statistics Canada profiles employment and mobility of doctoral graduates from Canadian Universities (Desjardins, 2012). The most recent report confirms past trends showing that one in five graduates consider leaving Canada for postdoctoral studies or employment, mainly to the United States. Almost 30% return after two years. Among PhD graduates from Ontario Universities and who resided in Canada prior to starting their degree, a whopping 74% remained in Ontario two years post-graduation; higher than the trend in the rest of Canada and somewhat higher than was the case in 1995. Not what one might expect when mobilizing talent is an oft cited goal; however the excellent employment growth experienced in Ontario from 2000-2007 (13%) (Drummond Report, 2012) likely contributed in part to the regional retention of graduates.

In terms of careers, 90% of the PhD graduates from Canadian universities were employed with a distribution of 40% to 62% in private sector, government, technical or health/social service depending on the discipline of study (Desjardins, 2012). Between 17-27% felt they were over qualified for their job; the mismatch between educational attainment and job skill is of concern since students identify intellectual challenge as something they value in a career.

The limited data from our own doctoral graduates at Queen's University mirror similar trends. Faculty supervisors mentor their students to become researchers; many fail to acknowledge the possibility of a career other than in the academy while others do not believe they have a role in preparing students for careers. Not surprisingly then, students' expectations are rather narrowly focused on academic employment notwithstanding the realities of the job market and the stated institutional goal of preparing leaders for a global society. So how does one reconcile different outlooks and position graduates to compete favourably for jobs in a variety of domains and locales? Reset the expectations so they align with market realities, engage the student in career planning, and prepare them for a global job market. The obvious next question is how?

At Queen's we have adopted a multi-pronged approach including three main graduate initiatives. First, building on the Province of Ontario's Quality Assurance Framework that articulates degree level expectations

(DLEs) for all degree levels, each academic program must describe what their master's and doctoral students will have achieved upon completion and identify career paths. These DLEs are available on the web informing current and prospective students about what to expect from their program and future prospects. Second, to support the academic, personal and professional success of graduate students in their early, mid and late stages of their programs, a centrally organized series of workshops and seminars in each of six skill and competency areas are offered (Queen's University website, 2012). Career planning and social responsibility including diversity, inclusivity, and cultural competency are examples of topics covered under the Expanding Horizons banner to prepare students for their future roles in a globalized economic environment. Third, opportunities to bridge students' academic training with real world applications are strongly encouraged and promoted. Partnerships with MITACS and FedDEV (organizations supporting internships with industrial partners, non-governmental agencies, and business enterprises) support internships that enable graduate students to apply their knowledge in non-academic environments exposing them to alternate career paths. International experiences through exchanges and visiting studentships are also facilitated though funding support can often be a barrier to these initiatives.

Approaches such as those described above can be found at many Canadian institutions, though data on their impact on students' career expectations, aspirations and ultimate career choices are needed. Considering the investment in internationalization, evidence that our graduates are prepared for and increasingly seek out careers that afford global perspective and impact is essential.

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Technology and the 2020 Workforce: Global Careers in the Transnational Era

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ProQuest

In their insightful forecast of *The 2020 Workforce*, Jeanne Meister and Karie Willyerd (2010) describe the changes our economy is experiencing as technological and demographic developments transform the nature of work, the organizations that do it, and the skills required to be successful at it. They describe a world that would be difficult to imagine if it were not only eight years away. But given the technological developments across the last decade, it feels like a well-grounded assessment of where we are going. Moreover, it offers some profound challenges to institutions of higher education as they prepare the next generation of graduates for it. The good news, no matter how disruptive all this might be, is that universities are well situated to play an integral role in embedding technology in learning while deepening their commitment to developing well-rounded thinkers.

What could possibly be so different about a workforce just eight years away? Meister and Willyerd (2010) argue we can expect a workforce comprised of five generations working alongside one another, as older workers retire later and millennials arrive on the scene. It will be a workforce where the entering associates will be using technology far more sophisticated than the companies that hire them, thus driving a "bring your own device" culture that threatens to upset IT departments and planning. It will be a context in which it will be possible to acquire, use, and integrate talent from around the world even while connecting this workforce to anyone, anywhere, at any time, leading to asynchronous collaboration and the diffusion of virtual teams within and across organizations of all sorts. Beyond the demographic shifts in which millennials will comprise more than 47% of the workforce, and will bring women into the majority, it will be a workforce so embedded in a knowledge-based economy, and so dramatically shaped by globalization, that it will demand that companies embrace digital workplaces, the ubiquity of mobile technology and a

1 As of this volume's publication, Rodrigue Gauvin is a consultant for publishing companies serving the academic community.

culture of connectivity. Meister and Willyerd (2010) tell us this will blend the line separating work and leisure time, coining the phrase "weisure time" to describe the new reality. It will be a workforce whose embrace of social media will have led it to adopt a "participatory" approach to everything, and thus not be willing to wait for exciting new appointments and responsibilities or for structured and centralized learning experiences. In short, it will be dynamic, energetic, entrepreneurial, a little bit unfocused and most likely difficult to manage.

As challenging an environment as that is for me as a businessman, it is equally challenging to you as leaders of higher education institutions. While I may be affected by all those changes in 2020, you are already feeling its effects because the drivers of this change are now students at your universities. They crowd your lecture halls, drain your broadband capacity, demand the flipping of your institutional teaching model, and are hungry for new skills that will prepare them for 2020 and beyond. Meister and Willyerd (2010) point out that this new generation needs a technologically integrated education that emphasizes problem solving, the development of judgment, data analysis, relationship building, collaboration and communication. By 2020, with the rise of the global workplace, they conclude that there will be a shift from transactional work toward more value adding work that will demand higher- order skills— skills that they argue are perfectly suited for a generation nurtured on technology and skills that can be developed using technology. In the knowledge economy of 2020, for instance, knowledge workers will spend more than one day a week looking for information. Therefore developing their ability to find credible, authoritative information, analyze and synthesize that raw information into insightful conclusions and then apply it to real-world problems should be the central focus of learning institutions today.

Fortunately, technology is perfectly suited to help. The emergence of learning simulations and game-driven approaches to teaching support the kind of project-based experiences that will prepare today's students for tomorrow's global careers. When coupled with further developments in lecture capture, audience participation technology, social media-based collaborative tools, Massively Open Online Courses (MOOCs) and emerging research tools that support analysis and synthesis "in the cloud" (tools like Atlas.TI, Mendeley, and other annotation applications), these

technologically intermediated learning approaches extend the university into the global environment. In doing so, they place the student in a global network where they will develop the sort of communication, collaboration and problem solving skills that will position them for success. By using technology to disrupt traditional learning models, extend the learning environment beyond its institutional borders, and connect students to a new world whose economic drivers are more likely to be non-Western and multi-cultural, universities will be sure to ride this wave productively into the future rather than crash against the shore of the new reality in 2020.

Now, as much as I appreciate Meister and Willyerd's (2010) book, I believe that in many ways this is not unprecedented, and that, as Kent Anderson (2012) tells us, "cultural precedents largely withstand the whims of technological change," meaning that technology will always have a secondary role to the cultural goals of scientists and academics. So, with all this cheerleading for technology, allow me to conclude with a reference to Howard Gardner's (2006) wonderful work *Five Minds for the Future*, his delightful essay on the intellectual mindsets necessary for success in the future and, in my opinion, a trenchant argument for the university's traditional role in developing the "whole person." He tells us that the future will demand leaders who have developed the following "minds": **disciplinary, synthesizing, creating, respectful** and **ethical**. In other words, content mastery will not go away but in fact will be more important than ever, and when coupled with the synthesizing mind, the ability to integrate ideas across categories and boundaries, and the creating mind, the capacity to uncover and clarify new problems, questions and phenomena, students will need universities to manage the vast amount of information that now exists, test their knowledge in "safe" reality-based contexts, and communicate their learning with collaborators around the globe.

So in a world awash with data and drowning in "voices," how does a mature person make decisions and choose between alternatives? In a global environment with no borders, what does citizenship mean? Clearly, there is a role for technology here, but teaching students judgment and the softer skills of perspective, respect and ethics remain vital. Creating an awareness and appreciation of differences among people, and teaching them to fulfill their responsibilities to each other as citizens of a global

community is central to the university's mission and more important than ever for a global career. And there is good news in all of this—as I said, none of this is unprecedented! As Chad Wellmon (2012) tells us in "Why Google is not making us stupid or smart": "technology is neither an abstract flood of data nor a simple machine-like appendage subordinate to human intentions, but instead the very manner in which humans engage the world" (p.69). People have always engaged with technology, been overwhelmed by it, thought that the next innovation would "change everything" and in the words of some, "move us into a post-humanist" era. But the importance of people and how they interact with technology has never been attenuated. In other words, in the 2020 workforce, successful people will succeed less because of technology per se and more because of their ability to mediate technology to support their development of insight, perspective and knowledge.

This is true because for centuries universities have played a critical role in helping people navigate the difficult decisions regarding technology and its uses, whether that technology was the printing press or the internet. And by doing so, universities have prepared centuries of men and women to live in a world that has, seemingly, always been threatened by technology and information overload.

So yes, technology can help prepare the next generation for global careers—by supporting this generation's desire to participate, express themselves via blogs, build collaborative solutions via wikis and take learning outside the classroom and embed it in community-based challenges. Technology can mediate these experiences, marshal the resources to execute them, and gather the outputs for further analysis and dissemination. Individuals with experience in such a technology-mediated learning environment are more likely to succeed in the workforce of 2020 and beyond. But ProQuest's perspective is that universities will continue to provide the all-important context and understanding without which the technology would be useless anyway. The good news is that a truly global career awaits the person who can understand the nuances of the relationship between culture, technology and knowledge.

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III. THE DEVELOPMENT OF GLOBAL SKILLS

Summary of Papers and Discussion

Higher education leaders and policy makers frequently use the terms "global skills" or "global competencies" to describe the abilities that will enable students to solve problems of global scope and to engage productively with international colleagues. While these terms reflect the aspirations of a global era, such skills and competencies are not always well-defined at the graduate level. The task of articulating valued skills presents a number of practical challenges, including a lack of consensus about the general value of learning outcomes to graduate programs and the need to respect variations in learning objectives by degree level, type and field.

Nevertheless, graduate leaders were able to arrive at some general values relative to global preparation at the 2011 Global Summit on Career Outcomes for Graduate Students, convened in Hong Kong the year prior to the 2012 Global Summit in Germany. In the 2011 forum, summit participants agreed that "(post)graduate institutions require a solid understanding of the conceptual and personal skills required to lead and contribute to the global knowledge community. These skills must be deep (within disciplines and fields of research) and well as broad (transferable to a range of professional activities)."

Topics and questions for the three subpanels of Panel 3 built on this foundation, inviting speakers to provide examples of specific global skills and training models both broadly and within different fields if study:

- *Defining Global Skills:* What broad skills/which mindset will master's and doctoral students need in order to succeed in the global knowledge economy? What successful models exist for preparing students? How can graduate leaders encourage the involvement of faculty in the definition or assessment of these skills?

- *Global Skills and Careers I:* Science, Engineering and Medicine: What special preparation and skills do students in these fields need in order to pursue successful global careers? How can programs ensure that students are prepared to serve both local and global contexts? How can the outcomes of this preparation be assessed?

- *Global Skills and Careers II:* Social Sciences and Arts and Humanities: What special preparation and skills do students in these fields need in order to pursue successful global careers? How can programs ensure that students are prepared to serve both local and global contexts? How can the outcomes of this preparation be assessed?

Readers will find that Panel 3 papers give as much attention to the delivery mechanisms used to provide graduate students with global training as they do to specific global skills. Fundamental questions raised here about curricular content and approaches to training may be of particular interest to those seeking to enhance graduate curricula with internationally-oriented training and experience.

Defining Global Skills

In a presentation focused on the relationship between national and university contexts, **Bernard Tan** (National University of Singapore) observed that the "cosmopolitan" economy of Singapore offers graduate students incentives and opportunities to enter a global workforce. NUS nevertheless considers it a high priority to promote two-directional flows of students to and from the country and university. Joint doctoral

and master's programs, along with travel funding to attend international conferences, are designed to give graduate students "the ability to see issues from different perspectives" and the skills to conduct joint research.

Programs with an international training component also enable graduate students to develop specific skills of professional practice, as **James Wimbush** (Indiana University) demonstrated. Describing a program in international law, Dr. Wimbush explained that first-year students learn to work with private firms, NGO's and agencies in India, China and Brazil to learn international legal contexts and address the needs of communities in these regions. By contrast, a program for Global Organizational Leadership offered by the university's business school trains students to hone their marketing skills through training opportunities in Latin America. Dr. Wimbush noted that international marketing skills are not limited to the country where they are first practiced and honed, but can be transferred to other international contexts as well.

The discussion following these presentations suggested that developing curricula around specific global skills remains a difficult challenge for many universities. In response to concerns that faculty often do not approve of professional training for graduate students, **Debra Stewart** (Council of Graduate Schools) and **Hans-Werner Schmidt** (Universität Bayreuth) asserted that graduate schools need to engage centralized university centers or develop general training requirements to ensure that students receive such training.

Finally, **Ernst Rank** (Technische Universität München) stressed the importance of treating students as key agents and leaders in the process of attaining global skills. At TUM, students are provided clear guidelines for international experiences abroad, but they also take the lead in developing connections—experiences that enhance not only global awareness but also "intellectual leadership."

Global Skills I: The Sciences, Engineering and Medicine

In the second subpanel, **Xiangpei Hu** (Dalian Institute of Technology (DUT) and **Gerard van der Steenhoven** (University of Twente) highlighted parallel trends that are relevant to graduate students pursuing STEM and medical degrees: a growth in industry careers, and increased

student interest in international training and experiences.

The Chinese graduate education system has promoted the development of graduate degrees that specifically prepare students for industry research. At DUT, master's programs are organized into academic, professional and international tracks so that students with a specific interest in international preparation may receive intensive training in this area. Doctoral programs, also tracked by professional or academic orientation in China, are supplemented by opportunities for PhD students to enhance their global preparation by pursuing research abroad.

Dr. van der Steenhoven's presentation provided a model for integrating professional skills training into curricula at one's home institution. At the University of Twente, doctoral students are exposed to professional and global skills through a multi-phase, mandatory training program. The foundation of this program is a workshop in which students are introduced to the value of professional preparation for a broad range of careers. "This step is very important, since most young scientists are very eager when it concerns their own research project, but have difficulties in focusing on anything that is beyond a PhD defense." Following this preparation, students take a workshop on research management that focuses on topics such as research funding, business plans, science communication, ethics, strategic management and project orientation.

Global Skills II: The Social Sciences and the Arts and Humanities

The discussion of global skills in the social sciences and the arts and humanities addressed the attitudes and perspectives acquired through exposure to diverse experiences. Focusing on the social sciences, **Klaus Boehnke** (Jacobs University Bremen) argued that students need what he termed "disciplinary otherness"—a facility with the viewpoints of other disciplines. This exposure must be a characteristic of "globally successful graduate education in the social sciences," he added, due to the interdisciplinary nature of social science research and the international scope of social dynamics. Graduate degree programs should encourage interdisciplinary experiences, for example, by requiring that advising committees for dissertations include advisors from different disciplines.

Noreen Golfman (Memorial University of Newfoundland) asked

participants to consider whether programs and institutions that claim to offer students a "global awareness" truly deliver on this promise through curricular requirements. Dr. Golfman's paper identifies two areas— language training and mobility incentives— where graduate programs could do more to enhance the global training of social scientists and humanists.

Conclusion

The papers and discussions summarized here show that the landscape for global skills preparation is currently uneven, but rich in diversity. At the conclusion of the summit, participants agreed that graduate leaders must build on current offerings to embed international experiences and training into graduate programs.[1] Part of this work, they acknowledged, is engaging faculty in the definition of global skills, even if skills are delivered in co-curricular workshops and orientations. These observations of global skills are supplemented by papers from Panel 4, "Supporting Transitions on a Global Career Pathway," which offer a number of strategies that universities may undertake to prepare students for global careers.

1 See Appendix A.

Preparing Future Researchers for a Global Workplace: Practices at the National University of Singapore

Bernard C. Y. Tan
Vice-Provost, Education
National University of Singapore

Countries with vibrant economies tend to be characterized by the presence of cosmopolitan cities with a critical mass of highly educated people. To move up the economic ladder quickly, emerging countries are usually receptive to the idea of having well-educated and talented people from different parts of the world embedded in the local population. For example, emerging countries in Asia have seen a significant growth of their foreign resident population in the past two decades. This global trend has implications for universities in terms of the way graduate students can be trained. Universities need to prepare graduate students (future researchers) for a global workplace.

The key to preparing graduate students for a global workplace is to broaden their minds by giving them a global exposure that would allow them to see issues from multiple perspectives. This can only happen if graduate students have ample opportunities to interact or work with people from a diversity of countries and cultures throughout their candidature. At the National University of Singapore (NUS), this is accomplished by our strategy of taking our graduate students out to the world and bringing the world into NUS.

Taking our graduate students out to the world

On average, every doctoral student gets funding to travel to 2-3 international conferences during their candidature. Besides exposing doctoral students to cutting edge research that is being done globally, these opportunities allow them to interact with people from different cultural backgrounds and thereby see how issues may be viewed differently by people from different parts of the world.

NUS has joint doctoral programs with:

- King's College London (for Science)

- Imperial College (for Science, Engineering, Medicine, and Computing)
- Indian Institute of Technology (for Science, Engineering, and Computing)
- Duke University (for Medicine)
- Australian National University (for Science and Engineering)
- Karolinska Institutet (for Medicine)
- Ecole Supérieure d'Electricité (for Engineering)
- Technical University of Denmark (for Design and Environment)
- Eindhoven University of Technology (for Engineering)

NUS has joint master's programs with:

- Australian National University (for Science and Arts)
- University of Melbourne (for Social Sciences)
- University of Basel (for Medicine)
- Technical University of Munich (for Engineering and Science)
- King's College London (for Design and Environment)
- Peking University (for Business)
- Fudan University (for Business)
- Korea University (for Business)
- Ecole des Hautes Etudes Commerciales, Paris (for Business)

All these joint doctoral and master's programs allow graduate students to conduct joint research and project work with fellow students from other countries, and include spending time in these countries. Such exposure helps to equip graduate students with a global orientation.

Bringing the world into NUS

The 1,930 faculty members at NUS come from 46 countries and received their doctoral degrees from 31 countries (excluding Singapore). Each year, NUS hosts about 350 visiting faculty members who come from approximately 40 countries. This international faculty mix ensures that graduate students receive instruction and supervision by faculty members from a good spread of countries. The diversity of opinions of these faculty members help to broaden the minds of graduate students.

Located at NUS, the national level Campus for Research Excellence and Technological Enterprise (CREATE) brings together a collection of renowned universities that allow researchers to interact readily and generate greater innovation. With this campus, graduate students have opportunities to interact and work with researchers from:

- Massachusetts Institute of Technology (on infectious diseases, environmental sensing, biosystems and micromechanics, and future urban mobility)
- Swiss Federal Institute of Technology, Zurich (on global environmental sustainability)
- Israel Institute of Technology (on regenerative medicine)
- Technical University of Munich (on electromobility in megacities)
- Hebrew University of Jerusalem (on inflammatory diseases)
- Cambridge University (on carbon reduction in chemical technology)
- Shanghai Jiaotong University (on environmental sustainability solutions for megacities)
- University of California, Berkeley (on building efficiency and sustainability in the tropics)
- Peking University (on sustainable low carbon future)

In the media space, NUS has formed international research centres jointly with partner universities. Graduate students have opportunities to interact and work with researchers from:

- Chinese Academy of Science (on language translation technology)
- Keio University (on ubiquitous technology)
- Tsinghua University (on extreme search technology)
- Indian Institute of Technology, Bombay (on social media technology for communities)
- Zhejiang University (on sensor enhanced social media technology)

Our efforts to prepare graduate students for a global workplace appear to be bearing fruit. Our latest employment surveys for graduate students reveal that 34% of those who completed their studies in 2011 and 2012 work overseas. Others chose to work in Singapore because of the many employment opportunities available (in multi-national corporations and local enterprises). Singapore is a global cosmopolitan environment where people from almost every nationality can be found.

Models from Indiana University

James C. Wimbush
Vice President for Diversity, Equity, and Multicultural Affairs and Dean, The University Graduate School
Indiana University

Indiana University (IU) has long been recognized as a leader in international education. From its first study abroad program in Europe during the summer of 1870 to its current plan to establish a new school for international studies, Indiana University continues to be a leader in equipping students with global skills essential for careers in a variety of work settings. On the Bloomington campus, there are several longstanding international-focused programs; for example, the campus teaches 77 languages and has six Title VI area-studies centers. In fact, it's been determined that at least 16% of all course sections taught on the Bloomington campus have international topics as their primary focus. To focus and advance the institution's efforts further on the Bloomington campus, in August 2012, the Indiana University Trustees approved the proposed School of Global and International Studies. As stated in the proposal,

> The proposed School of Global and International Studies in the College of Arts and Sciences would focus a unique and powerful alignment of linguistic, cultural, area studies, and professional expertise on the profound questions that arise from a globalized world. It would organize the university's efforts to develop degrees that meet the needs and challenges of this complex environment, and to teach global competencies that prepare students to succeed. And through an unparalleled combination of faculty from the social sciences, humanities, and professional schools with extensive area studies and international expertise and remarkable strengths in languages, it would insure Indiana University's reputation and leadership in this international arena. (Indiana University College of Arts and Sciences, 2012)

Having a wide array of international-focused programs and creating a new school to organize its efforts represents only part of Indiana University's approach to preparing students for careers in the global environment. In March 2008, Indiana University adopted an international strategic plan

that pledged a commitment not only to increase institutional international engagements, but also to provide more international learning opportunities and experiences for its students. While there are a lot of efforts to provide undergraduate students with international experiences, there are also many successful programs for graduate and professional students on the Bloomington campus. The purpose of this paper is to briefly highlight programs in two schools—The Maurer School of Law and the Kelley School of Business—as models for successful ways to help graduate and professional students gain competencies for careers in a globalized environment.

The Maurer School of Law established the Center on the Global Legal Profession with a goal to "[f]ocus on the unprecedented challenges lawyers are facing around the world and develop research and training materials to assist current and future attorneys in their understanding of international legal systems," according to the press release announcing the center (Indiana University Maurer School of Law, 2009). A key component is internships in India, China, and Brazil for first-year law students. Students work with private firms, NGOs, and other agencies on a variety of critical social concerns that provide both an exposure to legal issues in the foreign countries as well as, in some places, an opportunity to address societal needs. In addition, the Center has a strong research focus to facilitate the work of its faculty related to creating a global understanding of the legal profession. Students, faculty, and practitioners benefit tremendously from the activities and research generated by the Center.

For a number of years the Kelley School of Business Full-time MBA program has provided its students with an opportunity to learn about business in a country of their own choosing. The Kelley International Perspectives (KIP) is a course where students choose a country that they'd like to learn more about, resulting in a visit to the country that they plan. The students make appointments for company tours, to meet with company and government officials, and alumni in the area. The more than a decade-old program has taken students all over the world and provided them with invaluable opportunities for global understanding of business, as well as networking.

Similar to the KIP program, Kelley launched the Global Business and Social Enterprise program. This program is for students interested in

social entrepreneurship consulting, whereby they are actively engaged as consultants with companies and organizations, thus far in Peru, India, and Ghana. The program gives students an opportunity to apply the leadership and business skills learned in the classroom to real problems and issues in another country.

Of particular interest for graduate education is the Kelley School of Business Institute for Global Organizational Effectiveness. The Institute is open to MBA. and PhD students interested in Latin America. According to the Institute's website, the mission is to "enhance the global effectiveness of organizations by augmenting their human capital—with a special emphasis on Latin America. The Institute fosters a unique collaboration of top students, faculty, alumni, and highly selected organizations working hand-in-hand to achieve results: development of specialized, diverse talent that can meet the global market demand and creation of new knowledge that will advance global business." For doctoral students, the training and international experience, though focused on a specific region of the world, should help to broaden their global knowledge and skill base for careers anywhere in the world.

The international initiatives in the Maurer School of Law and Kelley School of Business represent only a few examples of what is being done on one of Indiana University's campuses to broaden the thinking and skills of graduate and professional students. The University Graduate School also embraces both the history and current strategic plan of Indiana University by working to create opportunities for graduate students to obtain skills for success in the global arena. Two efforts of particular interest are an international professional development experience for students in STEM fields and a proposal for an international teaching opportunity for advanced doctoral students in any field.

In spring 2012, a group of doctoral students visited Sungkyunkwan University in Seoul, Korea for what proved to be an amazing opportunity for students to learn about the Korean educational system and the university, and to make connections for post-doc and visiting faculty positions at the university. The program is funded by an AGEP grant from the National Science Foundation, and targets underrepresented students in STEM fields who have not traveled abroad. The main goal of the program is to increase opportunities for underrepresented STEM doctoral students to

teach and conduct research in international universities, laboratories, and/or industries. In the short-term, the expected outcome is for IU doctoral students to gain increased global literacy through exposure to specialized training and practical experiences in an international setting. The long-term outcome is for increased research and program collaboration between IU and the host institution.

For well over a decade, the University Graduate School has offered the Future Faculty Teaching Fellowship program to advanced doctoral students interested in teaching careers in a teaching-focused institution. Doctoral students from the Bloomington campus spend a full year on one of Indiana University's regional campuses with the duties and responsibilities of a full-time faculty member under the tutelage and supervision of a mentor from the host campus. The idea is to give the student a real-life preview of what it is like to teach in an institution different from the one where they are being trained. The program has been hugely successful as it has created a path for full-time tenure-track placements at those and other institutions throughout the country. Moreover, the program has been expanded to include additional institutions in the region and a Historically Black College or University (HBCU), Howard University. The University Graduate School is now working to expand the program abroad so that interested doctoral students have an opportunity to experience faculty life for a significant period in another country. It is believed that such an international experience would create opportunities for post-doc and teaching positions in those countries and provide students with a more global perspective for whether they spend their teaching careers in the United States or abroad.

For over 140 years Indiana University has provided students with ever-increasing opportunities to gain global skills, and with several current successful initiatives by its schools in Bloomington and with the creation of a school to better organize all of its efforts, Indiana University is now even more poised to prepare students for productive careers at home and abroad.

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The Development of Global Skills and Careers At Dalian University of Technology

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How do graduate students develop their global skills for prosperous careers? This is becoming a big challenge for many institutions with the development of economic globalization. Dalian University of Technology (DUT), as one of the top universities in China, has made every effort to prepare its graduate students for successful careers.

To begin, I will give you a big picture of DUT's graduate education programs. There are 9,331 master's degree candidates and 3,424 PhD candidates at DUT, and every year we enroll and graduate 3,900 students. DUT pays close attention to the career development of our graduate students. With the development of economic globalization, the way graduate students choose their careers has changed. Only a small percentage choose to do research or teach at colleges and universities; the majority choose careers in enterprises and government organizations. Being in a global manufacturing situation, the job market in China requires talents with a strong international perspective or international background. This contradicts the current objectives of advanced education in institutions. The consequence is that job-hopping happens frequently for master's and PhD graduates because they are not well prepared for initial careers without targeted education. So the colleges and universities still need to do more to develop graduate skills and careers.

Students exposed to cultural diversity are better able to compete in the new global economy. They are inspired to think differently and to propose creative solutions to challenging research problems. Language skills and negotiation skills are also honed through experiences with diversity. Therefore, during recent years, DUT has made great efforts in preparing graduate students for global skills and successful global careers.

First, DUT highlights the concept of "strengthen the foundation, widen the opportunities." This semester, DUT worked out a new scheme for a graduate training program (educational plan) that mainly focuses on primary disciplines. For example, the training program for master's students is divided into three categories—academic, professional, and

international schemes—with three, two, and three years of education respectively. Different kinds of master's degrees are conferred according to the specific categories.

Secondly, DUT has set up several programs to train students for an international perspective. For Ph.D. students, DUT provides two ways for pursuing research abroad. The first way is provided by the China Scholarship Council, whose objective is to provide assistance, especially financial assistance, to Chinese citizens wishing to study abroad and to foreign citizens wishing to study in China. DUT sends about 100 PhD students per year through this program. The other way is through joint degree programs. Currently, we have established this kind of program with institutions from France, Belgium, and other countries.

For master's and MBA/EMBA students, DUT also has several kinds of international programs. For example, DUT has set steady collaborations with Waseda University for joint master's degree programs. For MBA/EMBA education, DUT has an international MBA class every year, which is composed half-and-half of abroad and domestic students, and 60%-70% of EMBA students, all of whom have opportunities to study abroad. During the past 30 years, DUT has achieved great success in MBA education. The early MBA graduates are all stepping into high-level management positions.

Thirdly, DUT focuses on either academic or professional tracks. Academic master's degree students would focus on research within three years. The professional master's students would get their degree within two years, including a six-month internship in industry. This program is delivered in partnership with industry and enables the academic students to focus on their research. At the same time, the professional students prepare for their careers with six-month internships.

In addition, there are other international programs, such as international workshops and seminars, summer schools for international students, and short-term internship summer schools in Germany, Japan, etc. for our students. Although some programs are commercial ones, students are still encouraged to attend the programs to strengthen their global skills.

Promising outcomes have been achieved after years of endeavoring in the preparation of graduate skills for their careers. This can be shown by the following two phenomena. First, the PhD students that we sent abroad are now successful in every walk of life. Over the last five years, there

have been more than 800 students from DUT that have an international background, and this number is still growing sharply. Most of those MBA/EMBA alumni with a background of studying abroad are now in high-level management positions. This indicates that international experience has a positive effect on career development. Second, the student enrollment reports indicate that the percentage of enrollment from top universities is higher than before. This year, more than 60% of enrolled doctoral students are from "Project 985"[1] universities, which are the top 40 universities in China.

Higher education is constantly changing according to the global economy and social requirements. The colleges and universities are challenged on how to prepare students to better live and work in today's global society. Global skills are essential for graduate students as they are competing with excellent leaders, learning to be competitive in the global marketplace, and solving growing global problems. In the future, for the career development of our graduate students, DUT will continue focusing on global-skill-related programs, trying to fit into the global economy. This is for both graduate students careers and DUT's reputation in the future.

1 The goal of Project 985, launched by the Chinese government in 1998, is to invest in the development of a select number of top-tier Chinese universities.

Training Technology Leaders of the Future

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Twente Graduate School and Faculty of Science & Technology
University of Twente

In 2011, the European Physical Society published a report on the status of doctoral phase education in 26 European countries after signing the so-called Bologna agreement. On the basis of questionnaires that were sent out among doctoral candidates and supervisors, a large amount of information was collected. Two conclusions are cited here:

- More than half of the doctoral candidates aim for a postdoc position in academic research; about one third plan to go into industry.
- Almost 40% of the doctoral candidates plan to stay abroad or move abroad after their doctorate.

Although limited to physics, the conclusions can—with a certain margin of uncertainty—be extended to other science and engineering disciplines: a large fraction of young people with a recently earned PhD will take up a position in industry and/or move abroad. Hence, our doctoral training programs should provide courses that enable PhD students to better prepare them for a future outside academia. As an aside, it should be noted that such *global skills* are beneficial for those pursuing a scientific career as well, since many of the competences required for a successful career in industry—such as entrepreneurship, financial and organizational skills—are of growing importance for a modern professor as well who has to acquire research funds, organize projects, etc.

The question that needs to be answered is how to prepare our doctoral students in science, engineering and medicine for such a future. (For medical students the issue is somewhat different given their rather homogeneous job perspectives. However, new mixed academic programs are emerging—like the *Technical Medicine* program at the University of Twente—for which the same arguments apply.) The question can be split in two parts:

- How to convince the doctoral students at an early phase during their PhD years that broadening skills are essential given their future career perspectives?
- How to choose and educate those general skills in a 3-4 year program that is dominated by the primary task of PhD student: to conduct an excellent piece of research, publish the results, report on those results at conferences, and write and defend a PhD thesis?

At the Twente Graduate School (TGS) in the Netherlands we have developed an educational model to address both issues. Starting PhD students are invited to participate in two short workshops within 3-4 months after entering the program. The first half-day workshop is largely aimed at making the new doctoral students aware of the importance of acquiring skills that go beyond the specialization of their research subject. This step is very important, since most young scientists and engineers are very eager when it concerns their own research project, but have difficulties in focusing on anything that is beyond a PhD defense. Since TGS requires students to spend the equivalent of (about) 15 ECTS on courses and workshops aimed at acquiring broadening skills, it is very important that students are motivated to spend time on these subjects. Apart from the introductory workshop, which is also meant to meet fellow students and get familiar with the TGS system, a few months later a half-week workshop is organized on *research management*. This subject has been chosen to enable students learning a lot about broadening skills in a setting that is still familiar to them: a scientific research project. In fact, various—mutually different—projects are given to teams consisting of 4-8 students originating from various disciplines. The scientific content of each project is made clear at the beginning, while the student teams are asked to develop a plan for all non-scientific aspects of managing a research project. In this way the students are forced to collect information —either from local specialists or through the web—on diverse subjects such as research funding, business plans, science communication, ethics, strategic management and project organization. The teams have two days to prepare their plan, and the end results are presented to a panel of local professors in a competitive form. The same teams are also asked to review

one of the projects of the competing teams; in this way a critical attitude is created, which is also of obvious importance for almost any future career inside or outside academia.

Both workshops are well received by the students, although improvements can still be made. In the first two years of operation we have noted difficulties arising from creating student teams with mixed backgrounds. The background knowledge and attitude of science and engineering students on the one hand, and those from the social sciences and humanities on the other hand, differ considerably. At the university-wide graduate school of the University of Twente (TGS), we try to mix the two orientations as the actual societal problems usually require both technical and social skills in order to arrive at a realistic solution. Any grand themes, such as the development towards a sustainable society and healthy aging, illustrate this point. In the future, we intend to improve the research management workshop by selecting different subjects and—possibly—paying more attention to the composition of the student teams. As a third step in our training program aimed at preparing our doctoral students to pursue a successful global career, we ask them to follow courses on selected broadening subjects such as:

- Philosophy and History of Scientific Methods
- Advanced Science Communication
- Research Management
- Ethics of Technology
- Entrepreneurship and Valorisation

Moreover, a number of practical courses are offered on academic skills (writing, presenting etc.) and career development. Together, the entire package of workshops, courses and specific skill training corresponds to an equivalent of 15 European Credit Transfer System (ECTS) credits. We also require a similar effort for specialized courses in the subject field of the student, which are usually followed in the framework of an (inter) national research school.

How can the outcomes of this training program be assessed? As the Twente Graduate School was only established slightly more than two years ago, it is too early to provide definite conclusions. However, we

have established a set of formal targets ("learning targets") which the doctoral students need to achieve once they have completed their graduate education. By informing the students about these targets, and verifying afterwards through questionnaires whether or not these targets have been reached, we can verify whether or not the TGS model is effective in preparing our students for a successful career after their PhD. More information on the formal definition of the TGS learning targets, or PhD profile, can be found on the local TGS website.[1]

Acknowledgement: I am grateful to Clemens Pouw and Petra de Weerd-Nederhoven who—as directors of the Twente Graduate School—have crucially contributed to its concept.

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1 The site http://www.utwente.nl/tgs/Education/General%20Information/phd%20profile.pdf provides the profile of a starting and finishing PhD student at the Twente Graduate School in diverse subjects such as research domain & techniques, research environment, management, career orientation, networking etc.

Preparing Social Scientists for the World

Klaus Boehnke
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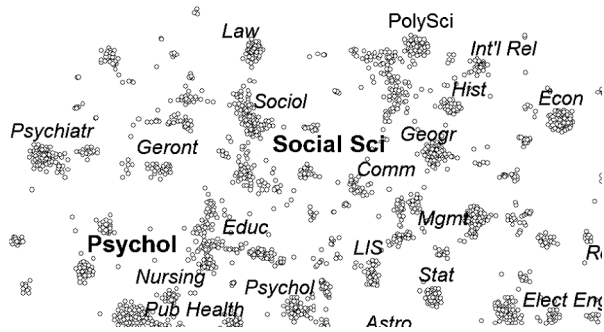
Jacobs University Bremen

The motto of this year's global summit reads "From Brain Drain to Brain Circulation: Graduate Education for Global Career Pathways." It offers a timely frame for discussing the special preparation and skills students in the social sciences as well as arts and humanities need in order to pursue successful global careers.

The current brief paper focuses on "special preparation" in the social sciences and refrains from discussing necessities for arts and humanities as well as discussing more narrowly defined skills, like, for example, language skills. This restriction is adopted because already the comprehensive discussion of "the social sciences" is a challenge. When this paper speaks of the social sciences, it relies on scientometric work, e.g., by Boyack, Klavans, and Börner (2005); who plot the social sciences as depicted in the following (truncated) graph, based on their analyses of databases.



Very crudely summarized, what the graph depicts is citation overlap between academic journals in the year 2000. The graph is included here, because it can serve as a blueprint of demands for globally successful graduate education in the social sciences. The demand visualized by the graph is that neighboring disciplines have to speak to each other in institutions of graduate education. To understand global social change (and that is the focal task of a globally oriented social science in current days,) traditional disciplinary borders of academic discourse have to be broken up if social scientists are to be trained adequately for the challenges of a global career.

What does the demand mean for graduate education in concrete terms? It means that cross-disciplinary discourse has to be institutionally built into graduate education. Institutionally building such discourse into graduate education has to go beyond superficial interdisciplinarity. What is necessary is the everyday interaction of the disciplines in course work, doctoral research, and colloquia. The social sciences as a whole have to develop an ethos that reflects an agreement that social and political processes cannot be understood without an acknowledgement that such processes are always enacted by individual actors. At the same time it has to be clear that individual behavior cannot be understood adequately without an eye for the (social, political, cultural) context in which it takes place. In fancy terms, bio-psycho-social dialects have to form the institutional basis of graduate education.

This demand does not mean that interdisciplinary degrees should be aimed for. What should, however, become the rule is that degree programs incorporate elements that enforce interdisciplinarity in the treatment of research questions. How might this be done?

There probably is no once and for all rule, but the principle should be that more "otherness" be introduced into graduate education programs than is typically the case. In classic (Central) European doctoral education it was common that a young researcher had one mentor and would usually pursue the research interests of that mentor further, sometimes with minimal, sometimes with more creative input of his or her own. That mode of graduate education, however, proved to be a cul-de-sac for innovation, in principle. This is one of the reasons why the Anglo-American style of structured doctoral education has recently been adopted more frequently in (Central) Europe. But just adopting Anglo-American structural principles of graduate/doctoral education is not enough. A minimal further requirement is that doctoral advising does not rest on the shoulders of one advisor but subscribes to a committee principle. The PhD committee should not comprise of a group of scientists who examine a candidate at the end, but a group of colleagues who engage in advising from the beginning of doctoral research. All PhD committees should encompass "external members;" however, "external" should not just stand for a different institutional affiliation, but also for a different disciplinary affiliation. One of the committee members who accompany the process of

doctoral research from the very beginning ought to come from a discipline that is not the degree discipline.

That said, there is likely no one-size-fits-all solution to organizing the inclusion of "otherness" in doctoral education. Sometimes it might be sufficient to organize for the continuous presence of representatives of other disciplines in a regular doctoral colloquium. Sometimes it might be sufficient to incorporate a representative from another school of thought from within the degree discipline in the PhD committee. This could, for example, mean incorporating a qualitative researcher in the advising of a research project that relies on survey data. In other instances, it might be appropriate to incorporate an advisor from a different cultural context or language community, but from the same degree discipline, in the PhD committee. This could, for example, be a representative from a case-law tradition for a project researching the codification of supranational regulations in a code-law tradition. More frequently, however, it should be the case that in a political science research project, for example, one member of the committee comes from psychology; or in a developmental psychological research project, one committee member comes from sociology. What should not be sought is the mere inclusion of otherness in the form of including an academically informed citizen from another discipline. Having an engineer be part of a sociological PhD committee for a project that has nothing to do with technology does not make sense. "Incorporation of otherness" only makes sense when "other" thoughts are introduced by someone who has him or herself done research on the topic of the doctoral project at stake, but has done so from a different disciplinary perspective.

Why is disciplinary "otherness" crucial for globally successful academic careers in the social sciences? Because only by incorporating otherness into the design of doctoral research is it possible to adequately attend to the "workings" of social change in a global context. Had one to analyze a stable phenomenon, it would seem advisable to do so with ever more disciplinary rigor, seeking ever-improving specialization. However, when a phenomenon is in flux, as the world is at least since the fall of the Iron Curtain, but maybe longer (since the late 1960s in many Western publics, as Ronald Inglehart labeled them,) it will create an advantage both for scientific knowledge acquisition and for individual careers of

academically trained individuals in and outside of universities, if they are prepared by their doctoral education to look at things from a "different angle."

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The Development of Global Skills in the Social Sciences, Arts and Humanities

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Many graduate liberal arts program websites boast a commitment to social engagement, to the training of critically aware, global thinkers. But a scan of the actual course or workshop offerings in academic programs points to a gap between the rhetorical promise of inflated web text and the generally traditional content of graduate programs. As ever, there are tensions between the narrow, discipline-based rigors and requirements of our programs and the demands and expectations of a wider world. Are we now really training global citizens or just hoping and saying that we do?

Here is a bold statement on a web site produced by Dawson College in Montreal:

> Those of us who have witnessed tragic events in our community and in the world have paused to take stock of our roles as members of an increasingly violent and cynical global community. One might wonder: what role can the often backward looking humanities play on the global academic and non-academic stage? Why should we spend our time examining the historical achievements of humanity when the world is in crisis and there are pressing practical problems to be addressed? Students will discover that humanities courses contribute a valuable and practical service to public culture. In the humanities classroom great thinkers, past and present, are examined in their social, historical, economic and ideological context. Students learn to hear the human voice behind the text, thus they learn tolerance and understanding. Students learn to develop clear, critical, organized and thoughtful ways of communicating both orally and in written form. These skills are essential for conflict resolution and for making a thoughtful contribution to society no matter what career path our students decide to pursue. (Dawson College, 2012)

The blurb is aimed at those interested primarily in undergraduate education, but it registers a recent shift in thinking about the value and

practical benefits of humanities programs in general. There is no denying the earnest tone of the paragraph, but just how much time or space is devoted in our graduate programs to helping students make connections between their research and "making a thoughtful contribution to society?" How, indeed, do we provide our students with "global awareness," the claim of so many schools?

Consider language training. There was a time, not so long ago, when Humanities PhD students in English-speaking programs were required to study one or two languages to complete their programs. My research was in Canadian literature thus French and German were added to my course repertoire. French and German language and literature informed modern Canadian literature and so it was considered important to appreciate the full breadth of cultural influence. Such language requirements have dropped away from many Humanities programs for several reasons, pressure to improve time-to-completion rates being paramount. It is not that we no longer recognize the value of cultural influences, but, rightly or not, competitive factors have generated changes in our program requirements. Have we sacrificed acquiring useful skills for all the wrong reasons?

So it is that we say we are preparing our social sciences, arts, and humanities (ssah) students for the world, but yet we rarely encourage them to pursue languages that would facilitate their comfort in that world, say Mandarin or Arabic. Paradoxically, language departments are shrinking while the need to offer more practical skills for the international workplace grows. To prepare our students for the world we should develop programs that encourage language literacy—and connect these programs to real research pursuits.

Consider mobility. The number of students in North America who study abroad is growing, but ever so slowly. Roughly 2% of Canadian students—undergraduate and graduate—study abroad (with a majority studying in the US) and a little over 1% of U.S. students study abroad. Work-study abroad programs in "ssah" fields remain sorely undeveloped. In Canada, we know that those who pursue master's level programs abroad, in part or whole, are, in order, in business, management and public administration; the social and behavioural sciences, and law; and, architecture, engineering and related technologies. According to

the U.S. Department of Education (2010), "social sciences, business and management, and humanities were the top three fields of study among U.S. study abroad students in 2007–08" (p.118). But with relatively few students looking beyond national borders, we are clearly not yet embedding adequate incentives for study in the world for which we claim to be preparing them. This is not the case in in the EU where mobility among graduate students is both easier and more a natural part of many graduate programs. Obviously, Asian students travel abroad in massive numbers. Travel to work and study, for at least part of a program, extends and deepens the graduate experience.

Preparing our students to be global citizens should fall easily to "ssah" programs, but arguably we take much of this for granted, as a natural effect of core curriculum. We are still better at theory than practice. The applied side of "ssah" studies is often taken up by community colleges or certificate programs by default. We have graduate programs in art or art history but leave the training of arts administrators to others; we teach cultural studies but university graduate programs in media arts management are rare. We need to continue to focus on how the theoretical and the practical inform each other. We still have a long way to go.

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IV. SUPPORTING TRANSITIONS ON A GLOBAL CAREER PATHWAY

Summary of Papers and Discussion

As the papers of the first three panels have shown, international graduate education leaders see great value in fostering a university climate that encourages graduate students and faculty to embrace diverse opportunities for a global career. Yet even in the most supportive environments, a transition from one stage of a career to the next, or from a home setting to a research opportunity abroad, is an inherently challenging experience. The fourth summit panel examined ways in which graduate institutions and programs can support students and faculty as they anticipate and experience new cultures and professional roles. The following themes and questions structured the panel:

- *Preparing Graduate Students for Research Abroad:* What are the challenges of preparing international students and faculty to study and conduct research at an institution outside their home country? How does your university advise students preparing to embark on an international experience? Do you take any measures to encourage them to come back after an international research phase?

- *Orienting Incoming International Students and Faculty:* What can "receiving" institutions do to ensure that students and faculty are able to adjust to a new culture and academic environment?

What support services, orientations, training programs, or other opportunities can support this transition?

- *Transitions to the Workforce:* How can graduate institutions prepare graduate students to move successfully from their programs to the workforce? How do you collaborate with industry, public institutions or others in this respect? What special challenges exist for international graduate students in this area? What legal obstacles exist?

The papers assembled in this chapter offer a number of good practice recommendations for universities seeking to build support structures for students and faculty adapting to new environments.

Preparing Graduate Students for Research Abroad

Studying and conducting research abroad are often formative experiences for graduate students and carry both risks and benefits for a future researcher's career. **Julia Kent** (Council of Graduate Schools) presented a CGS project that seeks to prepare graduate students to confront and manage an area where a lack of preparation is particularly high—research integrity in international collaborations. Dr. Kent's paper describes how the project will allow graduate schools and programs to prepare students for the types of ethical and legal issues that tend to emerge in international collaborations. The integration of such issues into graduate programs has the potential not only to help graduate students avoid research misconduct, but also to succeed in an increasingly international research enterprise.

Research abroad may also be considered a risky proposition for countries whose investments in international research experiences for graduate students have not resulted in direct returns on investment. In his paper on international research opportunities for Chilean doctoral students, **Daniel Wolff** (University of Chile) indicated that employment incentives must be created to attract high-performing students back to their home countries, a goal that is currently difficult to achieve given a lack of industry positions for PhDs. In discussion, **Vahan Agopyan** (Universidade de São Paolo) pointed to similar challenges in Brazil, where

the development of industry has not yet caught up to the development of human capital.

Discussants nevertheless agreed that the benefits surrounding international research opportunities for graduate students far outweigh the risks. Helping students to set expectations for their international research experiences increases the likelihood that a period spent abroad will be productive for the student and beneficial to the institutions where he or she pursues a future career. This preparation will not solve the problems still faced by countries seeking to attract students home after a period abroad. As Panel 1 discussions and paper suggested, however, the positive impacts of high-quality preparation may have long-term benefits to multiple countries.

Orienting Incoming International Students and Faculty

Programs designed to prepare students for research, study and employment abroad are more commonly offered after students and faculty have arrived at their destination, and the next sub-panel offered a range of good practices in the orientation of these groups to a new campus and country. **Martin Bendsøe** (Technical University of Denmark) presented details of a comprehensive program at his university to prepare new students and faculty for a variety of different dimensions of their experience. Dr. Bendsøe's paper gives particular stress to the importance of providing incoming students, faculty and their accompanying families with resources that support acculturation and integration into Danish society.

In a paper on the orientation practices of Australian universities, **Joe Luca** (Edith Cowan University) points out that approaches to supporting international students and faculty must respect the fact that these groups are not homogenous. Encouraging advisors to develop "flexible" and "culturally sensitive" strategies are one of number of best practices developed with the needs of individual students and faculty in mind.

Transitions to the Workforce

The final set of presentations for Panel 4 offered two long-term views of

the skills and preparation that graduate students need as they move into the beginning stages of a career or careers. **Lucienne Blessing** (Université du Luxembourg) observed that "transferable" skills taught within a university setting might not be transferable across all employment domains and suggested that continued discussions in Europe about non-academic career pathways would be valuable.

Recognizing that the future workforce for current graduate students is rapidly changing in ways that make employment opportunities difficult to predict, both for students and those who train them, **Graham Carr** (Concordia University) advocated for a broad vision of graduate education that is international, interdisciplinary, and characterized by diverse experiences. This preparation, his paper argues, must be complemented by training in broad professional skills, a model for which, *GradProSkills*, is described in his paper.

How can leaders in graduate education create awareness for the need for a new, broader view of a graduate education, one that is matched with the career opportunities, local and global, that will be available to current graduate students? The discussion period focused on one area where priority action is particularly needed. **Rose Alinda Alias** (Universiti Teknologi Malaysia), **Maxwell King** (Monash University) and **Debra Stewart** (Council of Graduate Schools) observed that a wide range of stakeholders stand to benefit from a better understanding of the skills and experiences that employers are seeking. A particularly successful strategy for understanding potential gaps between students' training and their career needs, Dr. King observed, is to survey alumni of graduate programs. Given the need in some countries to demonstrate the value of international experience to a graduate student's future career, it may be particularly useful to use survey instruments to learn more about the global skills demanded by employers.

Conclusion

Whereas in the past, the workforce and economy presented a more limited number of opportunities to change contexts— professionally, geographically and culturally—today's students and faculty may experience transitions not only as milestones, but as a defining part of

their professional lives. Entering new environments with optimism and flexibility is never second-nature, however, and the next generation of future researchers and professionals need support that will help them make confident choices about their professional plans.

Preparing Graduate Students for Ethical Challenges in International Research

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The last decade (2001-2011) has seen major changes in U.S. graduate education in two converging areas. First, a growing number of U.S. universities are developing explicit research ethics programs for graduate students across a range of Science, Technology, Engineering, and Mathematics (STEM) disciplines. Program development has been catalyzed, in part, by recent training expectations issued by the National Science Foundation (NSF) and the National Institutes of Health (NIH) for federally funded researchers. Second, international research and educational collaborations with international partners are growing in number and providing graduate students with new opportunities.

While U.S. universities are actively engaged in both kinds of activities, more focused attention is needed to address the ethical issues U.S.-based students and researchers face when participating in international collaborative research and educational programs. Supported by a grant from NSF's Ethics Education in Science and Engineering (EESE) program (#1135345), CGS is conducting a project that will result in institutional models for preparing graduate students to confront the broad range of ethical issues that typically arise in international STEM research and educational collaborations. Through the activities of the project, "Modeling Effective Research Ethics Education in International Collaborations: A Learning Outcomes Approach," CGS is engaging faculty, experts, and universities in defining the discrete knowledge, skills, and behaviors that are especially valued in the subsequent careers of scientists and engineers in their fields, and in using these desired outcomes to develop curricular content, to assess student understanding, and to improve educational programs.

In the spring of 2012, CGS issued a Request for Proposals that invited U.S. universities to develop learning outcomes with the participation of faculty researchers. The selection criteria encouraged these

1 As of this volume's publication, Dr. Kent is Director of Communications and Advancement at the Council of Graduate Schools.

institutions to also address one or both of two priority areas: 1) those faced by graduate students conducting field research in international settings, and 2) those that international graduate students frequently encounter when studying in U.S. programs. In September 2012, CGS will made five sub-awards to U.S. graduate institutions to develop pilot projects that address issues of research ethics and research integrity encountered in science and engineering (S&E) research collaborations, including research collaborations and exchanges as well as joint or dual degree programs.

What types of skills, knowledge and training are needed?

Many research institutes and organizations with strong investments in the globalization of science have focused attention on research integrity issues that arise in international collaboration (Burroughs Wellcome Fund & Howard Hughes Medical Institute, 2006; CGS, 2010; NAS, NAE, & IOM, 2011), while experts in research integrity and research ethics have explored institutional, cultural or legal factors that shape researchers' awareness of, and views about, ethical issues in research (Anderson and Steneck, 2011; CGS, 2012). The publications and reports that resulted from the discussions above include examples of the ethical and legal issues that emerge in international collaborations in STEM fields. Some of these vary by discipline: in engineering, for example, cultural differences may result in different engineering codes and design and manufacturing processes; in biomedical and stem cell research, cultural differences may result in disagreements regarding permissible methods of producing stem cell lines and working with human embryos. As was highlighted at the recent workshop organized by the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine, international collaborations may also bring to light differences in the ways in which research is organized and conducted. For example, misunderstandings may arise when differences in the relationship between government, industry, and universities are not anticipated or well understood, and institutions, researchers, and graduate students in different countries may have conflicting views about enlisting industry representatives in collaborative projects.[2]

2 See the summary of a presentation by Dr. Susan Butts, Senior R&D Director (retired) at Dow Chemical Company, pp. 27-28 in NAS, NAE, & IOM, 2011.

In 2011 and early 2012, CGS completed the first steps of the EESE project, developing a white paper that synthesized what is currently known about the needs of students involved in international collaborations and developed a sample set of desired learning outcomes for graduate students involved in international research collaborations. The draft templates were shared with an Advisory Committee composed of experts in research ethics education and learning assessment, faculty researchers engaged in international collaborations in STEM fields, and graduate deans representing a range of STEM disciplines. The Advisory Committee meeting resulted in an expanded set of learning outcomes which were later analyzed and divided into three core areas: cultural contexts, research practice, and ethical values and frameworks. Each of these areas of learning was divided into multiple aspects of learning (e.g., knowledge, skills, and professional attitudes). The language of the outcomes focuses on observable—and therefore measurable—outcomes of the learning experience, a key concept from the Scholarship of Teaching and Learning (SoTL). Some examples are offered below:

By the time they complete their course of study, students are expected to:

- Compare policies and norms (explicit or implicit) for research conduct among partners. (Knowledge)
- Analyze ethical and practical challenges of sharing data and resources among international research partners (Skills)
- Demonstrate concern for limitations on the ability of research participants in some countries to provide informed consent. (Professional Attitudes)

As the white paper and the project make clear, CGS views the articulation and assessment of learning outcomes as a tool for improving student learning within graduate curricula—not as an exercise in satisfying growing requirements for graduate-level learning outcomes. The project seeks to help graduate schools to engage faculty in meaningful assessments of student learning. The sample learning outcomes are therefore broad and flexible by design. To be competitive, proposals for the project needed to have a plan to engage faculty in the development of outcomes that are

specific to their fields and the types of collaborations in which they are engaged.

A monograph summarizing the results of this project and the achievements of participating institutions is scheduled for publication in 2014. We look forward to the contributions that the results of this project will make toward addressing each of these needs in U.S. STEM graduate education and to the broad exchange of ideas these results may inspire with our respective partners abroad.

Note: This paper is adapted from a CGS white paper, *Modeling Effective Research Ethics Education in Graduate International Collaborations: A Learning Outcomes Approach*, co-authored by Daniel Denecke and Julia Kent.

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Preparing Graduate Students for Research Abroad

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In order to understand the challenges that Chilean Universities face regarding the internationalization of their graduate programs and preparing graduate students for research abroad, it is important to briefly describe the historical evolution of graduate studies in Chile.

The development of doctoral programs in Chile is rather recent, with the creation of the first programs in the late sixties of the last century focused on basic sciences and engineering. This foundational period (1968-1982) occurred in tandem with the institutionalization of scientific research at the oldest universities (University of Chile, Catholic, University and University of Concepción) and also the creation, in 1967, (as in other Latin-American countries) of the National Commission for Science & Technology (CONICYT), an agency fostering and funding scientific research. The first PhD programs were in the areas of Biology, Physics, Mathematics and Chemistry.

In the period of development, between 1983 and 1998, there was an increase in the number of doctoral programs and also in student enrolment. During this period, institutions, such as Andes Foundation (1983) and CONICYT (1988), began to give the first doctoral scholarships. In 1993 there were 15 PhD programs in the country, mostly in Science and Technology and 32 total doctoral graduates.

From 1999 until now there has been an important expansion in Chile of the tertiary education system of undergraduate and graduate programs and student enrollment, specially fostered with the creation of the Program for Improving Quality and Equity in Higher Education (MECESUP).

Currently, 47 Universities offer graduate programs: 216 PhD programs, and 1,082 master programs. Of those, universities that belong to the Council of Presidents of Chilean Universities (CRUCH) offer 153 PhD programs and 614 master programs. Private Universities offer 23 PhD programs and 344 master programs. The total enrolment in doctoral

programs was 4,100 students in 2011 and the total number of graduates will reach around 500 this year.

At present, the system is highly heterogeneous with programs well consolidated, such as those in basic science, especially in the field of Biology and Biomedicine, but with more than half of the graduate programs created during the expansion period since 1999.

Another important aspect to consider is that in Chile, most of the research and development is done at the universities, and only a minor proportion is developed in industry or governmental institutions. Since most graduates from PhD programs are recruited by universities, the formation of doctoral graduates has had as an objective to be a tool for the reproduction of the higher education system.

Although this aim is relevant and has a positive side, since most of the Universities in Chile urgently need to increase the number of PhD graduates in their academic staff, it also has some problems. One of them is that the graduate students in many Chilean universities still have few opportunities for international experiences, such as stays abroad during the development of their programs. Another problem is that graduates tend to continue the research lines of their advisers with whom they have obtained their PhD, so the danger of "inbreeding" is also present.

Nowadays the most important challenges of CRUCH research universities and their doctoral programs are to promote partnerships and to reach higher degrees of internationalization. For example, at the University of Chile, which leads the scientific production in the country, around 45% of the ~1,500 articles annually published in mainstream journals are co-authored by foreign scientists. Also their professors have active collaborations with colleagues abroad. However, this high degree of international connection at an individual level has to be transformed into more institutional collaborations. This means that the challenge is increasing collaborations and agreements with prestigious international universities and research centers, creating instruments to support the students to spend periods abroad or do part of their thesis at international academic institutions.

Currently, the most important CRUCH universities have developed programs for financing a few months stay abroad for their graduate students during their thesis period. At the University of Chile

for example, we have a competitive program that grants annually around 60 fellowships for stays abroad. Similar programs are being carried out at the Catholic University of Chile and the University of Concepción. Regarding international graduate mobility, our institutions have been, and are involved, in networks of the European space programs, such as ALFA phase I, II and III, Alßan and Erasmus Mundus, and Iberomerican networks, among others.

Most importantly, our universities are also increasingly establishing co-tutelle agreements between some Chilean doctoral programs and others in European Universities, mainly in France, Spain and Germany. During the 2005-2011 period, around 50 doctoral students' theses from the University of Chile were guided under co-tutelle agreements with European universities, mainly from France. Joint degrees and dual degrees agreements are also being explored.

Regarding national public policies to support graduate formation, in the last years, the number of fellowships for national accredited doctoral programs granted by CONICYT, has increased from 330 in 2006 to 600 in 2012.

Another important initiative, established in 2009, is the "Becas Chile" program for financing the formation of doctoral and master students abroad. To apply to this competitive fellowship program, the applicant has to be accepted in a university ranked among the top 150in the Shanghai University ranking or in one of the top 50 best programs in the disciplinary field. Since it was established, around 2,000 doctoral fellowships have been granted to finance the formation of students abroad, mainly at universities in the UK, US, Spain, France, Australia and Germany. The fellows have to sign a contract with legal and economic implications establishing that they have to return to the country after receiving their degrees otherwise they have to return the total cost of the fellowship.

These two fellowship programs have produced some tension in the system because the best students tend to apply to international programs at the expense of national programs. To compensate for this problem, CONICYT has introduced competitive calls for stays abroad from four to ten months for students of accredited national doctoral programs and also has a program to finance doctoral co-tutelle fellowships. Starting this year the national doctoral fellowships will also include the stays

abroad. Another important initiative to foster development of international research careers is the CONICYT program for postdoctoral fellowships for doctoral graduates from national programs, which could be carried out at national or international universities.

Regarding initiatives at the university level, there are a few examples of graduate programs recently created with an international perspective such as the master's program of Management for Globalization at the University of Chile and a joint doctoral program in Psychotherapy between the University of Chile, Catholic University of Chile and the University of Heidelberg.

Finally, the most urgent challenges regarding this national effort to form this important amount of advanced, high human capital at national and international doctoral and postdoctoral programs is to develop incentives at the Universities, in the public sector and enterprises, for the insertion of these graduates. Currently, an increasing number are being hired at the universities, but the number inserted in industry to carry out research, development and innovation is not significant yet, in spite of some fellowship programs, such as the one at CONICYT for that aim.

Orienting Incoming International Students and Faculty

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Introduction

The Technical University of Denmark (DTU) has a strategic focus on attracting and retaining international students and staff members (including PhDs). DTU's reputation is a cornerstone for attracting international talent and the effort is supported by strongly helping students and staff in their relocation to DTU and Denmark. DTU has 1,200 international staff members, representing 88 nationalities. This corresponds to 25% of the total staff. Of the 7,500 students enrolled at DTU, approximately 1,800 are foreign students.

International Staff

One section of DTU's Human Resource department, International Faculty Services (IFS), is dedicated to supporting the recruitment and relocation of international staff, as well as their accompanying family. The section consists of seven employees and one head of division.

International Students

A separate division, International Affairs, handles international student affairs. This division consists of 10 employees, and one head of division, as well as several student employees.

Before Arrival

When international job candidates consider accepting a job at DTU, they are offered a meeting with an HR consultant. The purpose is to discuss and present the issues of relevance for a good start at DTU, and for living in Denmark.

After signing a contract with DTU, the international employee will continue to receive support from IFS with regard to the Danish system, e.g., work and residence permit, social security, taxation, etc. The employee and family can also receive housing assistance through either a self-service web portal or through direct contact with DTU's housing consultant, who provides suitable phase-in housing for employees (including PhDs). IFS will also provide extended services, such as guidance on how to find a suitable daycare or schools for accompanying children.

Students are offered a three-week course in Danish language and culture, approximately one month before the semester starts. The objective of this course is to introduce students to the Danish language and culture, in order to enable them to communicate by using Danish in everyday situations.

After Arrival

Within the first two months, the International employee and spouse will be invited to an Introduction Day. This offers a warm welcome by our president, and presents relevant information about DTU as a workplace. The introduction day is mandatory for all new international employees. International staff members are also offered a course on "the ways of the Danes." The course provides information about Denmark, the Danish culture, the challenges involved in moving to a new country, and not least the pitfalls of dealing with Danes.

Job support for spouses is an extremely important service. The majority of international spouses at DTU are highly-skilled individuals who are also seeking a career in Denmark. IFS offers a variety of services. These include career counseling, job interview training, job-seeking methods in Denmark, etc. Another very important factor in retaining employees is "making friends" in the new country. IFS has established two social networks – "The International Employees Network" and "The Spouse Network." These networks have voluntary board members responsible for organizing social activities throughout the year. In 2012, the chairman of the former network received our Internationalization Prize at DTU's Annual Commemoration Day.

Once a year DTU organizes an International Afternoon where

all employees—Danish and non-Danish—are invited, together with their families, for an afternoon of socializing across cultures.

When our international students arrive, we introduce them to our university and to Danish culture during an intensive introduction week of activities with the aim of preparing our international students for life at DTU. Life here can be very different from home, also when it comes to teaching styles. At DTU students work a lot on projects and report writing in groups/teams. Typically, we have no tests during the semester (feedback is given through homework that does count for the final grades), and it is expected that teachers and students have a high level of interaction during and after classes. The introduction week is thus focusing on ways to handle the DTU mode of studying.

Concerning housing, we guarantee accommodation to all of our international MSc students. We believe that a safe base is an important beginning to a successful study experience at DTU. The student organization, Polytechnical Association (PF), is our forerunner in regard to social integration. The student-driven initiatives include football tournaments, Friday bars and international committee meetings.

We hope and work so that our very talented international students want to stay in Denmark after graduation. The Career Center at DTU offers a wide range of activities including workshops on how to seek employment in Denmark, "speed dating for jobs," and facilitating face-to-face meetings with companies. Also, a big job-fair is held every spring at DTU.

Further Initiatives

Employees: We are presently implementing ways of communicating and relating to potential, as well as former, international employees through social media. The International Employee Network has recently set up a Facebook page used for communication of social activities, stories about Denmark, and personal experiences. It is a forum for meeting people who are employed, or formerly employed, at DTU. IFS also has plans for establishing an ambassador's program, and for creating an ambassador package, which the employee may present at a home or future institution.

Students: We are an international university and our students should gain international experiences, as intercultural competencies are mandatory in many types of engineering jobs today. This should also include our Danish students going abroad, and in this area we need to do even more—it is our objective to significantly increase the number of outgoing exchange students. In that connection, our international students play an important role as ambassadors for their home country and institutions.

Orienting Incoming International Students and Faculty

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Edith Cowan University

International students constituted 26.9% of Australia's postgraduate research students in 2010 (Australian Education International, 2011). Asian nations continue to provide most of Australia's incoming international students and faculty. The Council of Australian Governments (2010) *International Students Strategy for Australia* (ISSA) and Australia's ESOS (*Education Services for Overseas Students*) legislation promote and support quality education and consumer protection for overseas students. Australian universities require quality assurance processes that help enhance the international dimension of their teaching and research. The Tertiary Education Quality and Standards Agency (TEQSA) regulates and assures the quality of Australia's higher education sector on a regular basis, and can check internationalisation strategies including recruitment, language proficiency, curriculum, mobility, scholarships, support services, feedback and management responsibilities.

Incoming international students and faculty do not constitute homogenous groups. Both face challenges of functioning effectively in a foreign country that has different patterns of educational thinking and behaviour from the places where they have previously lived, studied and worked. Linguistic and cultural diversity can impact both social relationships and research student-supervisor relationships (Malan, Erwee, Van Rensburg, & Danaher, 2012) and relationships with their communities of practice. Positive attitudes and willingness for grasping opportunities are needed to promote engagement and social encounters that allow students and faculty to learn from opportunities presented by the institution (Fotovatian, 2012; Green & Myatt, 2011; Wang & Li, 2011).

Australian institutions deploy a wide variety of strategies to help orient incoming international students/staff. Some of these include:

- Orientation/induction programs normally provided for all new university students/staff and which may be augmented by buddy or mentoring schemes, as well as programs that encourage

engagement with the community;

- Online training resources, which in many cases are mandatory, and assist in addressing individual needs, promoting good practice, and understanding legal compliance issues and policies;

- Mandatory training for supervisors of research students. These trainings encourage supervisors to develop flexible, student-centred, and culturally appropriate supervisory and feedback strategies that recognise students' prior knowledge and the challenges of adapting to new cultures, as well as clarifying expectations of the supervisory relationships, feedback strategies and approaches to academic writing (Wang & Li, 2011); and

- Training courses for developing required English language, academic writing, research and other skills necessary to be a successful researcher.

Strategies used at Edith Cowan University to orient and support incoming international students and faculty are summarised in Table 1. In particular, the SOAR centre (Jones, Torezani, & Luca, 2012) has been a strong support service for international students and gained the highest score in Australia of 98% as a measure of 'Support Satisfaction' in the 2011 International Student Barometer (ISB) survey findings. The SOAR Centre was established to help develop social and academic networks amongst research students as well as to provide research training and career development support. It was also designed as a central hub and referral point for other ECU services, providing an accessible and visible shop front across two campuses. Ten SOAR Ambassadors are employed, and have various skills aligned to research design, methodology, software and other research training skills needed by HDR candidates. They also provide advice on all university support services.

Table 1: Edith Cowan University Programs and Services for Incoming International Research Students and Academic Staff

Programs/ Services	For Incoming International Research Students	For Incoming International Academic Staff
Welcome & Induction	• Orientation/Induction (face-to-face) • Graduate Research Induction Program (Online) • Supervisor induction and agreements • Faculty specific and Research Centre induction • SOAR Centre	• University induction programs • Faculty-specific induction programs
Training	• Research Training courses: English as an additional language, academic writing workshops, Research Methods etc. • University academic staff development training • Faculty seminar series for researchers • Faculty-specific training for researchers • SOAR Centre	• University academic staff development training programs • Supervisor Training (Mandatory) • Graduate Certificate in Higher Education (free for academic staff)
Peer Support	• SOAR Centre • Faculty-specific and Research Centre programs	• Supervisor team participation • Mentoring programs • Faculty-specific programs
Social Events	• Graduate Research School events: coffee mornings, sundowners, BBQs • Forums for Postgraduate Students • Faculty specific and Research Centre events	• Faculty-specific events
Other Services	• Faculty writing and research consultants • Student services (University)	• University services
Online Information	• University website • Graduate Research School websites • Faculty websites	

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Transitions to the Non-Academic Workforce

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Introduction

Doctoral education is about knowledge creation as much as producing a highly qualified workforce on an increasingly global market. Career development, other than for an academic career, has thus far received little attention. With an increasingly global competition and workforce, and an increasing number of doctoral candidates, the question is whether and how we should prepare doctoral candidates to move successfully to the workforce, taking into account the wide variety of careers.

What are the facts? The number of doctoral candidates has seen a strong growth (Borell-Damian, 2009; Auriol, 2010; OECD, 2011). From 1999 to 2008, enrollment in the EU27 countries increased by 28%[1]; in the U.S. by 57%[2]; and in the countries neighboring the EU27 by even larger percentages (Technopolis Group, 2010). The latter is also the case in newly developed and developing countries. In the OECD area, some 200,000 doctoral degrees were awarded in 2006 against 140,000 in 1998, a 40% increase in just eight years, even though in some large countries numbers have been stagnating (e.g. Canada, France and Germany) (Auriol, 2010).

The employment rate remained high due to increased demand for highly skilled personnel: in 2009 the average employment rate of doctorate holders, who obtained their degree after 1970, was 93%, compared to 70% for all individuals aged 25-64 (OECD, 2011). These numbers are impressive: demand seems to be keeping up. Or have doctorate holders increasingly occupied positions earlier occupied by bachelor or master's degree holders? A non-negligible share of up to 10% doctorate holders was found to be employed in non-related or lower qualified occupations (Auriol, 2010).

Despite the overall positive employment prospects, transition to

1 Changes in the EU27 varied strongly with France down 27% and the UK down 1%, even though growth in tertiary education in these countries increased 10% (Technopolis Group, 2010)
2 Enrolled in 2008: ca. 500.000 in the EU27, and ca. 460.000 in the U.S. (Technopolis Group, 2010)

the workforce has not been smooth and has varied strongly depending on factors such as employment sector, discipline, country and, of course, individual preferences. In the following, I focus on the employment sector using a simple division between academic and non-academic sectors. The latter includes both research and non-research positions, as well as public, private and not-for-profit sectors.

Two Career Paths, One Expectation

Academic careers

An academic career is commonly seen as the career path to aim for, as the only truly valid path, while other careers are viewed as for "those who did not succeed in getting into academia." An exception is engineering, which traditionally saw a considerable transition of doctorate holders into industry. Several studies suggest that depending on the country, 20-80% of doctorate holders do not stay in academia (OECD, 2011; Auriol, 2010). Low numbers can be found in countries that are developing their higher education sector, such as the EU neighboring countries (Technopolis Group, 2010) and South American countries such as Brazil and Chile. The number of doctoral candidates working as researchers varies from 50-80% depending on the country, but the majority of researchers do not hold a doctoral degree (Auriol, 2010).

Unfortunately, a mismatch exists between the expectations of doctoral candidates (and probably of their supervisors) and these facts. A survey (Ates, Holländer, Kotcheva, Kristić, & Parada, 2011) amongst nearly 7000 European doctoral candidates in more than 30 countries showed that the most highly specified preference was the academic research sector (70-83%, depending on country). The public and private non-academic research sectors were less preferred with 35-53% and 22-69 %, respectively. Interestingly, male respondents feel very disadvantaged in academia because of their gender (70-92%, depending on country). Far fewer women reported such feelings (40-61%). Sadly, satisfaction by those involved in research, whether in academia or not, is less than in other positions; salaries seem to be the major contributor (Vitae, 2010; Auriol, 2010).

Non-academic careers

Given the fact that the majority of doctorate holders, at least in the EU and U.S., follow a non-academic career, do we correctly prepare our doctoral candidates? Are these sectors content with the skills and competencies of doctorate holders? A study in the U.K. involving 56 Human Resource directors and senior managers (CIHE, 2010) revealed that outside niche or very specialist areas, employers see few distinctive differences between doctorate and master's holders (with the exception of engineering doctorates). Only 10% strongly agree that qualification is a guarantor of a high-quality candidate. The individual and the quality and relevance of the programme or university are more important. The study also reveals that employers see more issues with doctorate holders: lack of work wisdom, lack of commercial awareness, limited work experience, inability to market skills, narrow focus/overspecialization, unrealistic expectations, difficulty adapting to non-academic environment.

Measures for a Smooth Transition

With rising unemployment due to the recent financial and economic crisis, this discrepancy between expectations and reality needs to be addressed to ensure future positive employment prospects for doctorate holders. A smooth transition to the workforce is required, involving all parties: doctoral candidates, universities, employers, and governments and funding agencies. Foremost, raising awareness and changing mindsets with regard to career development and career possibilities have to be addressed.

Universities

As the Salzburg principles state, the core of doctoral education is training as researcher (European University Association, 2010). Universities have to recognize "that doctoral training must increasingly meet the needs of an employment market that is wider than academia" (p. 4.) and that "career support must take into account individual goals and motivations and acknowledge this range of careers" (p. 5).

Universities have to take responsibility for the career development of their researchers, in particular their doctoral candidates, taking into account a large variety of careers. This involves a range of measures

from the development of an HR strategy for Researchers (European Commission, 2005), a quality framework (e.g., Quality Assurance Agency of Higher Education, 2004), research training, and career advice, to tracking and monitoring alumni. The "Vitae Researcher Development Framework" (Careers Research and Advisory Centre, 2011) and its derivations for specific sectors can provide useful guidance. It sets out the knowledge, behaviors and attributes of effective and highly skilled researchers appropriate for a wide range of careers, and can be used for planning, promoting and supporting the personal, professional and career development of researchers.

Increasingly, European Higher Education is replacing the traditional master/apprentice relationship between supervisors and doctoral candidates with a more structured education following the Salzburg principles, offering discipline- and topic-specific training, as well as transferable skills and career advice. It has to be realized that in academia, we can prepare for an academic career – and that is what we mostly do – but we have difficulties offering what is needed for so-called intersectoral boundary spanning. Even though universities increasingly offer training in transferable skills, it is questionable whether these skills can be transferred to non-academic sectors: training in writing tends to focus on scientific publications, presentation skills focus on academic audiences, etc. An offering for those skills that support a career outside academia is scarce and the needs of the non-academic sector differ. Small and medium-sized enterprises (SME's) are looking for soft skills, whereas large R&D companies usually value deep knowledge and broader competencies (Borell-Damian, 2009).

Universities should encourage contacts with other sectors during the PhD. While as some have suggested, it is not the university's responsibility to train researchers for careers in other sectors, it should give students opportunities to engage with the private sector through internships and treat job training as the responsibility of the individual company (Vandevelde, te Kaat, & Van Rossem, 2011). Contacts with other sectors can intensify knowledge transfer between sectors, create new opportunities, promote future cooperation, advance career opportunities for doctoral candidates, increase awareness of doctoral candidates for different careers, and increase the awareness of non-academic sectors

of the qualities of doctorate holders. The latter requires shared values on research, trust and a long-term approach. Excellence in research was found to be a hallmark of success in collaborative research programmes (Borell-Damian, 2012).

Alumni can play an important role. However, little is known about the career paths of doctorate holders. A recent survey of 112 mostly large research-intensive institutions showed that 78% support career development, for example through transferable skills training, but only 23% systematically track careers, and only 7% do so after more than 7 years (European University Association, 2012). Instruments for tracking and monitoring alumni have to be developed in order to inform doctoral education and to ensure smooth transitions between sectors.

Non-academic sectors

As mentioned before, trust between universities and other sectors is essential. Such trust is, for example, built on formalized but flexible research and research training collaboration between industry and universities, including joint research projects, industrial doctorates, or similar schemes. Joint and long term strategies are needed to avoid isolated activities (Ates et al., 2011).

Governments and funding agencies can encourage and stimulate intersectoral exchanges, e.g. through recent initiatives of the European Committee to finance bi-directional secondments and professional / industrial / engineering doctorates. Doctoral candidates in such positions reported additional challenges, but overall valued the expanding range of employment opportunities (Borrel-Damian, 2009). Such programmes will increase awareness with all partners involved and are supported by policies such as those of the European Commission, who underlined the importance of so-called triple-I approach to doctoral programmes: covering the interdisciplinary and international and the inter-sectoral aspect.

Doctoral candidates

Doctoral candidates need to have realistic expectations and be aware of the wide range of career choices: not working in academia is not a failure. They should be aware of the skills they attain through doing research and how these can be applied outside academia. Furthermore, they should

develop a wide range of skills, particularly transferable skills, and engage with non-academic sectors. The above-mentioned "Vitae Researcher Development Framework" can provide support.

Conclusion

Transition to the workforce is a topic we need to understand and address with all stakeholders to the benefit of all. A major aspect is raising awareness of the multitude of careers that are available outside academia, as well as the competences required and the competences offered. A highly skilled workforce remains essential for society and economy: a smooth transition to the workforce a prerequisite.

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Transitions to the Workforce

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To put in context a Québecois and Canadian perspective on graduate student transitions to the workforce it is essential to understand that our universities are publically funded institutions. Education is a provincial responsibility and different ministries approve new programs and provide operating grants to universities, some of which are used to support graduate scholarships and student mobility. In Québec, additional competition-based support for research and graduate training is provided by the *Fonds de recherche du Québec*, a research council with three axes covering *Nature et technologie, Société et culture*, and *Santé*. The federal government also supports national granting agencies in Natural Sciences and Engineering (NSERC), Social Sciences and Humanities (SSHRC), and the Canadian Institutes for Health Research (CIHR). These agencies are the main source of university research funding in Canada. They support graduate and postdoctoral studies directly through scholarships and fellowships, and indirectly through faculty research grants.

Because of this substantial public investment in universities and research, growing political emphasis on accountability, and understandable concerns about Canada's economic performance in a volatile international economy, there is increasing scrutiny—from government, business and the public at large—of the tangible returns from graduate education with respect to employment and economic growth. One way that universities have responded to this scrutiny, and to changing employment trends, is by launching new diploma and Professional Master's degrees that credentialize highly qualified personnel for specialized occupational niches. Paradoxically, the success of these non-research programs—which are often lucrative for universities—begs the question about employment outcomes for traditional master's and PhD degrees, and the perception that in some fields there is a glut of graduate degree holders on the market.

1 As of this volume's publication, Dr. Carr is Past-President of the Canadian Federation for the Humanities and Social Sciences.

The Canadian government clearly signaled its research and graduate training priorities to the university community with its 2012 budget, which incentivized Tri-Council investment in university-industry research partnerships. In a budget that was otherwise known for its austerity, the government also injected substantial new funding into Mitacs, a national organization that promotes research training opportunities for graduate students through university partnerships with the private and, to a lesser degree, public and not-for-profit sectors. The integration of professional work training programs into university-industry partnership grants is increasingly common in Canada. To compete successfully for funding, universities are evaluated for the scope and quality of the professional training environment they provide to the graduate students and postdoctoral fellows working on the project. NSERC's CREATE (Collaborative Research and Training Experience Program) program is the best example of the new focus on research training, but SSHRC will also prioritize professional development when it launches the next phase in its suite of 'Talent' funding in 2013-14.

The combination of market demands for new programs, external pressures to demonstrate educational outcomes, and changes to the landscape of publically-funded research require that Canadian universities directly address the challenge of preparing graduate students for the workforce. Nevertheless, three issues complicate the question of what graduate institutions can do to best foster those transitions. *First*, it is a given that there will be increased future demand for knowledge workers with advanced research skills, but do we really know what shape this work will take, particularly if we reflect on how dramatically work environments and cultures changed in recent years? Preparing students for the workforce of today is one thing, but preparing them sustainably to enter or adapt to a future workforce that is postmodern, posthuman, global, virtual and volatile is a different challenge altogether. *Second*, are we preparing students to enter a domestic or international workforce, in a host country or their home country; and how much will those distinctions matter in the future? *Third*, how much is the task of preparing students for the post-graduation experience contingent on having a better understanding of their work aspirations and expectations of their degrees? Many of today's graduates want to enter the workforce on their own terms, and may be less

interested in pursuing field-specific work than translating their expertise to other purposes.

Graduate institutions best prepare graduate students for the workforce by offering them a high quality disciplinary or interdisciplinary education combined with a broader *formation* as a qualified professional. To fulfill this mission with one eye fixed on immediate needs and another on the future, we must first examine and reframe the form and content of the disciplinary training our programs provide. Without rejecting traditional best practices we need to acknowledge that some conventional modalities of graduate education are anachronistic, and ask why our programs are frequently designed solely to train students for entry into the academy despite overwhelming evidence that most graduates are employed in other sectors. We need to foster a culture of diversity and innovation in graduate institutions by recruiting broadly, exploring different ways to educate and train students that capitalize on new technology and mobility advantages, promoting trans-disciplinary learning opportunities, and pursuing collaborative partnerships that reach beyond campus boundaries into industry and community. Providing students with international research and training opportunities and/or developing double degree programs where the flow of students genuinely goes both ways will also better prepare them for the global labor market.

Inevitably, there are institutional and cultural impediments to advancing these discussions on campus. Universities, and the education systems of which they are part, are seldom nimble or flexible enough to effect rapid program change, and there is widespread, legitimate skepticism among faculty and students about initiatives that appear to skew graduate education away from ideals of knowledge production for its own sake, and toward market realities, governmental imperatives, and closer ties with industry. Universities need to work with disciplinary associations and each other to spark evidence-based discussions about the purpose, worth, value and structure of graduate degrees, and to implement actions that position programs in the forefront of new forms of knowledge acquisition and mobilization in the 21st century.

Finally, graduate institutions must ensure that students have access to professional skills training programs that complement their disciplinary education. In 2008, the Canadian Association for Graduate

Studies (CAGS) identified a broad range of soft skills that improve student employability. In 2011 Concordia launched its *GradProSkills* program, which is one of the most comprehensive professional skills initiatives across the country. *GradProSkills* offers hundreds of annual workshops, webinars, videos, and online resources on topics from project management and networking to time management and presentation skills. Because Québec is a predominantly French-speaking society and the majority of our graduate students (domestic and international) are non-Francophone, a unique feature of *GradProSkills* is French-language training designed to facilitate job-readiness in the local market. The entire program is offered free to graduate students and postdoctoral fellows and the uptake is viral. Significantly, the program is partly funded with *Insertion professionnelle* money provided by the Government of Québec, which specifically supports student transitions to the workforce. But in an era of scarce resources the program's delivery is feasible because it draws on a network of existing, if previously invisible, campus services that provide students with a unique opportunity to augment and customize their skills training in alignment with their professional goals.

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V. LEVERAGING LOCAL AND GLOBAL RESEARCH NETWORKS

Summary of Papers and Discussion

The globalization of research often moves at a faster pace than the globalization of graduate education programs. Panel 5 focused on best practices for using research networks to enhance the preparation of graduate students for global careers. Speakers from Australia, South Africa, Germany, and the United States were invited to reflect on the following questions in three areas:

- *Integrating International Research into Formal Degree Programs:* What models exist for integrating global research experiences into formal degree programs? What are the barriers to successful integration? How can these barriers be overcome?

- *International Collaborations and Research Experiences:* What role do international research experiences (i.e., participation in joint and dual degree programs, research exchanges, and international collaborations) and international university partnerships play in preparing students for global careers?

- *Interdisciplinary Opportunities:* Interdisciplinary research, like international research, prepares students to communicate with students and faculty whose training or "research culture" may be different from their own. How can interdisciplinary research and education programs inform or integrate graduate education for global careers? How can global research and education programs inform or integrate interdisciplinary research?

A common theme here, and throughout the summit, was that big challenges such as sustainable development, public health, energy, climate change, and security require collaborations that are international, interdisciplinary, and inter-sectoral (i.e., involving collaborations between government, universities, and industry).

Integrating International Research into Formal Degree Programs

The formal structures that accommodate internationalization in graduate education and recognize students' participation vary. In each instance, however, a common goal is to ensure that safeguards are in place and barriers are overcome that allow institutions to pave the way for quality research. **Laura Poole-Warren** (University of New South Wales) presented on three models for integrating research experiences into formal degree programs: researcher exchange, integration of formal coursework and joint research programs. Her paper notes the underlying rationale for each model and discusses how each fosters global skills needed by today's young researchers. It then identifies some of the common barriers to effective integration such as risk management, intellectual property, and tracking the mobility of new researchers, and concludes by identifying the key role of the graduate school in developing mechanisms to overcome these barriers.

In discussion, Laure Poole-Warren noted that the global graduate community still lacks a clear definition of what is meant by "global skills." While this term is typically taken to include diplomacy, cultural sensitivity, language skills, understanding of political climates, and risk taking, she emphasized the need for greater emphasis on global citizenship. **Robert Augustine** made the point that while graduate education leaders can do a lot to build networks that provide the essential infrastructure for fostering global citizenship, they can also benefit from a focus on how to eliminate "bad global citizenship practices."

International Collaborations and Research Experiences

In discussing the role that international research experiences play in preparing students for global careers, **Maxwell King** (Monash University)

focused on joint and dual degree PhD programs. He identified numerous advantages claimed by institutions, supervisors, and students, and observed that each of these can be described in terms of enhanced preparation for global careers. He noted, however, that most of the challenges institutions face are administrative in nature, and require active graduate leadership for effective resolution.

Ihron Rensburg (University of Johannesburg) presented on the broader global forces that will necessitate changes in how graduate institutions prepare scholars with global skills. He identified a variety of global collaborations (joint degrees, research exchanges, international agreements, and visiting professors), and situated these in the context of forces that require scholars to be have greater skills in collaboration, generally. His paper identifies seven factors that characterize successful collaborations.

One of the themes that emerged in the discussion in response to this topic was the issue of reciprocity. Care must be taken to ensure that there are benefits to both partnering institutions and communities of scholars in an international collaboration. **Bernard Tan** (National University of Singapore) made the point that the location for an international conference can have an impact on the resulting collaborations. As a result of ensuring that conferences are held outside of Europe and North America, much more real collaboration has arisen between scholars in their respective regions.

Interdisciplinary Opportunities

Many of the most exciting opportunities in research are interdisciplinary in nature. Because disciplines play such a strong role in the organization of so many university systems around the world, university leaders are seeking out innovative models for fostering interdisciplinary work. **Hans Werner-Schmidt** (Universität Bayreuth) presented on reforms to the German university system that positioned newly-formed graduate schools to play a central role in attracting international postgraduates and in building interdisciplinary programs. His paper argues that graduate schools with interdisciplinary programs are best positioned to establish international collaborations, by virtue of the central role that international

students and international exchanges play in those roles. In effect, he notes, interdisciplinary and internationalism are mutually supportive developments, and graduate schools have been key change agents in both for Germany.

Maureen Grasso (University of Georgia) presented a model for understanding how interdisciplinary opportunities develop competencies and skills needed for global research. Skills such as the ability to manage ambiguity, openness to new ideas, and risk-taking that may be particularly valued and exercised in an interdisciplinary context are also highly valued in global research context, and experience in one area can enhance the student's abilities to thrive in another.

Discussion focused on whether and to what extend true interdisciplinary work at the graduate level required substantially more work and a change in supervisory practice to be successful. **Ernst Rank** (Technische Universität München) stated that, while real interdisciplinary work is generally not possible in a PhD thesis, it does happen in team projects, and teamwork is as important an interdisciplinary skill as content knowledge. **Noreen Golfman** (Memorial University of Newfoundland) added that interdisciplinary work driven by graduate students has had a beneficial effect on institutional culture, by encouraging collaboration among advisors or supervisors.

Conclusion

Presentations and discussion in this panel emphasized that neither internationalization nor interdisciplinarity is an end in itself. On these topics, participants urged that it is imperative to enhance international and interdisciplinary opportunities for graduate students in order to develop core skills that the next generation of researchers will need and to make progress in finding solutions to the core issues that affect us all.

Global Research Experiences: Models and Managing Challenges

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Research today is embodied by the term "borderless knowledge," with many research outputs being accessible globally within hours of their acceptance and open access models making research outputs freely available to many who did not have such access less than a decade ago. Social media has further broken down the borders to knowledge transfer and the concept of global citizenship, in the virtual sense at least, is now a reality. The benefits of these trends for researchers is that there is unprecedented capacity for enhancing knowledge generation with the diversity of inputs accessible and there are extraordinary opportunities for learning and development of both research skills and the so-called generic or transferable skills. This paper will address the following questions:

- What models exist for integrating global research experiences into formal degree programs?
- What are the barriers to successful integration?
- How can these barriers be overcome?

Models for integrating global research experiences into research degree programs

While a range of approaches exist for integrating international experience into research degree programs, this paper will focus on three key models using examples from research programs around the globe. They are researcher exchange, integration of formal coursework and joint research programs.

Researcher exchange. These types of exchanges form the backbone of collaboration and knowledge exchange in most high impact research programs. They may be formal programs such as Practicum Exchange programs, where students spend time in collaborating institutions with reciprocal arrangements, or may be in one direction involving fieldwork

or studies conducted in other countries where the research could not be conducted at the home institution. Typically, the underlying rationale for these international experiences is the research itself rather than focussed development of generic or transferrable skills (although the latter does tend to naturally occur).

There also exist specific programs involving research visits, exchanges and workshops such as those provided by the Group of Eight (Go8), "a coalition of leading Australian universities, intensive in research and comprehensive in general and professional education"—who have initiated a program with the China Nine (C9), a similar group of universities in China. The purpose of these programs is based on strengthening research linkages between Australia and China and developing leadership capabilities in postgraduate researchers. Another example, developed by Deutsche Forschungsgemeinschaft (DFG,) is the International Research Training Groups program, which aims to "encourage and deepen bilateral cooperation between German universities and universities or research institutions abroad."

Formal coursework. Some universities have developed programs such as the Diploma of Professional Practice at UNSW in which courses on global citizenship are offered. These typically exist alongside study abroad and practicum exchange programs in which formal learning can be put into practice via international experiences. There are such programs available around the world, including the U.S., for example at Lehigh and University of Washington and in Europe, at the Universiteit Utrecht and University College London. It is not yet clear what impact these formal coursework programs may have in research degree programs; however it is an area that many universities are examining to promote consistency, structure and scholarly approaches in international research experiences.

Joint programs. Joint research degree programs, in which candidates spend parts of their candidature across two institutions and receive a jointly badged research degree, are becoming more common in the current globally-focussed research environment. The Go8 and Universitas21 (U21) are two umbrella groups under which Australian universities offer joint PhD programs. The Go8 have a joint domestic PhD program that allows candidates to enrol at two institutions at the same time and conduct research under joint supervision. There is also a joint Go8 PhD

program with the European Molecular Biology Laboratory (EMBL) in Germany. Global networks of research universities such as U21 also have joint PhD programs, which can occur across any of the network partners who have signed a memorandum of understanding on the program. These international programs typically embed research experiences across two or more countries in the program. Such international networks of research intensive universities also provide significant opportunities for researcher mobility as noted above.

Barriers to successful integration

There are many challenges that are presented when attempting to expand research experiences beyond the institutional level and these may be magnified when extending such experiences internationally. A key reason for this is the increasingly regulated environment in which research activity resides. For example, mechanisms need to be provided to assure appropriate management of risks that may be encountered, including workplace safety and specific travel risks. Other considerations include management of intellectual property, ethical approvals and provision of appropriate infrastructure and resources. On the conduct of the research, robust, high quality supervision and alignment of candidature matters are key aspects to ensuring that the international experience has the desired outcomes for both the candidate and the institution. Finally, an issue that has proven a challenge to most institutions is tracking mobility of research candidates.

Overcoming barriers

Many of the challenges identified can be managed via specifically designed, well-resourced programs embedded within research programs. Additionally, the mechanisms and processes for organisation and approval of international activities can be streamlined at an institutional level to be made consistent and transparent. Finally, institutions need to develop mechanisms for assessing the effectiveness of these programs in order to promote quality improvement of the programs and their wider acceptance.

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International Collaborations and Research Experiences

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What role do international research experiences (i.e. joint and dual degree programs, research exchanges, and international collaborations) and international university partnerships play in preparing students for global careers? This is the question I will attempt to address in this paper. In particular I would like to focus on participation in joint and dual PhD degree programs.

Monash University has a number of joint and dual PhD degree programs with other universities, although we are trying to phase out dual degree programs and have only jointly awarded PhD programs. One very active program is with Luleå University of Technology in Sweden. We recently held a very successful two-day workshop of researchers from the two universities at Monash University's Prato Centre in Italy. As well as presentations and discussion on specific scientific topics, there was a major stream of workshop on improving and identifying good practice in the administration and supervision of joint and dual PhDs. All attendees were invited to participate in this stream. There were presentations by senior managers, researchers, recent graduates and students. A very powerful presentation was given by Dr. Tamas Jantvik, a newly graduated PhD in Industrial Electronics/Artificial Intelligence from the two universities. He gave a detailed account of his experience in the joint program. The research side worked very well, partly because his two mentors/supervisors from the two universities were already collaborating with his Monash supervisor visiting Luleå on an annual basis. They also had complementary research skills. He did, however, encounter difficulties in satisfying the administrative requirements of both institutions. He noted that "some of the administrative processes for successful dual-award graduation were formed in parallel with me executing these processes." Naturally we both plan to improve these processes for future graduates.

Dr. Jantvik concluded his presentation with a number of observations on the enriching and broadening experience he found in

1 As of this volume's publication, Professor King is an Emeritus Sir John Monash Distinguished Professor at Monash University.

completing a dual PhD. Examples given in his presentation were:

a) "Increased insight into how researchers conduct their work.
b) Increased insight into how PhD students work.
c) Increased insight into different PhD examination processes.
d) Increased project management skills.
e) Increased social competence.
f) Increased familiarity with the ways of the world."

He felt he now had greater confidence to be a researcher in a global environment.

After hearing this and other presentations, the attendees at the workshop with an interest in the topic spent time discussing the advantages of joint and dual degrees for institutions, mentors/ supervisors and students. We agreed that advantages of these programs for students are:

1. They experience how to collaborate internationally and possibly some of their early papers involve international co-authors.

2. They have an increased insight into how research can be carried out in different research cultures and they may also experience two different research traditions in their chosen field of research.

3. They have access to expertise, technology, equipment and library resources from two universities.

4. They develop a more international network with fellow students and researchers from at least two countries.

5. They have increased management skills.

6. They have an international experience which involves living in a second country for an extended period of time.

7. They have new non-research related experiences, resulting in personal growth and development and improved social competence.

8. Their language skills improve.

We don't claim that this list is exhaustive; it is just what we came up with on the day. There may well be other benefits. It should also be noted that these programs require the student to spend at least one year at each institution. Research exchanges and international collaborations may require less time at the second institution and less engagement with that institution (i.e., not being enrolled as a student at the second institution and therefore having to satisfy the requirements of that institution). The above advantages might also apply to research exchanges and international collaborations but perhaps with less intensity.

Returning to the question posed in the opening sentence of the paper, I think points one through eight do each help prepare students for global careers, with points two, four, six, seven and eight making the strongest contribution. I would also add that students' experiences give them greater confidence to think globally in terms of their career. Their international student and researcher network will most likely give them a greater range of career opportunities to choose from. It is also my understanding that employers do value an extended international experience when making recruitment choices.

Universities (and many governments) are seeing the strategic importance of research collaborations. We are seeing something of an explosion in jointly awarded degrees and research exchanges. Clearly these developments will lead to a greater number of researchers who see themselves as global citizens rather than as citizens of a particular country.

Harnessing Globalisation in the New Knowledge Society: Developing Graduate Talent for Innovation and Inclusion

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Vice Chancellor
University of Johannesburg

The next four decades leading to 2050 will see the world experience unprecedented changes, including an explosion of urbanisation, revolutionary innovations in science and technology and a rebalancing of economic power from developed to developing countries, which will offer new opportunities as well as risks. Key drivers of change during this period of extraordinary change for the planet are: (1) a West to East tilt; (2) interconnectivity; (3) globalisation; (4) climate change; (5) science and technology; and (6) the rise of Africa.

These changes point to a significantly more integrated, multi-polar and inter-dependent world, and of increasing dependence on the active construction of knowledge societies that constantly develop new ideas, technologies, methods, products and services. This new world of multiple knowledge nodes will include the development of many South-North and South-South knowledge nodes.

Specifically, despite their different histories, cultures, development trajectories and endowments, countries and regions from the East and the South, in parallel with their increasing economic, political, social and cultural influence, with the East well ahead of the South, are expected to present more robustly their research competitive advantages. They are also expected to invest more heavily in knowledge production, as they move their economies and societies 'upstream' and compete more actively for important global research projects. No more will the presence of critical research mass in the West and the North be the sole determinant for winning global research bids. Instead, global research projects will enable the scaling up of well-established research groups in the East and South. An excellent example of this is South Africa's winning of (a 70% share of) the Square Kilometre Array (SKA) radio telescope project which aims to link thousands of radio telescopes, enabling unprecedented astronomy

research to be carried out from this country. Another example from South Africa is in the field of palaeontology, to which leading global scholars are being attracted as a result of recent discoveries. In response, countries and regions such as the European Union are now playing catch up, by establishing their own large regional research projects. Many existing projects, such as the CERN Large Hadron Collider Project, although based in the North, increasingly involve participants from the South, including in this instance six South African universities, the University of Johannesburg amongst them.

These important changes challenge our assumptions, and require us to rethink our understandings of the purposes of graduate education at the present time. Traditionally, we have been concerned with the development of graduates' knowledge, theoretical frameworks, methodologies and experiences (= "depth.") Now, in addition, we have to turn our attention to different ways of knowing within culturally diverse and trans-disciplinary networks and teams, and thus to the revaluation of global scholarship, by nurturing global scholars and citizens who, while anchored in their home nations, regions and continents, are able to apply knowledge gained across cultures, nations and regions (= "breadth.")

Moreover, collaborative research projects have become a fact of life, especially so in science, engineering and technology, and the era of the "brilliant loner" and "master" in all the diverse facets of a research project has virtually come to an end. The demands of time, equipment and facilities, as well as the multi-faceted nature of research in the 21st century, makes it extremely difficult for an individual to make a significant contribution entirely on their own.

In this regard, the University of Johannesburg and other institutions are already experimenting with exciting new approaches for nurturing global South-North and South-South excellence networks. These include:

1. *Joint degree programmes*, where graduate students are able to undertake studies with two sets of supervisors/advisors across continents, and graduate with a joint degree. The most effective instance of this at the University of Johannesburg is our joint programme in organic catalysis with St Andrews University.

2. *Research exchanges*, such as the University of Johannesburg's partnership in Water Nanotechnology with the Indian Institute of Technology (IISc) in Bangalore. In this important research collaboration initiative several of our doctoral students are now undertaking advanced work with co-supervisors/advisors at the IISc, and a good number of post-doctoral students from the IISc are undertaking further research at the University of Johannesburg. Another important UJ research exchange is a multi-university Water Nanotechnology collaboration involving UCLA and Ben Gurion and Ghent Universities. Our EnerKey research programme is a South African-German collaboration, with the University of Stuttgart, conducting applied research and knowledge exchange in energy and climate protection strategies focusing on multi-disciplinary and multi-institutional research about how a city and its inhabitants derive, transform, transport and use energy, and how the province can move to a low carbon province. Our collaboration with the Royal Botanical Gardens at Kew Gardens, U.K., and with colleagues at Imperial College London aims to establish a DNA database for all tree species in Africa, and eventually across the world.

3. *International agreements*, of which several hundred exist but are only partly functional. Accordingly, they are being reviewed to focus efforts on sound and substantial international networks, notably U21, in which membership will be taken up in 2013.

4. *Visiting professors* play an important part in the maintenance of an active research culture in an institution or research group. First, to the hosting institution they bring the obvious benefit of bringing the highest levels of expertise and knowledge, and second, they provide the opportunity for students and young research workers at the hosting institution to learn from, and interact with these leaders in their fields.

Seven key success factors for these initiatives have been identified. First, collaborative research partnerships between individuals, research

teams or institutions must be founded on a shared, common, mutual and complementary interest. Second, such a partnership must be understood by the partners to be essential for the attainment of the research objectives and outcomes. Third, universities should determine, right at the start, their priorities and what they wish to achieve with their partners. Fourth, all partners must clearly communicate what they understand to be the requirements for successful collaboration. Fifth, partnerships must be equal, rather than asymmetric, even if one partner brings fewer resources to the partnership. Sixth, and again at the outset, reciprocity must be defined and built into the partnership. Finally, it must be recognised that, even with clear guidelines, successful partnerships are founded on people and human interaction, and must meet the criteria of honesty, openness, accommodation and responsiveness to changing circumstances.

Graduate Schools: An Opportunity to Foster Interdisciplinary Research and International Collaborations

Hans-Werner Schmidt
Vice President for Research and Director of the Graduate School
University of Bayreuth

As PhD students are in Germany the main personnel for carrying out research projects, German universities increase their efforts on a national and international level to attract the most talented and qualified doctoral students to their departments and laboratories. In recent years, they have created central or decentralized graduate schools as an important tool to attract international postgraduates. master programs in English and graduate schools visibly mark the entrance to doctoral studies and offer to PhD students structured programs in a research environment composed of interdisciplinary expertise, an outstanding state-of-the-art research infrastructure with supervising scientists acting in international networks. master and PhD students profit directly from the enhanced expertise and expanded contacts, which increase the quality of their research and enhance their further career perspectives.

Graduate schools open new ways to implement interdisciplinary PhD programs at Universities. By this they provide an important platform to foster interdisciplinary research. PhD students will explore, in a much broader way, modes of interdisciplinary research and utilize their internal and external contacts to benefit their own research and to plan their future careers.

An illustrative example at the University of Bayreuth is the area of polymer and colloid science. This area is one of the interdisciplinary profile areas of research and study at the University of Bayreuth. It is represented by more than 35 research groups from chemistry, physics and engineering, and includes the entire knowledge chain from synthesis, physics, characterization, processing, and technology of polymers to applications and products. Polymer Science is in itself an interdisciplinary area of materials science, based on the traditional disciplines of chemistry (organic, inorganic, physical chemistry and biochemistry) and including theoretical, experimental polymer physics and engineering sciences. Most

important in graduate education in this particular area are the master program Polymer Science and PhD program in Polymer Science within the Bayreuth Graduate School of Mathematical and Natural Sciences, the latter being a part of the recently established University of Bayreuth Graduate School. Based on interdisciplinary curricula, faculty members and PhD students interact and collaborate closely in a great number of interdisciplinary projects, collaborative research centers and research training groups funded by the German Science Foundation or other funding organizations.

What are the next steps in the future? The next steps clearly focus on international collaborations and global research networks. Graduate schools with dedicated interdisciplinary PhD programs are the best mechanisms for setting up international research collaborations. In this context, most important are international research experiences and research exchanges involving PhD students. PhD students in Germany are more and more interested in conducting part of their research abroad during their PhD thesis. Stays for three to six months are ideally suited. Therefore graduate schools and graduate programs should more intensively collaborate on an international level and should establish strong networks and partnerships. Funding agencies should bring more attention to this issue and continue to establish programs which foster international collaborations and international university partnerships, including PhD student and faculty exchanges. Joint research-oriented summer schools and joint teaching modules incorporated in master programs and graduate schools are the first steps toward enhancing international collaborations. The German Science Foundation, with its program on International Research Training Groups, is a very positive example.

Thinking beyond Traditional Paradigms: Interdisciplinary Opportunities

Maureen Grasso
Dean of the Graduate School
The University of Georgia

The world our students are entering today is faced with complex, systemic problems that require the know-how to cross boundaries, build bridges, create connections, and communicate effectively. Interdisciplinary opportunities prepare our students to address the "wicked" societal problems by moving beyond traditional academic disciplines. Allowing students to follow their passion by developing their expertise in a particular field and creating new knowledge are important outcomes of graduate education. However, providing them with the education and experiences to use their knowledge in a broader context is one of the greatest challenges that require our attention.

The typology shown in Figure 1, lists a set of broad research competencies, key individual characteristics, and basic communications skills that support interdisciplinary research. This succinct typology is not intended to be inclusive, but rather to serve as a starting point for discussion about the professional development experiences our students need in order to expand their capacity for conducting both interdisciplinary and global research. It is proposed that providing students with interdisciplinary opportunities also prepares them to conduct research within global research networks.

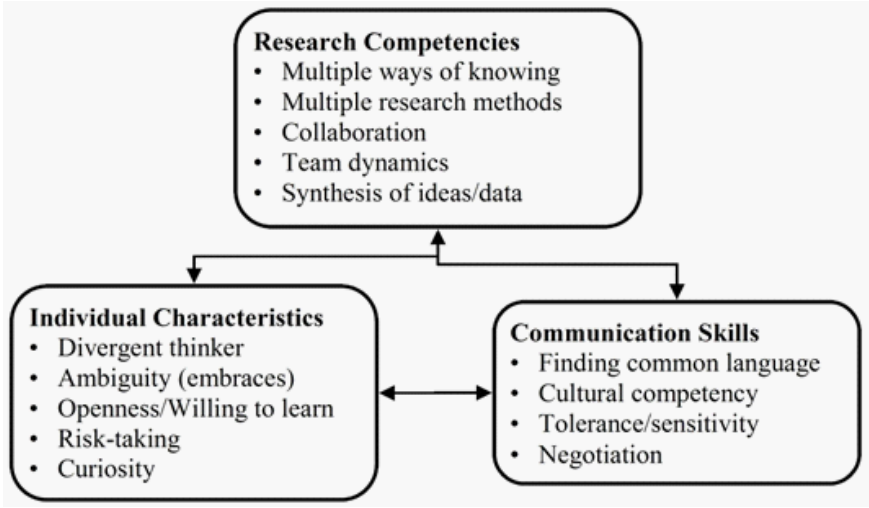

Figure 1. Competencies, characteristics, and skills supporting interdisciplinary research

Interdisciplinary research requires a minimum set of competencies to develop an integrative approach to examine critical issues. This research effort requires an appreciation and acceptance of different epistemologies or multiple ways of knowing, which can lead to integrated or new perspectives of the problem. Individuals involved in interdisciplinary research bring knowledge of different disciplines to the team and an understanding of "what they know they don't know" about the problem. Working on a problem from an interdisciplinary perspective and using a variety of research methods requires collaboration and teamwork. The end result requires the ability to synthesize and integrate multiple sources of information and data to generate new knowledge.

It is important to consider the individual characteristics that contribute toward the development of interdisciplinary research competencies. Divergent thinkers who can manage ambiguity, who are open to new ideas, and who are willing to learn are more likely to be successful in exploring new perspectives raised in interdisciplinary or global research settings. Risk-taking, not being afraid to fail, and the ability to learn from mistakes are other key characteristics. Perhaps most important, is having the curiosity and imagination to develop an interdisciplinary focus.

Communicating with others means being able to find a common

language to talk with those who may have different levels of expertise, who have expertise in a different discipline, or who conduct research in a different language. Communication skills also include recognizing and valuing the culture diversity of research team members, whether between disciplines or between cultures. The differences offer an opportunity to develop creative solutions or may require negotiation skills to resolve conflict and acknowledge biases.

Our experiences at the University of Georgia show us that there is reciprocity between conducting interdisciplinary research and participating in global research. In several cases, experience in one area has given students the knowledge and skills to undertake work in the other.

- The toxicology program has a multi-dimensional curriculum, asking students to look at problems from different perspectives, while learning how to converse with researchers from various disciplines. Participation in global research programs lets participants see how the lessons and skills taught in the classrooms and labs apply at different levels and in different circumstances. It allows students to compare approaches, look at successes and failures, and assess lessons learned.

- Faculty report that global research experiences change students in terms of knowledge gained about the research and, more importantly, broadened their world perspective. Students, such as the ones in our Infectious Diseases program, gain appreciation about the perseverance and dedication of conducting research with colleagues in other countries.

- Interdisciplinary programs such as the Ideas for Creative Exploration create a shared discourse to work together and build coalitions to reach across disciplines, institutions, and countries. These skills have been used by students to lead "quality of life" research projects around the world. In one case, a student reported that she "could not have come up with the project" for her Fulbright grant without the experience of participating in the collaborative international art projects led by the program.

In some programs such as the Complex Carbohydrate Research Center, the interdisciplinary and global experiences occur in the same time and place as teams of researchers from around the world work together using a variety of techniques and approaches.

Finding innovative solutions to the complex problems of today requires us to think beyond our traditional paradigms. Whether preparing our students to work in interdisciplinary research teams or to lead global projects, the ability to cross boundaries effectively and successfully is crucial. Providing our students with opportunities to develop the research competencies and communication skills, and to enhance individual characteristics that can be translated into both interdisciplinary and global work, will allow them to build the bridges and create the connections to generate new knowledge and find new solutions.

VI. OPPORTUNITIES FOR GLOBAL COLLABORATION

Summary of Papers and Discussion

Stakeholders outside the university play an important role in creating and disseminating information about the global workforce. Panel 6 addressed strategies for engaging in productive dialogues with international organizations, national and regional governments, and the public. Presenters from South Korea, South Africa, and Germany addressed the following questions under two broad topics:

- *The Role of National and International Organizations:* What role can national and international organizations (including funders of graduate education and research and disciplinary societies) play in supporting global career opportunities for graduate students?

- *Public and Media Outreach for Scientists and Scholars:* How does your institution interact with the (international) media? Do you train your scientists and scholars about when, what and how to communicate with society? How can the graduate education community contribute to a critical and rational dialogue on pressing global societal issues and thus influence public opinion making and foster international collaboration?

The Role of National and International Organizations

Governments and non-governmental organizations can work in a

variety of ways to strengthen the role that universities play in attracting and preparing talent for the global market. **Kyung Chan Min** (Yonsei University) noted that while 90 percent of Korean graduate students search for jobs off campus, more work is still necessary to dispel the notion within universities that graduate degrees prepare students for careers in academe. His presentation focused on a variety of ways in which the Korean government has worked to establish policy measures and provide incentives to support greater recognition of the role that master's and doctoral graduates play in the non-academic workforce.

Shireen Motala (University of Johannesburg) made the point that across the Southern African region, participation in higher education is low (at 5%). Such low participation makes it more difficult to structure opportunities to engage in international partnerships in such a way as to ensure benefits to the region. She described a number of foundations, partnerships, and associations that have been designed to foster "brain circulation" rather than "brain drain." She also discusses specific challenges, such as the fact that cross-continental partnerships have been more difficult to build, in some ways, than those with Europe, Brazil, and India, and that in a broader context of diminishing development funds, competing priorities of elementary and secondary education have taken precedence over graduate education.

Annette Schmidtmann (German Research Council) focused on a variety of means by which the German Research Council supports global opportunities, including funding PhD program opportunities that emphasize international collaboration, supporting "role model" programs that encourage scholars engaged in research abroad to return and incentives that foster early independence of young researchers, international networks, and political outreach.

Public and Media Outreach for Scientists and Scholars

The post-panel discussion focused on a key global skill demanded of the global workforce: communication. Participants discussed a variety of ways in which graduates students are prepared to communicate beyond their immediate academic communities of discourse and discussed the role of the graduate school in providing this training. **Ernst Rank**

(Technische Universität München, TUM) presented on how a leading research university in Germany's Excellence Initiative prepares scholars for excellence in research by also preparing them for their roles and responsibilities in society and the world. To achieve this, TUM sustains active collaborations across the university with units such as the Corporate Communications Center (to focus on communications and media strategies), the Carl von Linde Academy (for professional development in skills such as ethical reasoning and navigating cultural and international issues), the Munich Center for Technology and Society and others. The vast network of collaborations that TUM has utilized to prepare scholars with a broad set of global skills has proven beneficial for senior and young scientists alike.

Discussion highlighted a range of effective strategies for communicating with the public. In one example adopted by many participants and cited as highly effective, the graduate school held a competition for student presentations of a compelling "three minute thesis," or brief presentation of their work for a general, non-specialist audience. Participants from Australia, Canada, and the U.S. discussed the huge impact this seemingly small intervention has had on raising visibility among legislators and the media and raising the public profile of graduate education.

Conclusion

During this panel's discussion, Ernst Rank described graduate schools as "maybe the most international parts of universities." In places where this statement holds true, graduate schools have responsibilities not only for structuring and incentivizing opportunities for international collaboration but also for communicating their value and achievements to the public. In places where governments and foundations may now play the chief role in structuring and incentivizing these opportunities, assessing and communicating the value of an investment in international collaborative research is nevertheless equally vital to ensuring continued public support.

Participants at the summit represented the graduate schools of their universities as well as a range of other organizations in their regions that partnered with universities to prepare graduate students for the global

workforce. Their exchange of strategies and model programs highlighted challenges both common and unique, and a better understanding of these challenges will result in stronger and more effective solutions.

Pathways from Graduate School to Careers: Korean Contexts and Trends

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Presidential Advisory Council on Education, Science & Technology
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In this knowledge-based society with globally intensifying competition, every country gives a priority in national policy to fostering and securing global talent, essential factors for leveling up national capacity. The Korean government is making various efforts to establish an attractive environment in order to invite highly qualified human resources from overseas. Korea is one of those countries expecting social and economic problems in the near future due to a rapidly decreasing birth rate. However, due to a decrease in the number of 'good' domestic jobs for the younger generation, the Korean government is also trying to establish effective policy measures for students to develop their careers successfully in the global market.

The academic community in Korea has always considered graduate school as a place to nurture the next generation of academics. However, Korean society has recognized graduate education also as a basis of economic progress through education and research. We notice that almost 90% of graduate students search for jobs off campus; therefore graduate institutions should engage the government and employers in developing a new atmosphere to nurture students as competitive global talent.

Here we introduce some possible roles of national and international organizations by giving various examples. First of all, the government should expand policy efforts to strengthen the link between graduate training and global workforce trends. The Ministry of Education, Science and Technology (MEST) of Korea is providing the Global Partnership Program to invite world-class research institutes from overseas to establish a research center in Korea to attract excellent researchers from overseas. Another example is the Global Korea Scholarship (GKS) program to facilitate educational exchange and human resource mobility, particularly from developing countries. The POSCO TJ Park Foundation, launched by

the Pohang Steel Company (POSCO), the world's leading steel company, supports full scholarships for prospective leaders of Asia to enroll in graduate courses at some of the most prestigious Korean universities and institutions.

The MEST is also providing scholarships for Korean students to have a broad variety of experience in any region in the world. The Korea Foundation (KF), a nonprofit organization affiliated with the Ministry of Foreign Affairs and Trade of Korea, is also implementing the KF Global Internship Program, providing Korean students with opportunities to work as an intern or as visiting researchers at leading policy research institutions overseas.

As a bi-directional academic mobility program, ASEM-DUO Fellowship Program gives benefits to undergraduate and graduate students, university faculty, and school teachers from the educational institutions of ASEM member countries in Asia and Europe. The United Nations' Academic Impact project is also a good example, which aligns institutions of higher education, scholarship and research with the UN and with each other to address priority issues with which our world is faced. The UN considers the academic community a most important partner to strengthen its capacities on the UN's work: peace, development and protection of human rights.

Furthermore, the government should encourage and support universities to develop new programs for the development of global careers and to improve the quality of graduate training and professional development meeting global standards. The MEST will launch a project to support innovative new programs, preferably interlinking graduate education and the market. The Professional Science Master's Program can be a model in this project, and another model could be a program jointly created by university and global corporations, reflecting the knowledge and skills needed to succeed and the expectations they have for graduates.

Recently Korea joined the Free Trade Agreement (FTA) with many countries and regions, including Canada, the EU, Turkey, the U.S., etc. and will extend its effort to have more FTA signings. Moreover, Asian countries have been developing various types of regional cooperation in higher education, including CAMPUS ASIA, an Asian version of the European Community Action Scheme for the Mobility of University

Students. It is expected that this kind of development in global villages will create new global career opportunities and stimulate the professional workforce to move around more actively among those countries.

In this global environment, the dissemination of useful information about global workforce trends is becoming more important to developing global career opportunities efficiently. We expect that governmental institutions will be the main service centers for this task. Of course, global corporations originally established in Korea should also take part in this dissemination effort in the global market.

The Korea Research Institute for Vocational Education and Training (KRIVET) is one of the centers providing information and career counseling for all for their employment and career development activities. In fact, one part of the mission of the KRIVET is to establish and manage a system for collecting information and analyzing the labor market trends and to promote the international exchange of information on education and training. The Korea Trade-Investment Promotion Agency (KOTRA) and the Korea International Cooperation Agency (KOIKA) are also important institutions to promote global career development for graduate students by providing useful information.

The ability to speak the Korean language is also an important factor for successful achievement for a foreigner in Korea. The Korean government has been increasing the number of Korean language institutes overseas by developing the Test of Proficiency in Korean (TOPIK). The Ministry of Culture, Sports and Tourism is now supporting 75 Korean language institutes in 34 countries. Furthermore, various types of fellowships for Korean language training are awarded to researchers and graduate students studying Korean Studies subjects and other persons professionally engaged in Korea-related activities.

The global community today relies more than ever on reinforcing international cooperation to resolve the current economic crisis and other global issues, such as climate change, environment, energy, disease, food, water, and natural disasters. Graduate education should play a vital role in working to overcome these serious global issues, and, as part of this broader goal, support global career opportunities for graduate students.

The Role of International and National Organizations

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University of Johannesburg

Higher education is of vital importance to the long-term development of knowledge societies. Research, the training of researchers, and the enhanced social and economic opportunities that better educated populations can provide, are fundamental to knowledge generation and innovation both locally and globally. The challenges in Africa are particularly relevant here, since the current participation rate in higher education is estimated at 6%, compared to a global average of 26%. South Africa fares a little better with a participation rate of 16%, but across the Southern African region the rate is only 5% (Lewin, 2011).

In an increasingly interdependent and interconnected world, we need to work together to address global challenges such as sustainable development, energy, climate change, security and migration. It is especially in these areas that career pathways need to be developed, pathways that will benefit most from global exposure. Trends in higher education include greater diversification and specialisation, the promotion of institutional diversity, and the expansion of the role of ICTs and technology dependence, all of which influence the future career trajectories of young people.

Universities are experiencing fundamental changes in the way they perform their core functions, as a result of increased internationalisation. Internationalisation, in the form of both student mobility and an expanding exchange of ideas, theories, discourses and conceptual frameworks, should ideally promote institutional, national and regional goals; but despite the best intentions, current trends still perpetuate global imbalances. As was noted at the Southern African Vice Chancellors' policy dialogue in Mozambique in June 2012, "the flows of students and academics to and the borrowing of institutional and intellectual models from the North have dominated the historic patterns of internationalisation for African higher education institutions" (SARUA, 2012). In Southern Africa, various regional and cross-national organisations need to redouble their efforts to harness internationalisation in ways that benefit local development, and thus build on processes which started with the 1967 Arusha Declaration

on formalising higher education cooperation and international exchange and which were boosted more recently by the Bologna Process, launched in Europe in 1999.

A review of the role of national, international and disciplinary organisations, and their role in supporting global career pathways, highlights some obvious benefits. National and international funding partnerships are strategic vehicles for developing capacity at both individual universities and in the tertiary sector as a whole, and contribute to enhanced academic performance and better career opportunities for graduates. Such partnerships and collaborations also inform policy-making and improve access to and retention in higher education.

Some examples from the Southern African and African context include:

- In South Africa, the National Research Foundation disburses about $250 million annually in support of its aim to "increase the number and diversity of highly skilled knowledge workers who can qualify for critical positions in academia, the public service and the private sector" (National Research Foundation, 2012).

- Regionally, the Southern African Vice Chancellors Association plays an important role in mapping critical staff and human capacity shortages at universities, and has focused on improving the key competencies of senior managers through training programmes which address the region's unique challenges.

- At an institutional and disciplinary level, the University of Johannesburg (UJ), supported by the government Department of Science and Technology, offers a joint MSc programme in Nanoscience in partnership with several other universities. The Council for Scientific and Industrial Research provides financial and supervision support to UJ's Chemistry and Physics programmes, and its Masters programme in Nuclear Physics is supported by the parastatals of NECSA and iThemba Labs. A number of joint PhD exchange programmes in Engineering,

Health and Science exist with Ghent University in the Netherlands, Jacobs University in Germany and University Estadual Paulista in Brazil.

- The EU-funded Africa-Europe Higher Education cooperation for development has eight sub-partnerships, ranging from energy and climate change to migration, mobility and employment, and also aims to strengthen intra-African cooperation in higher education.

- The AU/NEPAD Africa Biosciences Initiatives consist of four regional networking models, in North, Eastern and Central, West and Southern Africa. The Southern African projects range from fish biodiversity, coordinated by the University of Malawi, to bioinformatics, coordinated by the University of Mauritius.

- USHEPiA, the University Science, Humanities and Engineering Partnerships in Africa, which is funded by the Rockefeller Foundation and the Carnegie Corporation, seek to train and retain African academic staff through South-South collaboration.

These and other international, regional and national partnerships provide us with the means, and the responsibility, to decide what types of knowledge we want to pursue, what kinds of knowledge alliances we wish to build, and how to enhance scholarly production and career pathways which promote "brain circulation" rather than "brain drain."

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The Role of National and International Organizations

Annette Schmidtmann
Head of Division Research Careers
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Introduction

One of the Deutsche Forschungsgemeinschaft (German Research Council, DFG) missions is the support and promotion of young researchers. Outstanding science and research need creative people and innovative ideas. This is why the DFG's funding portfolio places particular emphasis on young investigators. Based on academic excellence, flexible funding instruments are tailored to meet the specific needs of young scientists and academics, thereby enabling them to pursue their research careers. The DFG honors the best researchers with funding and, at the same time, gives them the means and freedom necessary for successful research. The DFG funds excellent research without regard to extra-scientific factors. Equal treatment of men and women and broad representation of the scientific disciplines in the self-government of the DFG ensure the diversity and originality required for outstanding research.

What role can DFG play in supporting global career opportunities?

1. First, offer attractive PhD programs which emphasize international orientation
2. Second, offer 'role model' programs after the PhD
3. Third, support return of researchers on adequate positions: early independence
4. Fourth, address and pursue strategic objectives in international networks
5. Fifth, advise politicians.

PhD Programs with an International Orientation

In all DFG programs, international cooperation and experience are emphasized as important for a career in science and research, and this is

subject to review criteria. International collaboration is supported broadly, e.g. by providing means for travel or (even long-term) invitations of guest scientists. Thus, young PhD candidates have the opportunity early on to get in contact with international cooperation partners and gain knowledge about the international state of research in their respective fields. A huge proportion of DFG's approximately 200 Research Training Groups, a successful program running for more than 20 years, offer international training and cooperation. Indeed, 25% of the groups are so-called "International Research Training Groups" because partners from abroad are participating. The institutionalization of graduate training in the 45 Graduate Schools, stimulated through the Excellence Initiative, gives an incentive to German universities to take more care to foster an international and open atmosphere, which was a significant criterion in the peer-review and decision process of the Excellence Initiative.

Role Model Programs after the PhD

Many programs specifically address researchers from abroad in order to alleviate difficulties surrounding the decision to return to Germany. For example, outgoing fellowships include return fellowships to bridge the first months after the return to Germany prior to finding an employment position or adequate funding. During the stay abroad, travel funds are provided in order to support the process of contacting research institutions as potential employers in Germany.

One example for a role model program is the Emmy Noether Program (ENP) for junior group leaders. The Emmy Noether Program supports young researchers in achieving independence at an early stage of their scientific careers. "Emmys" are "handpicked." What does it take to be an Emmy? Applicants must demonstrate that they have conducted independent research after obtaining their doctorates and are able to build independent academic careers. They need to have detached themselves from their professors, meaning they should be independent and mobile, both geographically and thematically. Candidates should have worked abroad for at least one year. It is irrelevant whether this international research experience was part of their doctoral training or gained afterwards. Applicants who have not done any research outside Germany, but who are

part of an international network, have a particularly good chance of being accepted. Scientific excellence and independence are the key criteria that all applicants must demonstrate in the tough competition for funding. In addition to the recognition gained through the position, the funding of a research group with two to five PhD assistants and post-docs is highly attractive. Like all DFG programs, it is open to non-German citizens.

Early Independence Puts Young Talent on the Fast Track

Young researchers benefit from greater academic freedom and excellent resources. In the Emmy Noether Program, they enjoy a privilege that many of their colleagues in Germany can only dream about and which is unheard of among many university lecturers; Emmy Noether fellows are scientifically independent. They select and head their own independent junior research groups, supervise doctoral students, teach, perform management tasks, administer their own budgets—and they do so at a university of their choice.

Close to nine percent of these young researchers come from outside Germany. The program does not pursue a brain gain strategy per se, but tries to recruit the best researchers, regardless of their current location. The ENP especially targets highly accomplished Germans who would like to return to Germany. For them, excellence funding might be just what they are looking for, as it allows them to conduct research in Germany under conditions that match the attractive packages offered in their adopted country. The biggest incentives are greater academic freedom and excellent resources for their own research group. Word of such benefits gets around in the scientific community. Young people go wherever conditions are most favorable.

International Networking – GAIN

In September 2012, the 12th annual GAIN meeting will take place in Boston. The German research organizations, the Alexander van Humboldt Foundation (AvH), German Academic Exchange Service (DAAD), and DFG, established under the GAIN initiative a new organization and an annual meeting to inform their U.S.-based post-docs about what is going

on at universities and research institutions in Germany. The interest in participating in this meeting has continuously increased: a few years ago, politicians from the German parliament began to discover that this meeting is an ideal platform for them to get in close contact with young researchers, hear about their problems and discuss with them developments in the German academic system. All in all, it has become a highly attractive meeting, giving the U.S.-based post-docs a feeling that they are warmly welcomed back to Germany after their research experience abroad.

Policy Advice: The European Research Area

The DFG actively supports the establishment and development of a common European Research Area. It recognizes as its most important role that of overcoming the national fragmentation that still exists in the European research landscape by means of close cooperation with its partner organizations in the context of EUROHORCs (Science Europe) and through joint funding of international research projects. The primary objectives are to ensure increased mobility across Europe, to create consistent quality standards by implementing common peer-review processes, and to create joint funding mechanisms. These joint actions by the national funding organizations simultaneously constitute the counterpart to the EU actions under the Seventh Framework Program (FP7). In this respect, the newly established European Research Council (ERC), which was created as part of FP7 and is the first pan-European instrument for funding basic research, is of particular importance. This coexistence of strong national funding bodies and a pan-European EU funding instrument represents a unique opportunity for the funding of basic research in Europe. Productive collaboration, balanced between cooperation and competition, will boost the European Research Area, making it more attractive and thus more fit for competition.

Public and Media Outreach for Scientists and Scholars

Ernst Rank
Graduate Dean[1]
Technische Universität München

Graduate schools can and should play a decisive role in the dialogue between academia and the public. Very often, they are the most international part of a university. Their members, young and senior scientists, have a background in many different sciences, nations and cultures. Young scholars work and often live together in a phase of their lives where they are critical enough to question traditional paths, mature enough for rational and responsible discussions on regional and global societal issues and creative enough to develop unconventional new ideas and concepts. Graduate schools should put this ideal basis for a science-based and society-oriented discourse into practice. They should provide a broad forum for discussion, interweave research with society, and prepare their scholars for their responsible role in the world.

Against this background, the Technische Universität München (TUM) is not only committed to excellence in research and teaching, interdisciplinary education and the active promotion of promising young scientists. The university forges strong links with scientific institutions and companies across the world, as well as with society. As our mission statement puts it, "The TUM seeks dialogue with the public. Society should know what we in science and technology are doing for our future, and we also want to know what society expects of us."

TUM is engaged in this dialogue with the public on all levels: from the top management of the university to the heads of the departments, from individual senior scientists to young researchers. Our institutional outreach is coordinated and led by the Corporate Communications Center (CCC) which was heavily redesigned as part of the strategy that won TUM the designation of "University of Excellence" in 2006. Since then, media coverage has almost tripled, and a variety of new formats including a high-gloss TUM science journal, multimedia press releases, and a TUM YouTube channel have been established. A strong focus on English-language communication of newsworthy research at TUM has helped to

1 As of this volume's publication, Professor Rank is Chair of Computation in Engineering and is a member of the Faculty of Civil, Geo and Environmental Engineering at TUM.

raise the university's profile not only in English-speaking countries, but also worldwide.

The CCC coordinates the media presence and statements of the president and the members of the Board of Management, as well as the participation of TUM scientists as experts in any news coverage. The focus is multi-dimensional: topics of regional and political importance call for the expertise of TUM scientists. For example, Winfried Nerdinger, TUM professor of architectural history, was recently chosen by the Bavarian government to lead the process of establishing a memorial and documentary site for the origin of the Nazi movement in Munich. Furthermore, there are many national and international topic areas where our researchers make very valuable contributions to public discussion. Annette Menzel, TUM professor of ecoclimatology, was a lead author in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

TUM accepts its responsibility to educate young scientists to become excellent communicators and promoters of their science, as well as critical and accountable global citizens. The Carl von Linde Academy, established in 2003, provides our students with more than 200 courses strengthening their key competencies in ethical and philosophical questions, cultural and international issues, as well as personal development and professional skills.

In 2012, TUM founded the Munich Center for Technology in Society (MCTS) that focuses its research and training on the interface between the sciences, technology and society. Social scientists, ethicists, philosophers, historians, political scientists and media experts collaborate on joint research projects with engineers and natural scientists, on senior and junior levels. By bringing such diverse disciplines together, TUM wants to contribute to the public discussion by raising questions such as: How do society and the world of research influence each other? What ethical questions need to be considered when developing new technologies? How can the world of science and the general public communicate with each other? The Munich Center for Technology in Society collaborates with TUM Graduate School master's courses and integrates aspects of social science into all subjects taught at TUM.

In 2006, TUM established the International Graduate School of Science and Engineering (IGSSE), sponsored by the Excellence Initiative

of the German federal and state governments. The IGSSE combines academic excellence with high-profile doctoral education. The success of the graduate school is built upon young researchers' teams operating on cutting-edge science at the interface of science and engineering. Here, young scientists help create new paths of scientific thinking beyond the classical disciplines and simultaneously benefit from an outstanding training program. This is also geared toward the interaction of scientists with the media and the public. Our 2011 IGSSE Forum, a large symposium with 100+ PhD candidates, their advisors and international guests, addressed the question of how young researchers can contribute to the public dialogue on pressing issues of society. The young researchers' teams have also taken up the challenge of interacting with society. The team "Diesel reloaded" wants to implement a holistic approach to electromobility with a focus not only on the scientific and technical questions, but also on societal concerns and needs. Their "Innotruck," a hybrid diesel/electric tractor-trailer, is being developed for road shows and events geared to engaging in dialogue with the general public.

In a collaborative effort with the Deutsches Museum in Munich, we have installed an open research laboratory that brings everyday research work into the heart of the general public, with nanoresearchers working on scanning tunneling microscopes. From the initial research question to the first data analysis, the entire research process takes place in the Museum. Visitors are welcome to ask the scientists questions, and can also discuss topics of interest, such as the opportunities and risks of nanotechnology or even career choices for young people in the audience.

There are many more examples of programs to foster the dialogue between science and the public. While it is obvious that this dialogue is urgently needed, we clearly underline that it is necessary to get our young scientists prepared as early as possible for this challenge. We have to sharpen their perception of "what they do" in the labs and how this might possibly interact with society. We need to provide them with the tools to communicate effectively and at the same time listen to their counterparts. In this sense, a graduate school can be much more than just an organizational framework for excellent doctoral education. It can and should be a strategic institution connecting universities and society.

CONCLUSION: GUIDING PRINCIPLES FOR SUPPORTING GLOBAL CAREERS

The Strategic Leaders Global Summit concludes each year with the announcement of a consensus statement that outlines commonly-shared principles related to the summit theme. The diversity of countries and institutions represented at each year's forum means that agreement on all questions and issues raised at the summit is neither possible nor appropriate. Diverging viewpoints may reflect important differences in the missions of universities, for example, or between strategic national goals for graduate education.

Summits held over the past six years have nevertheless produced strong consensus statements on a range of important issues in graduate education. Past proceedings volumes contain principles on advancing graduate education globally (2007); Scholarly Integrity in a global context (2008); creating and maintaining effective international collaborations (2009); quality assessment in graduate education and research training (2010); building pathways from graduate schools to careers (2011); and, as the result of the 2012 summit, supporting global careers in graduate education.

The 2012 consensus statement, Principles for Supporting Global Careers in (Post)Graduate Education, outlines eleven areas where universities and graduate schools can work to support positive flows of global talent and successful global careers for their students and alumni (see Appendix A). Many of the principles focus on effective engagement with various groups, recognizing that graduate deans and other university leaders have a unique role to play in communicating the value of global careers to students, faculty and other stakeholders both on and off-campus.

The principles also articulate ways in which graduate leaders can help integrate preparation for global careers within institutional and curricular structures.

As the product of careful reflection and debate among the summit's participants, the principles have broad relevance to a range of international university contexts. I hope they will prove to be valuable to a wide readership of graduate leaders confronted with challenging questions related to graduate student mobility or career preparation.

Debra W. Stewart
President
Council of Graduate Schools

APPENDIX A: PRINCIPLES FOR SUPPORTING GLOBAL CAREERS IN (POST)GRADUATE* EDUCATION

Like all previous summits, the 2012 Global Summit concluded with a session in which participants worked together to revise and approve a set of conclusions based on areas of consensus that had emerged in earlier sessions. The consensus statement for the 2012 Summit included eleven recommendations informed by a shared goal: to prepare future knowledge workers with the skills and knowledge needed to enter a career that is "global" regardless of whether it requires travel or emigration.

Preamble

Today's doctoral and master's students will enter and lead a rapidly globalizing economy and research enterprise. In a world where technology and research offer new opportunities for global collaboration, all early-stage researchers must be prepared for the challenges and opportunities of a globalizing workforce. The participants of the 2012 Global Summit on Graduate Education encourage 'brain circulation,' or the multi-directional flow of talents, education and research that benefit multiple countries and regions and the advancement of global knowledge. It is the responsibility of graduate schools to match expectations for doctoral and master's students and faculty training with opportunities and incentives.

At the same time, a productive discussion of "brain drain" and "brain

circulation" requires careful examination of terms, assumptions, and values. Graduate leaders recognized the need to distinguish between a short-term and a long-term perspective on the global mobility of talent. While it is useful to track short-term patterns of student mobility, it is also important to understand long-term impacts of mobility on individuals, national and global economies, and global research and development.

In this context, it is important for universities and graduate schools to:

1. **Communicate the value and relevance of the broader concept of 'brain circulation.'** Graduate leaders have an important role to play in communicating the importance of global training opportunities for students, early-stage researchers and faculty on their campuses.

2. **Integrate international experiences and training into graduate degree programs.** These experiences can take place both at home and abroad. Not only should universities promote joint and dual degree programs, academic research exchanges, and internships, they should also use the international diversity of their campuses as a basis for training in cross¬-cultural skills.

3. **Provide robust support systems, programs and services** for international students and early-stage researchers on their campuses.

4. **Respect reciprocity in international collaborations** and recognize both material and non-material contributions.

5. Engage the intellectual leadership of faculty and students in developing **innovative and interdisciplinary global research practices** and related experiences appropriate to the field.

6. **Identify specific global competencies** within and across degree programs. As they prepare future knowledge leaders, faculty and researchers have an important role to play in identifying

these competencies by degree type and across fields of study, and across sectors.

7. **Prepare students and faculty to use emerging technologies** to advance and share knowledge globally. New technologies are essential to research collaboration and management, communication, and networking.

8. **Prepare graduate students for ethical issues** that emerge in a globalizing workforce. At stake in this preparation is human health and safety, the protection of the environment, and the quality of research.

9. **Assess and share the outcomes of global experiences and partnerships.** Assessments of institutional benefits, research outcomes, and learning are essential and will be most meaningful if designed to improve the quality of programs. It is critical to differentiate desired outcomes for different career pathways, e.g. in academia, industry, government and non-profit sectors.

10. **Collaborate with external partners in government, industry, professional societies, and non-governmental (NGO) sectors to facilitate multi-directional talent flows.** In particular, universities have an important role to play in communicating the impact of policies regarding, for example, immigration and professional credentials, on research productivity, national and regional economies, and on individual career trajectories.

11. **Encourage funding agencies** to allocate funding for international research experience and global competency training for PhD candidates.

* Since "graduate" and "postgraduate" are both commonly used terms for master's and doctoral education, and vary by country, the term "(post) graduate" has been used here.

APPENDIX B: PARTICIPANT BIOGRAPHIES

Dr. Vahan Agopyan

Dr. Vahan Agopyan is a Civil Engineer with a master's of Engineering (Building) from University of São Paulo (USP) and a Doctor of Philosophy (Civil Engineering) from King's College London. He has been Professor (Building Materials) at USP, Escola Politécnica, since 1994, and Provost for Graduate Studies at USP since 2010. Dr. Agopyan is a member of the Board of CIB (Int. Council for Research and Innovation in Building and Construction), CBCS (Brazilian Council for Sustainable Construction) and IPT (Institute for Technological Research of the State of S. Paulo). He is also former Dean of Escola Politécnica/USP, CEO of IPT, Coordinator for Science and Technology of the State of S. Paulo and member of the Board of FAPESP (The State of S. Paulo Research Foundation) and CAPES (Ministry of Education Agency to support and evaluate graduate programs). He has been decorated with the National Order for Scientific Merit and is a Member of the Pan American Academy of Engineering. Dr. Agopyan has been Supervisor of 22 doctor of Engineering dissertations and 23 master of Engineering theses. As professor, he studies fibre-reinforced materials and sustainable construction.

Professor Rose Alinda Alias

Professor Rose Alinda Alias was promoted to the post of Deputy Vice-Chancellor (Academic & International) at Universiti Teknologi Malaysia (UTM) on the 15th of January 2012. Beginning in August 2007, she served as the Dean of UTM School of Graduate Studies. As of December 2011,

UTM had an enrollment of 10,888 graduate students, of which 3,439 are at the doctoral level and 4,435 are international students. She was also elected as Chairperson of the Malaysian Graduate Deans Council from January 2010 to January 2012, a group which comprises graduate deans from 20 Malaysian public universities and two government-linked private universities. Professor Alias obtained her PhD from the University of Salford, United Kingdom, and MBA, Master's of Science in Computer Information Systems and Bachelor of Science in Computer Science. She has graduated 10 PhD students and is currently supervising 20 PhD students from Malaysia and other countries. She has actively participated as a representative of UTM and Malaysia in various summits and meetings organized by the Council of Graduate Schools since 2009.

Dr. Robert M. Augustine

Robert M. Augustine serves as Dean of the Graduate School, Research, and International Students & Scholars at Eastern Illinois University where he holds tenure as Professor of Communication Disorders and Sciences. He is the recipient of the EIU Distinguished Teaching Award, the Dean's Award for Service, and the EIU Technology Leadership Award. He served as chair of the Department of Communication Disorders and Sciences, as a Visiting International Scholar at Herzen State Pedagogical University of Russia, and as Interim Vice President for Academic Affairs for Technology. Dr. Augustine created the First Choice Graduate Programs initiative that won the Midwestern Association of Graduate School's Award for Excellence in Graduate Education in 2011. He guided development of the Integrative Graduate Studies Institute, which won the ETS/CGS Award for Promoting Success in Graduate Education in 2011. Dr. Augustine's international contributions include launching the Global Ambassadors recognition program, creating study abroad scholarships, and guiding the first dual and joint degrees with international partners. He also developed the Dean's Award in recognition of the most outstanding grant proposals and the May Award for the highest achievement in granting. Dr. Augustine earned his PhD from Southern Illinois University at Carbondale. He holds the Departmental Distinguished Alumnus Award from Southern Illinois University and Illinois State University. He recently completed a three-year term on the Board of Directors of the American Speech-Language-

Hearing Association. He was elected to the Board of Directors of the Council of Graduate Schools in 2010 and currently serves as President of the Board.

Professor Martin Bendsøe

Professor, dr.techn., Dr.h.c. Martin P. Bendsøe is Senior Vice President and Dean of Graduate Studies and International Affairs at the Technical University of Denmark (DTU). He received his MSc in mathematics and physics at the University of Copenhagen in 1979, his PhD in applied mathematics at DTU in 1983, and in 1995 defended his Dr.Techn. degree titled "Optimization of Structural Topology, Shape and Material." In 2010 Martin P. Bendsøe received the Doctorate honoris causa (Dr.h.c.) from University of Liège, Belgium, for his contributions to computational mechanics. He has during three periods served as the chairman of the Department of Mathematics, DTU (1989–92, 1998–2001, 2006–2009) and has also been the Dean of the Graduate School at DTU (1995–98). With more than 6,000 citations, he is the author of six monographs (four as editor), two textbooks, and more than 150 papers in journals, research monographs and refereed proceedings, on optimal design and control of structures and materials. He has a broad international background and has served as reviewer for universities and research foundations in more than 10 countries. He served as President of the International Society of Structural and Multidisciplinary Optimization (ISSMO) 2003–2007 and he is the current Chairman of the Danish Academy of Technical Sciences. He has received several awards including the Villum Kann Rasmussen Award, the most prestigious Danish award in the technical and natural sciences.

Professor Lucienne Blessing

Professor Lucienne Blessing holds an MSc (1984) in Industrial Design Engineering from Delft University of Technology (NL) and a PhD (1994) in Mechanical Engineering from the University of Twente (NL). Since 2007, she has served as Vice-President for research and as Professor in Engineering Design and Methodology, Université du Luxembourg. She is also currently a member of the Steering Committee of the EUA's Council for Doctoral Education.

Professor Blessing's research interests include product development process, diversity (culture, age and gender), product-service systems, user-technology interaction, design methodology, and design research methodology. She has supervised 21 and co-supervised five successfully defended PhD candidates and is currently supervising 7 PhD students. Since 1999 she is also co-organizer and main lecturer for the two-week European International Summer School on Engineering Design Research for PhD candidates.

Professor Blessing is a founding member of the Design Society (2000) and has served as an elected member of its Management Board (2000–2005) and as an elected member of its Advisory Board (since 2005). She served as co-editor of the journal Research in Engineering Design (Springer Verlag) from 1994 to 2009. She has authored, with Amaresh Chakrabarti, "DRM, a Design Research Methodology" (Springer Verlag, 2009). Professor Blessing is co-author of over 160 peer-reviewed publications.

Dr. Klaus Boehnke

After completing two MA-equivalent degrees in English and Russian (1975) and Psychology (1980), Klaus Boehnke commenced his academic career as a lecturer and research associate at the Department of Psychology of Berlin University of Technology, receiving his PhD in psychology from that university in 1985. He then went on to positions equivalent to an assistant and an associate professorship at the Department of Educational Sciences of the Free University of Berlin, where he also completed his psychology habilitation, the traditional German second PhD, in 1992. In 1993 he accepted an offer of a tenured full professorship of socialization research and methodology at the Department of Sociology of Chemnitz University of Technology. Since early 2002 he has held a chair position in social science methodology at the private Jacobs University Bremen. Since 2007 he has served as Vice Dean of the Bremen International Graduate School of Social Sciences (BIGSSS), an inter-university institution of doctoral education in the social sciences, jointly run by the University of Bremen and Jacobs in a public-private partnership. BIGSSS is funded within the framework of the German Excellence Initiative and has just received a nine million Euro renewal grant from the Deutsche

Forschungsgemeinschaft (DFG), with support until 2017. Dr. Boehnke has spent extensive time abroad at the Australian National University (1987), at the University of Toronto (1997/8), and at the National University of Singapore (2008/9). His research interests, manifested in over 300 publications (more than 60 listed in WebofScience), focus on processes of political socialization and of value transmission in family and society.

Dr. Brenda Brouwer

Brenda Brouwer is the Vice-Provost and Dean of the School of Graduate Studies at Queen's University having been appointed after serving in an interim capacity for two years and completing a five-year term as Associate Dean. She received a BSc in Kinesiology from the University of Waterloo, an MSc in Biomechanics from McGill University and a PhD in Neuroscience from the University of Toronto after which she accepted a faculty position at Queen's University. Dr. Brouwer is a full professor in Rehabilitation Science with cross-appointments to the School of Kinesiology and Health Studies and the Centre for Neuroscience Studies. She maintains an externally supported research program focused on the biomechanical, metabolic and physical demands of mobility in healthy aging and aging in the presence of stroke. Motor control and cortical reorganization following stroke is also a key focus of her research. She has supervised over 35 research master's and doctoral students to completion and several postdoctoral fellows. She has received awards for excellence in teaching and research.

Dr. Graham Carr

Graham Carr is Vice-President, Research and Graduate Studies at Concordia University in Montréal. At the time of the 2012 Global Summit, he served as the Dean of the School of Graduate Studies, which oversees more than 100 graduate programs, 7,500 graduate students, and 100 postdoctoral fellows. He has also held the positions of Associate Dean, Research and Graduate Studies in the Faculty of Arts and Science and Chair of the Department of History. He is past president of the Canadian Federation for the Humanities and Social Sciences, which represents more than 75 universities and 80 scholarly associations, and which hosts North America's largest, annual multidisciplinary congress. Dr. Carr has a PhD

in History from the University of Maine and holds an MA from Queen's University, where he also received his BA (Hons) History. His research interest is the cultural history of the Cold War.

Dr. John (Jay) Doering

John (Jay) Doering, PhD, PEng, FCSCE, FEC is the Vice-Provost (Graduate Education) and Dean of the Faculty of Graduate Studies at the University of Manitoba, Winnipeg, Canada. Jay holds a first-class honours BSc in Civil Engineering from Queen's University, Kingston, Ontario and was the recipient of a Natural Sciences and Engineering Research Council (NSERC) of Canada, prestigious Centennial Scholarship, which he used to complete a PhD in Coastal Processes at Dalhousie University, Halifax, Nova Scotia. He then accepted an NSERC Visiting Fellowship at the National Water Research Institute in Burlington, Ontario, before starting as a faculty member at McMaster University, Hamilton, Ontario. In 1993 Jay moved to the University of Manitoba where he rose through the ranks to become Head of Civil Engineering in 2001, and then moved to his current position in July 2005. He has successfully supervised a significant number of master's and doctoral students, as well as undergraduate theses. Jay is the Past-President of Western Canadian Deans of Graduate Studies, and served for two consecutive years as President of the Canadian Association for Graduate Studies (CAGS).

Mr. Rodrigue E. Gauvin

Rod Gauvin is a consultant for publishing companies serving the academic community. At the time of the 2012 Global Summit, he served as Senior Vice President, General Manager of ProQuest Information Solutions (PQIS), which he joined in March 2001. Mr. Gauvin brings more than 35 years of information industry experience in reference, professional, trade, and educational publishing to his role at ProQuest.

PQIS creates digital products for serious researchers, including aggregation of journals, books, collections, and newspapers delivered through the powerful ProQuest platform to libraries globally. As the publisher of Dissertations and Theses, ProQuest maintains the largest digital archive of this important scholarly material serving graduate university programs. ProQuest is the official offsite repository for Dissertations and

Theses for the Library of Congress.

Prior to his appointment at ProQuest, he worked for the Thomson Corporation as President and CEO of South-Western Educational Publishing, and as Managing Director of Thomas Nelson & Sons in the United Kingdom. Mr. Gauvin started his career with Thomson at Gale Research (now Gale Cengage). A long-time supporter of libraries, he was the architect of the Gale/Library Journal Library of the Year Award.

Mr. Gauvin is Past-President of the Association of Library Trustees, Advocates, Friends and Foundations, now United for Libraries, a division of the American Library Association. Further, he has served on various association boards, including the Software Information Industry Association; American Association of Publishers, School Division; United Way of Washtenaw County; and, Friends of Libraries USA. Mr. Gauvin received his BA degree, cum laude, from Assumption College in Worcester, Massachusetts.

Dr. Noreen Golfman

Noreen Golfman is a professor of English and Dean of Graduate Studies at Memorial University of Newfoundland. She oversees more than 110 graduate degree programs, many of which are interdisciplinary. In 2010, the School was honored by the Canadian Association for Graduate Studies (CAGS) and the Educational Testing Service (ETS) for its outstanding contribution in graduation admissions practices, the first ever national award of its kind. The award acknowledged innovations in electronic admissions and thesis preparation, and a suite of digital applications to increase efficiency and diminish the carbon footprint.

Dean Golfman was President of the Canadian Federation for the Humanities and Social Sciences (CFHSS) for four years. The CFHSS is a lobby that represents over 80,000 Canadian scholars, graduate students and postdoctoral fellows. She is currently President of the Northeastern Association of Graduate Schools (NAGS) and President-Elect of the Canadian Association of Graduate Schools (CAGS), and she is Chair of the Board of Friends of Canadian Broadcasting, an advocacy organization that serves the interests of the public broadcasting and telecommunications system.

In addition to her scholarly contributions on film and literature,

Dean Golfman has been writing on the arts in more popular venues, maintaining several weekly columns in newspapers and magazines. She has also been a freelance commentator, reviewer and performer with CBC Radio and Television for over twenty years. For over three years she has been writing a weekly blog—Postcards on the Edge—largely dedicated to graduate studies concerns. She blogs and tweets regularly.

Dr. Maureen Grasso

Maureen Grasso, dean of the University of Georgia's Graduate School, oversees the administration of 94 doctoral, 139 master's, and 17 specialist degree programs and 33 certificates. She is a Fellow of ASHRAE and holds a BS from Utah State University, an MS from Cornell, and a PhD from the University of Tennessee, Knoxville.

Dr. Grasso has engaged the community in a strategic assessment of graduate education addressing the challenges of innovation, interdisciplinarity, inclusiveness, and doctoral completion. She led the University of Georgia (UGA) in a comprehensive assessment of doctoral completion and attrition involving all graduate programs. Her work in this area has resulted in significant policy and program level changes resulting in higher completion rates.

Dr. Grasso was a member of the Commission on Pathways through Graduate School and into Careers, which examined the perspectives of U.S. graduate students, universities, and employers and their preparation for competing in the global economy and solving problems of a national and/or global scope. The resulting report was presented at the April 2012 Legislative Forum in Washington, D.C. She recently received a grant from the Council of Graduate Schools to participate in the Doctoral Initiative on Minority Attrition and Completion (DIMAC). She is serving as UGA's primary institutional leader for the Center for the Integration of Research, Teaching and Learning (CIRTL) network, of which UGA is a core institutional member.

Dr. Grasso is currently serving a three-year term on the CGS Board of Directors. In 2009, she received the CSGS Award for Outstanding Contribution to Graduate Education in the Southern Region.

Dr. Xiangpei Hu

Dr. Xiangpei Hu is Professor of Management Science and Executive Dean of the Graduate School of Dalian University of Technology, China. He received his BS, MS and PhD Degrees from Harbin Institute of Technology in 1983, 1987 and 1996 respectively. He received the National Distinguished Young Scholars Award from the National Natural Science Foundation of China in 2007; New Century Excellent Talent awarded by the Ministry of Education of China in 2007; Life Fellow of International Society of Management Engineers in 2009; and Chang-jiang Scholars Distinguished Professor from the Ministry of Education of China in 2010. His research and teaching interests focus on Electronic Commerce, Supply Chain and Logistics Management, Intelligent Operations Research and the Real-time Optimization Control for Dynamic Systems. Dr. Hu serves on five journal editorial boards. He is currently a visiting professor at Harbin Institute of Technology, Zhejiang University, Hefei University of Technology. He has undertaken dozens of funded research projects and published over 100 scholarly publications.

Dr. Julia Kent

Julia Kent (PhD, Johns Hopkins University) is Director of Communications and Advancement at the Council of Graduate Schools (CGS). At CGS, she has conducted research on a broad range of topics in graduate education, including quality and accountability, interdisciplinary programs, professional doctorates, research ethics and integrity, career outcomes, Preparing Future Faculty, and international collaborations. She has co-authored (with Daniel Denecke) Research and Scholarly Integrity in Graduate Education: A Comprehensive Approach (2012), Joint Degrees, Dual Degrees, and International Research Collaborations (2010), and Preparing Future Faculty to Assess Student Learning (2011), a report on CGS's recent initiative on this topic. Dr. Kent is also Director of CGS's Strategic Leaders Global Summit, an annual forum that has brought together leaders in graduate education from almost 30 countries to discuss international issues in graduate education and research. She has served as Managing Editor of the current volume and the past four summit proceedings: Global Perspectives on Research Ethics and Scholarly Integrity (2009), Global Perspectives on Graduate International

Collaborations (2010), Global Perspectives on Measuring Quality (2011), and Global Perspectives on Career Outcomes for Graduate Students (2012). Before arriving at CGS, Julia was Assistant Professor of English at the American University of Beirut (AUB), where she served on the Executive Committee of the Center for American Studies and Research, a research center that draws visiting scholars from North America, Europe, and the Middle East.

Professor Maxwell King

Professor Maxwell King is an Emeritus Sir John Monash Distinguished Professor at Monash University and internationally recognized as a distinguished researcher in the field of econometrics. He has been a professor at Monash University since 1986. At the time of the 2012 Global Summit, he was Pro Vice-Chancellor (Research and Research Training) and a Sir John Monash Distinguished Professor. He was Head of the Department of Econometrics and Business Statistics from 1988 to 2000.

Professor King was made a Fellow of the Academy of Social Sciences in Australia in 1997 and a Fellow of the Journal of Econometrics in 1989. He has held visiting professorships at the University of Auckland and the University of California, San Diego. He is a founding member of the Australian Council of Deans and Directors of Graduate Studies and was the Council's Convenor from 2007 to 2009.

Despite a significant administrative load, he has always been an active researcher having published over 120 journal articles. He has supervised 43 Ph.D. students to completion and received the Vice-Chancellor's Award for Postgraduate Supervision in 1996. In 2009 he received a Career Achievement Award from the Australian Learning and Teaching Council.

Dr. Marta Lee-Perriard

As Publisher for International Theses and Dissertations at ProQuest, Marta Lee-Perriard, DPhil (Oxon), presently works with European universities and the UK Russell Group to publish doctoral theses. Marta received her doctorate from Balliol College at Oxford University capping a decade of progressive academic success focused on French and Comparative Literature. Prior to her graduate studies, Marta worked at UNICEF Supply

Division in Copenhagen. In 2003 she started her career at ProQuest in academic publishing. In her free time she serves as a founding member of Suited & Booted—a London based charity that provides mentoring and clothing to vulnerable men including the long-term unemployed, ex-offenders, and HIV positive.

Professor Joe Luca

Professor Joe Luca is the Dean of the Graduate Research School at Edith Cowan University (ECU). His research interests are focused on promoting the quality of research and research training, supervisory practice, online learning, graduate attributes and project management. In these fields he has written over 100 refereed journal articles, book chapters, and book and conference publications. He has developed an online supervisor-training course that all supervisors at ECU will need to complete for compliance. This is supplemented with enrichment sessions and user groups, with a view to promote supervisor excellence. He has held many leadership roles in helping to promote teaching, learning and research training, which include being on international and national executive committees and serving as program chair for a number of educational technology conferences including ED-MEDIA, Global Learn, and Australian Society for Computers in Learning in Tertiary Education ascilite.

Professor Luca has been recognized for his excellence in teaching and learning, both within ECU and nationally, and has been awarded a national award for Teaching Excellence in 2008 (Australian Awards for University Teaching), an Australian CAAUT Citation Award in 2007 and Vice Chancellor's Award for Excellence in Teaching in 2006 & 2001. In 2011, he was awarded a grant from the Australian Learning and Teaching Council (ALTC) to develop a Best Practice Framework for Higher Degree by Research Training Excellence in Australia.

Dr. Jun Ma

Dr. Jun Ma is Executive Dean of the Graduate School and Dean of the School of Government at Sun Yat-sen University in Guangzhou, P.R. China. He holds a Bachelor's degree (1990) in Politics from Wuhan University, a Master's degree (1995) in Public Administration from Renmin University, and a PhD in Public Administration from the University of Nebraska. Dr.

Ma is also Professor at Yat-sen University and Adjunct Professor in the Department of Social and Public Administration of the City University of Hong Kong (2008–2013). His research interests include Budgeting and Financial Management, Public Administration, Fiscal Sociology, and State Building.

Dr. Ma is Chief Editor of The Journal of Public Administration (Chinese) and serves on the Editorial Boards of Public Administration & Development (UK); Public Budgeting and Finance (US); Australia Journal of Public Administration (Australia); and French Public Finance Review (France). Dr. Ma is the author of numerous books and articles that have been published in English and Chinese.

Dr. Liviu Matei

Liviu Matei is Senior Vice President and Chief Operating Officer of Central European University (CEU) Budapest. He teaches higher education policy in CEU's Department of Public Policy and leads the Higher Education Policy Stream in this Department. He studied Philosophy and Psychology at Babes-Bolyai University, Cluj and Sociology at Bucharest University. He received his PhD from the latter. He benefited from scholarships at the New School University, Université Paris X, Université Libre de Bruxelles, Université de Savoie, Salzburg Seminar. His professional trajectory includes work as Co-chair of the Working Group on Higher Education of the Stability Pact for South-East Europe; Member of the Steering Committee, UNESCO - EU Commission Project on Management of Higher Education in South-East Europe; Director General for International Relations, Romanian Ministry of Education; Lecturer, Babes-Bolyai University; Program Director, Médecins Sans Frontières, Program of Assistance to Underprivileged Roma Communities in Transylvania; Director, Civil Society Programs, Open Society Foundation, Romania; consultant for UNESO, Council of Europe, Commission of the European Union, and OSCE on matters concerning higher education and civil society.

Professor Kyung Chan Min

Professor Kyung Chan Min has been Chairman of the Special Committee for Global Competitiveness of Higher Education in the Presidential Advisory Council on Education, Science and Technology of Korea since

2008. He was Chairman of the National Policy Advisory Committee for Ministry of Education, Science & Technology from 2008 to 2010. Professor Min has been involved in several national projects to develop innovations in graduate education in Korea, after he began a term as Dean of the Graduate School of Yonsei University, Korea in 2008. He served also as President of the Korea Association of Liberal Education and President of the Korea Association of Teaching and Learning Centers for University Education.

Professor Min has various administrative experiences at Yonsei University, which he joined in 1982 as a Professor of Mathematics. He has served as Dean of Admissions, Dean of Faculty, Dean of the University College and Dean of the Graduate School at Yonsei University. He is now Chairman of the Committee for the Yonsei Strategic Initiative. He has a BS and an MSc from Yonsei University, Korea, and another MSc, as well as a PhD in Mathematics from Carleton University, Canada.

Professor Min has been recognized as a distinguished mathematician in the field of topology and fuzzy mathematics. He served as President of the Korean Mathematical Society, President of the Korea Fuzzy Logic and Intelligent Systems. Moreover, he served as an Executive Board member and a Vice President of the International Fuzzy Systems Association (IFSA). He is now an associate editor of the International Journal of Fuzzy Systems.

Professor Min is also an influential scholar in science community in Korea. He was a Representative of the Citizen's Coalition of Scientific Society (CCSS) from 2008 to 2011. He is a member of the Scientific Advisory Board of the Institute for Basic Science, Korea and a member of the Board of Directors of the POSCO TJ Park Foundation.

Professor Shireen Motala

Professor Shireen Motala is Director of the Postgraduate Centre: Research and Innovation, at the University of Johannesburg. She held the position of the Director of the Education Policy Unit, Wits University from 1999 to February 2010. Her academic qualifications are BA (UDW), BSocSci Honours (UCT), MA (University of Warwick), PGCE (University of London) and PhD (Wits University). She sits on the Board of a number of policy research organisations including the Centre for Education Policy

Development and the South African Institution for Distance Education. She is currently Chairperson of the Education Policy Consortium which brings together policy research entities nationally. She was also the Chairperson of the UNESCO South African Commission from 2002 to 2006 and was the MEC appointee on the Gauteng and Training Council from 2002 to 2005. She has worked extensively in research and has provided leadership for regional and international partnerships which have led to collaborations with universities across Africa and with northern partners. These include providing leadership to the Consortium on Transition, Equity and Access in Education, a multi-year research programme with universities in Sussex, India, Bangladesh and Ghana. She has also been responsible for significant fundraising and for large research grants for the EPU, the most recent of which is large scale funding from the Royal Netherlands Dutch Embassy for a research programme on Literacy, Numeracy and Quality in South African Schools. Her research record is substantial and includes books, editorship of local and international journals and chapters in books.

As Director of the Postgraduate Research Centre: Research and Innovation at the University of Johannesburg, Professor Motala's responsibilities include leading the university wide strategy for improving enrolment at a postgraduate level, providing research support for postgraduate students and ensuring that throughput improves in the institution. In September 2010 she was appointed Associate Professor in the Faculty of Education, University of Johannesburg.

Dr. Patrick Osmer

Dr. Patrick S. Osmer is Vice Provost for Graduate Studies and Dean of the Graduate School at The Ohio State University and for 2012 is Past-Chair of the Council of Graduate Schools' Board of Directors. He chaired the CGS/ETS commission that produced the report Pathways through Graduate School and into Careers that was released in Washington, D.C., in April.

Appointed in 2006, Osmer has engaged Ohio State's graduate community in several major efforts, including a comprehensive assessment of the quality of Ohio State's doctoral programs. That process also uncovered a need for Ohio State to assess its wide-ranging life and environmental science efforts. Osmer co-chaired two task forces to

determine how Ohio State can move forward in these areas and is chairing the group implementing cross-campus networks for research and graduate education in both areas.

An authority on distant quasar evolution, Osmer joined Ohio State as Professor and Chair of the Department of Astronomy in 1993. While chair, Osmer provided leadership for building the department to internationally recognized high levels. Osmer was elected a fellow of the American Association for the Advancement of Science in 2009.

Osmer came to Ohio State from Tucson's National Optical Astronomy Observatory where he was deputy director from 1988 to 1993. From 1969 to 1986, Osmer was on the staff of the Cerro Tololo Inter-American Observatory in Chile. He served as director and head of mission from 1981 to 1985. Osmer earned a BS in astronomy from the Case Institute of Technology and a PhD in astronomy from the California Institute of Technology.

Professor Laura Poole-Warren

Professor Laura Poole-Warren received her PhD in Biomedical Engineering from The University of New South Wales (UNSW) in 1990. After commencing as a lecturer at UNSW in 1995, she built a successful research group focussed on understanding structure-property relationships of polymeric biomaterials. Between 1999 and 2001, she was a Research Professor at Rutgers University in the U.S, and during that time worked closely with the biomedical device industry. After returning to UNSW, in 2006, she took on the role of Associate Dean of Research in Engineering, a position held until she was appointed as Dean of Graduate Research in 2010. As the Dean of Graduate Research, Laura has executive responsibility for the Graduate Research School, the unit responsible for administration of the more than 4,000 graduate research candidates enrolled at UNSW. The other major part of her leadership role is in developing and implementing strategy and policy relating to higher degree research at UNSW and interacting with major partners such as the Group of Eight, Universitas 21 and China 9 Universities. In 2012, Laura was appointed Acting Pro Vice-Chancellor of Research. In this role she is responsible for management and strategic support of grant applications, including fellowships and postdoctoral researchers and researcher development

activities. She continues to be actively involved in research and teaching in the biomaterials and tissue engineering field, and currently supervises five PhD students and several master's and undergraduate thesis students.

Professor Ernst Rank

Professor Dr.rer.nat. Ernst Rank, born in 1954, studied mathematics and physics at the Ludwig-Maximilians-Universität München from 1974 to 1980. Having obtained his doctoral degree from the Faculty for Civil Engineering and Geodesy of the Technische Universität München (TUM) in 1985, he became a DAAD fellow at the University of Maryland, College Park, USA until 1986. From 1987 to 1990 he held the position of senior scientist at the Corporate Research and Technology Department of SIEMENS AG in Munich. He was appointed professor for Numerical Methods and Information Science in Civil Engineering at the University of Dortmund in 1990 and has held the chair for Computation in Engineering (formerly Bauinformatik) at the Technische Universität München since 1997. His main areas of research are in Computational Engineering and the modeling of product and processes in civil engineering. He has published more than 220 papers in scientific journals, as book contributions and in reviewed conference proceedings.

Professor Rank held the office of First Vice President of TUM from 2002 to 2008. From 2005 to 2006 he was responsible for coordinating TUM's proposals for the Excellence Initiative by the German federal and state governments to promote science and research at German universities. In 2006, he became Founding Director of the International Graduate School of Science and Engineering at the Technische Universität München, and in 2009, Dean of the TUM Graduate School. Since 2007 he has been head of the Advisory Board of the Technical University of Dortmund, advising national and international governments and research agencies in developing programs for graduate education as well as for international and interdisciplinary research cooperation. At the time of the 2012 Global Summit, Professor Rank was the Dean of the TUM Graduate School that was established in 2009.

Professor Ihron Rensburg

Professor Ihron Rensburg is the Vice-Chancellor and Principal of the

University of Johannesburg. Prior to this appointment, he was the Chief Executive: Strategic Corporate Services at the South African Broadcasting Corporation. In this capacity, he served as Chairman of the National Broadcasting Association (South Africa), President of the Southern Africa Broadcasters Association, and founder of the continental African Broadcasting Union. After the end of apartheid, he served as Deputy Director General in South Africa's National Department of Education until 2001.

Professor Rensburg was an anti-apartheid activist and leader (1976–2004). During this time, he spearheaded the creation of local, regional and national teachers' and students' movements. He is widely acknowledged for his policy, strategy, leadership and managerial skills, ably demonstrated during his stewardship of South Africa's post-apartheid education policy, legislation and programmes. As Deputy Director General of the country's national Department of Education (1995–2001) he led several teams that designed and created the new system of national and provincial education departments, the new national school curriculum, and various policies and legislation for school, further and higher education. In 2007 he was appointed honorary professor at the Faculty of Education at the University of Johannesburg, where he lectures in organisational theory and education leadership.

He serves in a non-executive capacity in many governmental and non-governmental institutions. He serves on the Council of the Association of Commonwealth University, is Chairperson of the Southern African Universities Association, is a Commissioner of South Africa's National Planning Commission, a Member of the Ministerial Committee on the Review of the Funding of Universities in South Africa, was Chairperson of Higher Education South Africa, the South African Vice Chancellors Association (2010–2011), and was Chairperson of the Ministerial Committee On Student Accommodation (2010–2012).

Professor Rensburg holds a BPharm from Rhodes University (1981), and an MA (1992) and PhD (1996), both from Stanford University. He has won many awards, including the Le Matinal Africa-India Education Leadership Award (2011), the Metropolitan Eastern Cape Education Leadership Award (2006), the WK Kellogg Foundation Global Fellowship (1992–1996), a Ford Foundation Research Grant (1995–1996), a HSRC

Social Movements Research Grant (1995–1996), the Merck, Sharpe & Dohme Fellowship (1979–1981) and the Rhodes University Bursary (1978).

Professor Hans-Werner Schmidt

Hans-Werner Schmidt is currently vice-president for research at the University of Bayreuth. He is also director of the recently founded "University of Bayreuth Graduate School."

Hans-Werner Schmidt studied Chemistry at the University of Mainz (Germany) and ETH Zürich (Switzerland). He received his Diploma and Dr. rer nat. degree in Chemistry at the University of Mainz. After a stay as Visiting Scientist at the Dupont Central Research in Wilmington, Delaware (USA), he moved to the University of Marburg to obtain his Habilitation in Macromolecular Chemistry. From 1989 to 1994, he was Assistant and Associate Professor of Materials, with tenure, at the Materials Department, College of Engineering at the University of California, Santa Barbara (USA). In 1993, he was Visiting Professor at the Institute Charles Sadron (CNRS) Louis Pasteur Universität Strasbourg, France, and in 2009 Visiting Professor at the Materials Department, College of Engineering.

Since 1994, he has been Full Professor for Macromolecular Chemistry at the University of Bayreuth. Hans-Werner Schmidt is Director of the Bayreuth Institute of Macromolecular Research (BIMF) and one of the founding members of the Bayreuth Centre for Colloids and Interfaces (BZGK). Since 2004, he has been Chairman of the "Elite Study Program Macromolecular Science" in the frame of the Elite Network Bavaria.

Dr. Annette Schmidtmann

Dr. Annette Schmidtmann studied Biology (majors: Molecular Genetics, Organic Chemistry, Biochemistry) at the University of Cologne from 1978 to 1986 and finished with a Diploma. From 1986 to 1989, she performed her PhD at the Institute for Molecular Biology at the University of Essen. She worked as a postdoc at the same institute from 1989 to 1991. In 1991, she started working as Program Manager for Life Sciences at the German Research Foundation in Bonn (Deutsche Forschungsgemeinschaft; DFG). In 1996 she moved to the University of Hildesheim as Research Manager, followed by a position of Coordinator at the Bureau of Ethics Commission,

Medical Faculty of the University of Göttingen from 1997 to 1999. After returning to the DFG, she took over the Coordination of Clinical Research Programs as Program Director. Since 2006, she has served as head of the division for "Research Careers." The division provides a broad variety of information offers for early career researchers. Further, it is in charge of about 200 Research Training Groups and 45 Graduate Schools under the Excellence Initiative, both offering structured PhD training.

Professor Zlatko Skrbis

Professor Skrbis is currently Pro Vice-Chancellor (Research and Research Training) at Monash University. At the time of the 2012 Global Summit, he was Dean of The University of Queensland Graduate School and responsible for the strategic direction of graduate research training at The University of Queensland. Professor Skrbis is also a convenor of the Executive Committee of the Council of Deans and Directors of Graduate Studies in Australia. He was previously the Deputy Head of the School of Social Science, and Associate Dean of Research in the Faculty of Social and Behavioural Sciences.

Professor Skrbis is committed to international engagement and has extensive experience in engaging with Latin America, Europe, China, and Indonesia, both as a researcher and as Dean of the UQ Graduate School.

Professor Skrbis joined The University of Queensland in 2001 from the Queensland University of Technology, having gained his PhD from Flinders University. He is a sociologist with an international profile in the fields of migration, cosmopolitanism, globalization and social theory. Recent publications include Constructing Singapore: Elitism, Ethnicity and the Nation Building Project, The Sociology of Cosmopolitanism: Globalization, Culture, Identity and Government, and Cosmopolitanism: Uses of the Idea.

Dr. Debra W. Stewart

Debra W. Stewart is President of the Council of Graduate Schools (CGS), the leading organization dedicated to the improvement and advancement of graduate education in the U.S. CGS's more than 500 member universities award 92% of all U.S. doctorates and approximately 81 percent of all U.S. master's degrees. Among its 40 international members the Council

includes 20 major Canadian universities. Stewart came to CGS in July, 2000 after serving as Vice Chancellor and Dean of the Graduate School at North Carolina State University and for a total of 12 years in university leadership positions in North Carolina. Under her leadership, the Council launched a series of projects designed to strengthen the capacity of member universities to prepare graduate students to meet the challenges of the 21st century. Major initiatives addressing PhD and master's completion and attrition, research integrity and professional ethics, international collaborations, preparation of future faculty, and new approaches to science master's education, are producing innovative new models to ensure that U.S. graduate education retains its position of global leadership. She has also spearheaded the creation of a public advocacy program that communicates the impact of graduate education to elected officials, corporate leaders, and potential students themselves.

Stewart's service to higher education includes leadership of the Graduate Record Examination Board, the Council on Research Policy and Graduate Education, the Board of Directors of Oak Ridge Associated Universities, and the Board of Directors of the Council of Graduate Schools. She was Vice Chair of the ETS Board of Trustees, a Trustee of the Triangle Center for Advanced Studies, and a member the American Council on Education Board. She has served on many boards and committees of the National Academy of Science, including the National Research Council Board on Higher Education and the Workforce, the National Research Council Committee on Educational Paradigms for Homeland Security, the National Research Council Assessment of the Research Doctoral Programs and the Engineering Ethics Center Advisory Committee (NAE), as well as advisory boards for the Carnegie Foundation for the Advancement of Teaching, the Woodrow Wilson Foundation, and the Migration Policy Institute, Task Force on Immigration and America's Future. She also serves on the International Advisory Board of the Freie Universität Berlin and the International Board of the Vienna University of Economics and Business.

Professor Paul K. H. Tam

Professor Paul Tam graduated from the Medical School of The University of Hong Kong (HKU) in 1976. He received his training and spent his early

career years in the Department of Surgery of the University until 1986. He was a Senior Lecturer at the University of Liverpool from 1986 to 1990, and Reader and Director of Paediatric Surgery at the University of Oxford from 1990 to 1996. He has been Chair of Paediatric Surgery at The University of Hong Kong since 1996.

Professor Tam has contributed to advances in paediatric surgery, especially in the areas of minimal invasive surgery, Hirschsprung's disease and hepatobiliary diseases such as biliary atresia. He also leads a large research team in genomics and stem cell biology. He has published over 300 articles in internationally refereed journals and 30 book chapters, and is ranked amongst the top 1% of most-cited scientists in Essential Science Indicators.

As Pro-Vice-Chancellor (Research) and Dean of Graduate School, Professor Tam steers research strategies and development of the University of Hong Kong. Professor Tam also heads the Knowledge Exchange Office and HKU's research development in Shenzhen and Zhejiang. He is a member of the Board of Directors of the Hong Kong Science and Technology Parks Corporation (HKSTPC) and a member of the Research Grants Council, University Grants Committee of Hong Kong. He is listed as one of 56 experts in the National Science and Technology Programmes Expert Database. Also, he serves on many international professional associations and was President of the Pacific Association of Paediatric Surgeons (2008–2009). He is currently Associate Editor of the Journal of Pediatric Surgery.

Professor Tam has given keynote lectures, including the Journal of Pediatric Surgery Lecture and the Suruga Lecture, at many international conferences. He is the recipient of numerous awards including the British Association of Pediatric Surgery Prize (1984), and the International Outstanding Leadership Award in Endoscopy from the Ministry of Science and Technology of the People's Republic of China (2010).

Professor Bernard C. Y. Tan

Professor Bernard C.Y. Tan is Vice Provost (Education) at the National University of Singapore (NUS). He assists the Provost in setting educational directions and policies, and in assuring educational quality for the University. He has oversight of the Registrar's Office, Office of

Admissions, Centre for Development of Teaching and Learning, and Centre for Instructional Technology.

Prior to his current appointment at NUS, Professor Tan was Associate Provost (Undergraduate Education) (2009–2012), Executive Council Chair of the NUS Teaching Academy (2009), Head of the Department of Information Systems (2002–2008), and Assistant Dean in the School of Computing (2000–2002). He has served on the University Promotion and Tenure Committee, the University Committee on Educational Policy, and the University Teaching Excellence Committee. He won the NUS Outstanding Educator Award (2004) and the NUS Young Researcher Award (2002).

Professor Tan was President (2009–2010) and Asia-Pacific Council Representative (2004–2006) of the Association for Information Systems (AIS). He is a Fellow of the AIS. He has served on the editorial boards of MIS Quarterly (Senior Editor), Journal of the AIS (Senior Editor), IEEE Transactions on Engineering Management (Department Editor), Management Science (Associate Editor), ACM Transactions on Management Information Systems (Associate Editor), and Journal of Management Information Systems (Editorial Board Member). He is on the advisory board of Information Systems Research. His research work has been published in major international journals and conference proceedings in the field of information systems.

Dr. Lisa A. Tedesco

Dr. Lisa A. Tedesco joined Emory University in May 2006 as Vice Provost for Academic Affairs, Graduate Studies and Dean of the James T. Laney School of Graduate Studies. She is a professor of Behavioral Sciences and Health Education in Emory University's Rollins School of Public Health.

Under Dean Tedesco's leadership, the Laney Graduate School, with more than 1900 students in over 40 degree programs, emphasizes opportunities for interdisciplinary study and professional preparation. New programs range from doctoral tracks that train students in laboratory and population sciences, to certificate programs in interdisciplinary studies in mind, brain and culture.

In 2012, Dr. Tedesco served as chair of the Board of Directors of the Council of Graduate Schools. She is a member of the AAU Association

of Graduate Schools executive committee and also serves as chair of the GRE Board.

As a health psychologist, Dr. Tedesco's research focuses on cognitive behavioral enhancement of oral health status, relapse prevention, and stress, coping and oral disease. She teaches in areas related to behavioral sciences and the health professions and has written and worked institutionally on matters related to curriculum change, inquiry-based learning and teaching, faculty development, and diversity.

Dr. Tedesco earned her doctorate in educational psychology from the University at Buffalo, State University of New York. Prior to joining Emory, she was a professor and associate dean in the School of Dentistry at the University of Michigan and also served as Vice-President and Secretary of the University and as Interim Provost.

Professor Gerard van der Steenhoven

Professor Gerard van der Steenhoven is Dean of the Faculty of Science and Technology at the University of Twente (since 2008). Moreover, he is Dean of the university-wide Twente Graduate School (since 2009). Van der Steenhoven was educated at the Vrije Universiteit in Amsterdam, where he obtained a PhD in experimental nuclear physics in 1987. After a postdoc at the Massachusetts Institute of Technology, Van der Steenhoven was appointed in 1989 at the National Institute for Particle Physics (NIKHEF) in Amsterdam where he has been leading various international projects, in particular in the domain of quark-gluon physics (with part of his group based at DESY, Hamburg) and astroparticle physics (with part of his group based in Marseille). He was appointed as Professor of Physics at the University of Groningen in 2000. Van der Steenhoven is an important representative of Dutch science, as a scientist and policy maker. He is founder and first chairman of the Committee for Astroparticle Physics in the Netherlands (2004–2008), chairman of the Netherlands' Physical Society (NNV, since 2007), and president of the board of the Dutch Research School on Process Engineering (OSPT, 2008–2011). Moreover, he is chairman of the scientific advisory board of the FOM Institute DIFFER (Dutch Institute for Fundamental Energy Research, since 2009), and member of the board of the recently started foundation on liquid natural gas research (LNG TR&D). Van der Steenhoven is also active in

the local Science Café, and as a board member in various organizations with an educational or cultural mission.

Dr. James Wimbush

Dr. James C. Wimbush is Dean of the University Graduate School, Vice Provost for Graduate Education, and Professor of Business Administration at Indiana University. As dean, he oversees 190 graduate master's and doctoral programs on Indiana University's eight campuses.

Nationally, he works to advance graduate education by serving as Past-Chair of the Board of Directors of the GRE; Chair-elect of the Council of Graduate Schools' Board of Directors; and as a member of the Executive Committee of the Association of Graduate Schools. He was appointed to the joint Commission on the Future of Graduate Education, which released the 2010 report The Path Forward: The Future of Graduate Education in the United States. In 2011 he was appointed to the Commission on Pathways through Graduate School and Into Careers, which released the 2012 report Pathways through Graduate School and Into Careers.

A professor of business administration at Indiana University since 1991, Dr. Wimbush is former chair of various units in the Kelley School of Business, including the Department of Management; Doctoral Programs in Business; and the MBA Program. He is also former Associate Dean of the Faculties for the Bloomington campus.

Dr. Wimbush has received multiple awards for his teaching of management and leadership. As an acknowledged national authority, he has published numerous articles and book chapters related to ethics in employment settings. Dr. Wimbush earned a PhD degree in management and a master's degree in human resources management and industrial and labor relations from Virginia Tech.

Dr. Daniel Wolff

Dr. Daniel Wolff received his PhD in Sciences at the University of Chile in 1974 and performed his postdoctorate at the Physiology Department, Boston University, School of Medicine, between January 1975 and July 1977. He has been Professor and researcher in Cell Physiology at the Faculty of Sciences, University of Chile.

Dr. Wolff served as Chairman of the Department of Biology,

Faculty of Sciences, University of Chile from 1992 to 1994, and from 2002 to 2004. He was Visiting Researcher at the CNR Center, Padova University, Italy in 1991, 1993, 1994 and 1995 and Visiting Professor at Robert Wood Johnson School of Medicine, New Jersey, USA, from April to September, 2000.

From 2006 to 2010 he was Director of the Department of Research, at the Vice Presidency of Research and Development, University of Chile. His responsibilities were to promote, guide and strengthen scientific research at the University of Chile, in all fields, and to provide support for submitting university projects to national research funding agencies.

Since 2010, Dr. Wolff has been the Director of the Department of Graduate Studies, Vice Presidency of Academic Affairs, University of Chile. He is responsible for fostering the development of programs leading to master's and PhD degrees. Also, he is responsible for articulating the human and material resources for the creation of new graduate programs and for overseeing the adequacy and quality of the 36 doctoral and 120 master's programs offered by the University.

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www.cgsnet.org

ISBN-13:978-1-933042-40-4
ISBN-10:1-933042-40-0