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UNU-MERIT at 25 years: How doctoral training at UNU-MERIT contributes to the community of scholars in the economis of innovation?

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UNU-MERIT AT 25 YEARS: HOW DOCTORAL TRAINING AT UNU-MERIT CONTRIBUTES TO THE COMMUNITY OF SCHOLARS IN THE ECONOMICS OF INNOVATION?

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Abstract[1]

This paper contributes to literature on the emergence of innovation studies as a scientific field. This area of research documents the mechanisms, interactions and meeting spaces that innovation scholars have developed to give substance and legitimacy to their work. What role is there for the training of young scholars in the development of this scientific field? Based on a web survey of UNU-MERIT's PhD alumni, we explore the ways in which doctoral training at a major research institute has contributed to the formation of young scholars in the broad field of innovation studies. In line with literature on the creation of science and technology human capital, we find that doctoral training grants PhD holders the technical knowledge and skills, together with the relational skills that sustain their membership and scholarly contributions to innovation studies. The evidence likewise suggests that the contribution of UNU-MERIT's PhD programme on the building of innovation research capacities in developing countries is constrained by postgraduate decisions to stay in the developed world. Young scholars follow a career development strategy of linking to mentors and key senior researchers, while scientific interactions with fellow students are more limited. Social interactions tend to be more prominent for maintaining relations with the research community.

JEL Codes: D85, I23, O30

Keywords: UNU-MERIT, innovation studies, doctoral training, social capital.

[1] This paper is dedicated to those who have contributed in establishing the PhD programme in the broad field of the economics of innovation at UNU-MERIT: Maria Ines Bastos, Charles Cooper, Robin Cowan, Sunil Mani, Luc Soete, Ed Steinmueller, Lea Velho and Bart Verspagen. We are grateful to all the colleagues who participated in both the pilot survey and the actual data collection process. Likewise acknowledged is support from Bart Verspagen, Robin Cowan, Wilma Coenegrachts and Eveline in de Break during the preparation and implementation of this study. An earlier version of this paper was presented at UNU-MERIT's 25th anniversary conference: Future perspectives on innovation and governance in development, 26-28 November 2014. We thank Arsev Umur Aydınoğlu for valuable recommendations.

1. INTRODUCTION

Doctoral training is a fundamental component of the socialisation process that helps graduate students to obtain the tacit knowledge, the technical credentials and social competences needed to join and contribute to particular research communities; doctoral training is a ritual that introduces and prepares young scholars for a research career (Jones et al., 2011). Bozeman et al., (2001) and Bozeman and Mangematin, (2004) assert that this socialisation process assists the development of the students' science and technology human capital, and the social networks that will underpin their future contributions to knowledge production, dissemination and use.[2] The process reproduces continuously; it involves research infrastructure and funding support, social institutions and social networks.

Young scholars are vehicles for the circulation and continuous creation of tacit and other forms of knowledge, for the integration and shaping of scientific work in ways that grant them opportunities for research, employment, mobility and in many cases, fruitful exposure and contacts with the world outside academia (Bozeman and Mangematin, 2004; Mangematin and Robin, 2003). Bozeman et al., (2001) propose that the evaluation of science and technology projects and programmes should look beyond the discrete products and immediate outcomes associated with those projects and programmes. Rather, the analysis should consider career trajectories, the graduates' ability to enhance their scientific and technical human capital, and their productive social capital networks as positive outcomes. Individual skills are as important as individual ties to networks and the transactions with those networks (Bozeman and Mangematin, 2004).

Science and technology human capital is created through formal education and training, coupled with personal skills, tacit knowledge and experiential learning embodied in individual scientists and engineers (Bozeman and Mangematin, 2004). Likewise relevant is the nature of the learning environment provided by the scholarly community (Pyhältö et al., 2009). The creation of social networks is somewhat complex to identify, young scholars may have different perceptions of the scholarly community "they belong to", and their experience and expectations associated with membership in that community (Pyhältö et al., 2009). Well documented is the role that mentors play in initiating a process of cumulative advantage for a young scholar's research career (Long

[2] According to Bozeman et al., (2001) and Bozeman and Mangematin, (2004), the science and technology human capital results from the sum of scientists' and engineers' scientific and technical knowledge, work relevant skills and social ties and resources. Education and networking abilities shape the bases of a future research career.

and McGinnis, 1985; Bozeman and Corley, 2004). The mentor influences collaboration opportunities, but also eminence and performance as factors that determine the student's productivity, impact, visibility and even prospects for academic placement.

The creation of relational capital through professional networks results from strategic choices around collaboration and interaction (Bozeman and Corley, 2004). In addition to the strategic choice of linking to the mentor, there is what Bozeman and Corley, (2004) term "cosmopolitanism," or 'the extent to which scientists collaborate with those around them as opposed to those more distant in geography or institutional setting' (p.599). Based on a study involving scientists and engineers in the US, the authors found that those who pursue a "mentor" collaboration strategy are more likely to be tenured, to collaborate with women, and to have positive views about industry and research on industrial applications. Regarding collaboration cosmopolitanism, the findings suggested that most researchers tend to work with people in their close work group. The exception is those able to obtain large scale research grants.

From the above, and based on Fagerberg and Verspagen (2009), this paper explores the ways in which a graduate programme contributes to the formation of a scientific field, namely innovation studies. The evidence stems from an online survey conducted among 86 United Nations University – Maastricht Economic and Social Research Institute on Innovation and Technology (UNU-MERIT)'s PhD holders graduated between 1995 and 2014. The paper draws and mainly contributes to literature on the creation of science and technology human capital, as discussed above. We focus on the ways in which the UNU-MERIT doctoral training programme in Economics and Policy Studies of Technical Change helps students navigate the socialisation process needed to join the community of innovation scholars. The hypothesis is that the PhD programme is the way for students to acquire the technical knowledge and skills, together with the relational skills required for their future contributions to the field of innovation studies. The acknowledged importance of networks and interpersonal relationships for the advancement of scientific careers (de Solla Price, 1963), including in innovation studies (Fagerberg and Verspagen, 2009; Verspagen and Werker, 2004), led us to investigate the interactions that UNU-MERIT PhD holders establish among themselves, and with the broader community in and around the institute. On this we found some diversity and differentiated importance of the channels that link alumni with the institute.

Our enquiry benefits from the sizable literature on impact evaluation of education programmes, particularly at the Master's and doctoral levels (Lasfer et al., 2013). This literature generally assesses success of an education programme based on indicators such as number of publications, projects or promotion at work. For instance, Lasfer et al., (2013) investigate the success of an engineering programme that aims to integrate industry to education. The authors report a positive impact for both sponsors from the industry, and students. Zwanikken et al., (2014) looked at the impact of a Master programme in public health across six countries regarding competencies relevant to low- and middle-income countries. They found that the programmes are influential in graduates' careers, especially in developing proposals and reporting in population health needs. Impact evaluations are also carried out to assess the extent to which economic benefits of a programme exceed related costs (Byrne et al., 2010).

This paper explores some of the scientific activities carried out by UNU-MERIT PhD graduates; we look at key outlets for publishing and scientific appearance (organisations, conferences, workshops and so on) which allow interactions with the broader community of innovation scholars. The aforementioned literature on science and technology human capital led us to look beyond individual impact and specific outcomes; rather, we asked about career paths followed by UNU-MERIT's PhD holders after graduation, and the extent to which the Institute helps alumni to integrate to society in general, and to the innovation community in particular. We found that the graduates' inner social network is much more vibrant than their scientific network. Moreover, whereas the main nodes in the social network are the alumni themselves, the main nodes in the scientific network are current research staff at the institute. Our findings concur on the importance of a relatively small number of prominent researchers at UNU-MERIT as the strongest nodes in the networks linking the alumni, the Institute and related researchers; these scholars provide the core of potential cohesive subgroups (Fagerberg and Verspagen, 2009). Overall, our findings confirm a networking pattern already identified by previous studies conducted on the larger community of innovation scholars (Fagerberg and Verspagen, 2009; Verspagen and Werker, 2004). The career development path chosen by PhD alumni resembles a mentor-based strategy (Long and McGinnis, 1985; Bozeman and Corley, 2004).

Based on a tracer study methodology, we characterised and learned about the whereabouts of UNU-MERIT PhD students upon graduation. We observe the pertinence to discuss our findings in light of the extensive literature on brain drain and research capacity building in developing countries (e.g., Oosterbeek and Webbink, 2011). World Bank (2010) for example, considers the

number of graduate scholars who returned home or to other developing countries, as well as the number who gained employment in senior positions in the public sector, academia, NGOs and the private sector, as impact or outcome indicators of a graduate programme. These indicators help to capture the overall contribution to socioeconomic development at the countries of origin of the young scholars. Our data suggest that the direct contribution of UNU-MERIT's PhD programme on innovation research capacities in the developing world may be limited. Several graduates from developing countries fail to return home upon graduation; Western European and North American countries tend to be the preferred destinations. Arguably, any contribution is mostly indirect as the graduates remain in contact with their home countries via professional networks or other professional activities. Network and diaspora effects are the most likely channels used by UNU-MERIT graduates to strengthen innovation research and policy capacities in the global South. Further research should shed light on this observation. However, as we document in this paper, in the spirit of Wagner, (2008), membership to emerging regional networks of scholars in the field is expected to formalise their contributions to the development of innovation capacities in developing countries.

The remainder of this paper is organised as follows. Section 2 introduces the methodology and the data used in this study. Section 3 presents the general profile of UNU-MERIT PhD alumni including aspects related to employability, career paths and geographical mobility -which countries PhD candidates came from, and where are they are living and working after successfully completing doctoral studies. A distinction is made between graduates who attended formal coursework as part of the PhD programme in Economics and Policy Studies of Technical Change, and those who only benefited from doctoral supervision from an affiliated researcher. The second group includes for example, students affiliated to the Faculty of Business and Economics of Maastricht University but supervised by researchers at UNU-MERIT. Section 4 identifies some of the channels used by UNU-MERIT alumni to contribute to innovation scholarship: main publishing outlets, conferences or organisations they are mostly associated with. Section 5 contains the core of this study, namely a social network analysis of the social and scientific interactions established between the alumni and the community around UNU-MERIT. Finally, Section 6 concludes.

2. METHODOLOGY

Methodologically this paper builds on World Bank (2010) and Fagerberg and Verspagen (2009). The first document is a tracer study conducted bi-annually to follow up beneficiaries of the Joint

Japan/World Bank Graduate Scholarship Programme. From this document we draw some indicators suitable to learn about both the characteristics of the alumni and the performance of higher education programmes such as the one offered at UNU-MERIT. Adapted to scope of our study, we incorporate three kinds of indicators, namely:

- Input indicators on implementation of the PhD programme. We include the number of applications received and processed, and the characteristics of scholars selected to join the programme. These indicators informed our analysis in Section 3.1 and part of Section 3.2.
- Output indicators to capture programme deliverables. These indicators include the number of scholars who attained their degree, employability in activities which allow them to mobilise the newly acquired skills through the academic programme, and some measures of their networking behaviour within the relevant scientific community. This type of indicators partially guides our discussion in Section 3.2.
- Outcome indicators to measure the impact on the overall socioeconomic development of the scholars' countries. They include the number of graduates who returned home or to other developing countries, as well as the number who gained employment in senior level positions in the public sector, academia, NGOs and the private sector. We use this type of indicators in Sections 3.3 and then in Sections 4 and 5.

World Bank (2010) advises on the pertinence of analyses in "before and after" mode, so that it is possible to highlight changes in certain indicators or factors that help understand performance of the graduate programme, or the individuals going through the training or education offered. In our case, this approach was useful to study the geographical mobility of UNU-MERIT PhD holders before joining the programme and after graduation.

2.1. A SURVEY OF UNU-MERIT PHD HOLDERS

Both World Bank (2010) and Fagerberg and Verspagen (2009) have tested sample questions that we adapted to design a web-based survey instrument as the basis for this study (Appendix 1 includes a copy of the questionnaire). In our study some questions served to build a general profile of UNU-MERIT PhD holders by gender, nationality, year of start/completion of PhD studies and so on. Likewise, we tracked patterns of residence and work after graduation. Based on Fagerberg and Verspagen (2009) we included some questions which allowed the study of cognitive and organisational characteristics of UNU-MERIT PhD alumni working in the broad field of innovation studies. In particular, we asked people about their fields of work, their

academic and other professional activities, any social and academic interactions with the community of UNU-MERIT scholars and more broadly speaking, with other researchers in the field. The methodology of Fagerberg and Verspagen (2009) has been used earlier to map existing communities of science, technology and innovation scholars and policy makers in Africa, AFRICALICS, and Latin America, LALICS, under the aegis of the Global Network for the Economics of Learning, Innovation, and Competence Building Systems (GLOBELICS). Our survey was piloted twice, each subsequent round improved based on suggestions from five UNU-MERIT PhD holders from different cohorts, nationalities and geographical location.

Additional information was retrieved from UNU-MERIT's website, and through personal communications with UNU-MERIT staff. Hence, we identified a total of 86 people who had obtained their doctoral degree from the Institute by 2014, but who had joined the PhD programme previous to the merger with the Maastricht Graduate School of Governance (MGSoG). An additional control for accuracy of our data involved cross-checking information about the topic of the doctoral dissertation of each individual entry.[3] The data collection period was September through early November 2014, including two monthly reminders to survey participants. A total of 49 UNU-MERIT PhD holders contributed to the survey, for a response rate of 55%. We used social media, such as LinkedIn, and other publicly available sources of information -personal web pages and CVs; to complete data on general characteristics for those who did not respond to our survey. Non-responses include people whose email bounced back, or those who sent an automatic response indicating they were on sabbatical or otherwise unavailable to participate in the study. Arguably, our survey collected general information for the whole

[3] A pertinent clarification is that the PhD alumni in this study refer to graduates from UNU-MERIT's PhD programme in Economics and Policy Studies of Technical Change (UNU-MERIT's PhD programme). There are two main reasons for the decision to exclude PhD alumni from the former MGSoG which has recently joined UNU-MERIT. First, the relevant period of time covered in this study makes it unsuitable to include the MGSoG which was created in 2004 as an independent school. With the exception of a few well-identified common courses in the respective curricula, before the merger with UNU-MERIT the doctoral programmes at each institution were rather different in both scope and design. Differences in terms of research and dissertation topics, available supervisors and publishing and publicising outlets between these two tracks were significant. Thus we found it difficult to blend the two tracks in one survey. Second, and most importantly, although the current PhD programme has been reorganised to reflect the blending of governance and innovation under "innovation and governance for development", at the time of implementing this study, mid-2014, there were no graduates from the newly designed PhD programme. We believe the methodology used in this study may serve well the purpose of conducting a similar exercise tailored to the specificities of MGSoG alumni.

population of UNU-MERIT PhD holders in the field of innovation studies up to November 2014.[4]

The data analysis built on multiple techniques including graphic representations to visualise the footprint of UNU-MERIT PhD graduates on innovation studies in geographic terms, but also with regards to the preferred channels for their contributions to innovation studies. The application of a simple social network analysis assisted our exploration of their social and scientific networks. Hence we captured the extent of social and scientific interactions among graduates, and between graduates and others; moreover, we were able to pinpoint the overall position of each individual graduate in social and scientific interactions.

3. A STUDY OF UNU-MERIT PhD ALUMNI

In 2014 UNU-MERIT celebrated a quarter of a century since the launch of its predecessors, MERIT (1988), as part of Maastricht University, and UNU-Institute of New Technologies (UNU-INTECH) (1989), as part of the UNU system. Since their inception, the two Institutes, created at the initiative of Luc Soete and the late Charles Cooper, have been devoted to research and training on the economic, social and political factors that drive innovation. UNU-MERIT has recorded significant transformations over time, including the merger of UNU-INTECH and MERIT in 2006 -hence the name UNU-MERIT; and the incorporation of MGSoG in 2010.

A relevant mandate of UNU-MERIT has been the training of young scholars in the fields of technical change, innovation and economic development, with recent inclusion of governance in domestic and international organisations. In the period 1989-1992 MERIT housed a Master's programme and since 1995, a fully-fletched PhD programme convened jointly by UNU-INTECH and MERIT. Ed Steinmueller (1995), Bart Verspagen (1997) and Robin Cowan (since 1999) assumed responsibility for the direction of programme from the MERIT side, while Maria Ines Bastos, Sunil Mani and Lea Velho were the responsible figures from UNU-INTECH's side. In its early years students and courses were hosted simultaneously by the two institutes. Since 2006 and mostly as a result of the merger between UNU-INTECH and MERIT, the PhD programme has been hosted under a single roof at Keizer Karelplein 19 in Maastricht. Over time, the programme has gradually grown to its current population of around 100 PhD fellows and 100 Master

[4] To prevent further confusion, we identified 86 PhD holders, 41 were affiliated to the in-house PhD programme, and 45 were supervised by a UNU-MERIT research fellow. We received 49 responses to our survey, 33 from graduates involved in the in-house PhD programme and 16 who were supervised by a UNU-MERIT fellow.

students.[5] Up to November 2014, 86 people had obtained doctoral degrees based on UNU-MERIT's doctoral training activities in the field of the economics of innovation; an indeterminate number of exchange and short-term visiting students have also been part of the Institute.

Though not officially codified strategy, the setting up of a PhD programme at UNU-MERIT can be interpreted as a contribution to the nascent scientific field of innovation studies (Fagerberg and Verspagen, 2009; Fagerberg et al., 2011)[6]; the programme would provide students with the science and technology social capital needed to integrate themselves and contribute to the emerging innovation research community. This strategy can be decomposed into two main pillars. First, setting up a formal doctoral programme within a university setting was an effort to formalise and grant legitimacy and structure to the training of young scholars in innovation studies. Second, mostly derived from the UNU mandate, the programme has intended to contribute to strengthening innovation research and policy-making capacities in less developed countries (UNU). This second objective introduces an explicit goal of expanding the borders of the emerging scientific field to encompass scholars from both developed and developing countries; after all, science is a global endeavour. At 25 years after its creation, how is UNU-MERIT doing in terms of meeting these two closely related objectives?

3.1. CHARACTERISING UNU-MERIT PHD HOLDERS

The population of UNU-MERIT PhD holders splits more or less evenly in two groups. On the one hand, a group of graduates who has not formally registered for and attended coursework at UNU-MERIT, but that has conducted doctoral studies under the supervision of a researcher affiliated to the Institute. In total, 45 PhD holders, or 52% of those in our population, belong to this category of non-in-house PhD holders. On the other hand, a group of PhD holders who have formally registered and completed the requirements of the in-house PhD programme includes 41 graduates, or 48% of the total. Students from these two groups mingle; however, as can be expected, the interaction is usually stronger between those formally registered to the in-house programme.

[5] At the time of conducting this study, Master's students follow the governance track only.

[6] Chris Freeman himself, founder of the Science Policy Research Unit -today the Science and Technology Policy Research Unit- (SPRU) and closely linked to Luc Soete and MERIT itself, had shown the way social science entrepreneurship can work in the building of the field of innovation studies (Soete and Verspagen, 2010; Fagerberg et al. 2011). Freeman was also influential in the development of other institutes in the innovation network, including the IKE group in Aalborg led by another prominent scholar in the field, Bengt-Åke Lundvall.

The distribution of UNU-MERIT PhD holders looks as follows. The cohort of non-in-house PhD holders is predominantly male. Our data show that 95% of people in this group are nationals of developed countries, particularly European (84%); Dutch nationals are the single most represented group, 42%. We also found that 22% of graduates in this group started their doctoral studies previous to 1995, year of formal creation of the PhD programme at UNU-MERIT; while 31% obtained their doctoral degree in or before 1995.

3.2. THE PHD FACTORY, THE IVORY TOWER AND CORRIDORS IN BETWEEN[7]

We now look at graduates who have been exposed directly to doctoral training through UNU-MERIT's in-house PhD programme. Information about the early years of the programme is mostly anecdotal, in the memories of those involved in its design and operation. Personal communication with UNU-MERIT staff indicates that between 1995 and 2010, something in the range of 783-933 applications were received to join UNU-MERIT's PhD programme; the number of successful applicants is 105, for a share of approximately 13.4% if we consider 783 applications. This proportion suggests that the PhD programme is highly competitive. Although not readily comparable, just by way of contrast consider that according to World Bank, (2010), during 1987-2007 the Secretariat of the Joint Japan/World Bank Graduate Scholarship Programme (JJ/WBGSP) received about 54,074 applications. The intake rate, ratio of awards per eligible candidate, was around 14%. In the case of UNU-MERIT, the 41 students who had graduated from the programme up to 2014 represent 39% of those admitted on or before 2010.

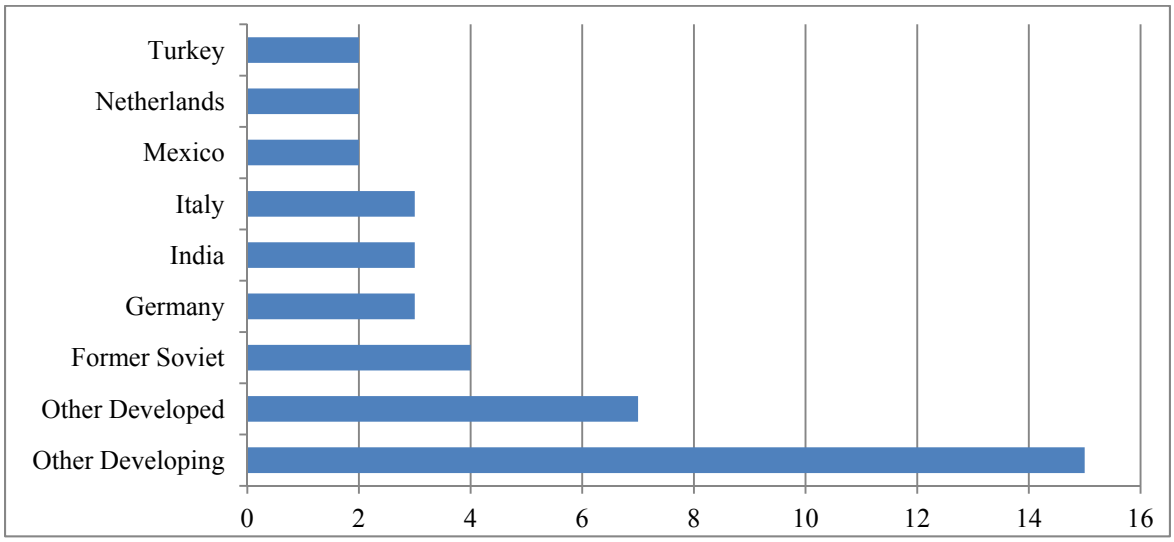
Our data suggests that the weighted average number of years to complete the UNU-MERIT PhD programme is 6.2 years with a median of 6 years. In the School of Business and Economics of Maastricht University the PhD completion period ranges between 4.7 to 5.1 years between 2004 and 2008, with a slight increasing trend.[8] Again, only by way of contrast with an imperfect benchmark, based on data from 620 (of about 950) 1996-97 PhDs, Siegfried and Stock, (2000) found that the median of years taken to earn a PhD in economics in the US was 5.3 years, with a mean of more than 6 years. Moreover, less than 20% of graduates would have obtained their degree within the 4 year period usually associated with doctoral studies. In a more recent study by the same authors, the data showed that time to completion of a PhD in Economics has been steadily increasing; by 2001 the median time to PhD was 7 years (Siegfried and Stock, 2004).

[7] These names refer to the different areas within the UNU-MERIT building where most PhD students were housed.

[8] These numbers are calculated from the annual report of School of Business and Economics, 2013.

The profile of UNU-MERIT PhD holders who have formally registered to the PhD programme indicates a larger share of males, 56%. The programme has attracted people of 32 different nationalities, the majority from developing countries (53%). The remainder are from a developed country (34%) or from a former Soviet country (Georgia, Kirgizstan, Russia or Ukraine) (13%). If we look at the number of graduates by nationality (Figure 1), 6 countries (Germany, Italy, India, Netherlands, Mexico and Turkey) represent about 36% of the total number of PhD holders; Dutch nationals would be even more important if we consider those who have adopted such nationality after graduation.

Figure 1 - Distribution of UNU-MERIT PhD holders in-house by nationality



Notes: Total number of PhD holders= 41, total number of nationalities= 32.

Source: Survey of UNU-MERIT PhD holders 2014

Studies that follow a tracer study methodology stress the importance of analysing quantitative-structural data on employment and career paths, the character of work and related competencies, and information on the professional orientation and experiences of graduates from higher education programmes (Heidemann, 2011; Schomburg, 2003; World Bank, 2010). Attending to the criterion of employability, we found that the UNU-MERIT PhD programme records positive results. At the time of survey, 92.7% of UNU-MERIT PhD alumni were employed full-time, with no significant differences between males and females. This high level of employability attests to the qualitative contribution the Institute has made to the technical and cognitive aspects of the science and technology social capital of the scholars emerging from the PhD programme. The innovation research community recognises the value that UNU-MERIT alumni bring to the

market place. These results assert on the alumni's ability to use their enhanced professional and academic strengths and effectiveness in performing their duties (World Bank, 2010).[9]

About 20% of PhD holders, regardless of whether they attended or not the in-house PhD programme, reported one or more additional affiliations. Research is the most relevant professional activity for UNU-MERIT PhD alumni. The overwhelming majority, from both groups, are affiliated to some kind of academic or research organisation. The group of graduates who attended training at the Institute shows a somewhat more diversified profile with people reporting activities across the different categories included in Table 1. The potential for UNU-MERIT graduates to contribute to development processes is interesting as about 14.6% of them work in some International/Regional Development Organisation or Not-for-Profit Non-Government Organisation. By contrasts, graduates who did not attend coursework at UNU-MERIT show a stronger tendency to work for government organisations, which suggests graduate training is a mechanism that allows the Institute to gain policy relevance, particularly in Europe.

Table 1: UNU-MERIT PhD holders, type of organisational affiliation (%)

Type of organisation	PhD programme in-house	
	Yes	No
Academic/Research Institution	73.2	64.4
International/Regional Development Organisation	7.3	0.0
Not-for-Profit Non-Government Organisation	7.3	0.0
Private Sector	4.9	6.7
Central Government	2.4	13.3
Research/consultancy start-up	2.4	0.0
Unemployed or non-specified	2.4	15.6

Note: The numbers represent percentages within each group.

Source: Survey of UNU-MERIT PhD holders 2014

3.3. MOBILITY OF UNU-MERIT GRADUATES

This section reports on our findings related to the geographical origin and destination of UNU-MERIT PhD students before and after graduation. For this particular question we worked with the full population of PhD holders as we have information on the nationality, and at least one professional affiliation for each graduate. There is considerable difference between the nationalities of the students who attended the UNU-MERIT PhD programme, and students who

[9] A more systematic study of the labour market for innovation scholars would help to better substantiate these findings; such study is outside the scope of this paper.

did not attend coursework at the Institute. The former group is composed of a truly international community, while the second group includes mainly European Union nationals, the majority of them Dutch. Figure 2, Panel A, documents the international composition of the PhD students: North America, some of the largest Latin American countries and at least half of the European countries; Asia and Africa are also well represented. By contrast, Oceania is a region where the programme intake is yet to permeate. Caution is needed when looking at this map, a single fellow from Russia might have a heavy representation in the graph while nineteen students from the Netherlands are a small dot in the map. The limitations are similar to any other geographical representation.[10]

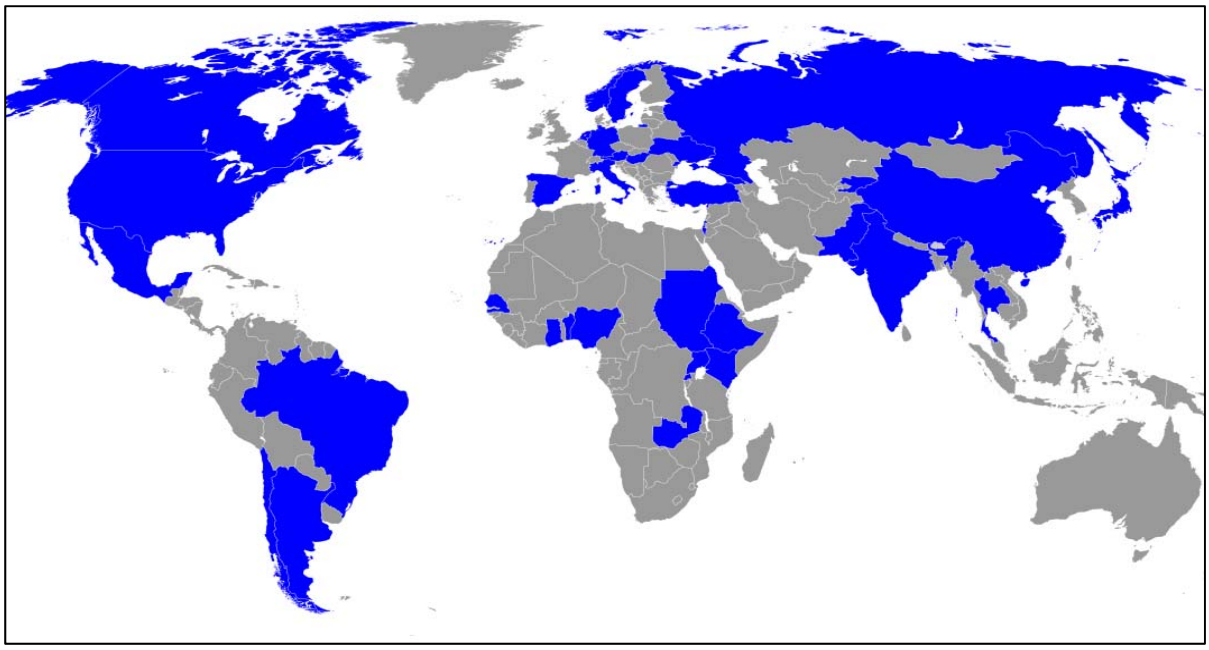
Figure 2, panel B, presents the professional affiliation(s) of UNU-MERIT alumni distributed by country of destination. This is what we call the Institute's 'footprint', as described by the mobility of graduates. At first glance, the geographical dispersion is smaller as compared to panel A. The UNU-MERIT PhD alumni work and live in North America, Western Europe, Brazil, Argentina, Chile, India, Pakistan, Japan, Dubai, Israel, Turkey, and the United Arab Emirates. In Africa graduates found positions in Sudan, South Africa, Nigeria and Benin. The predominance remains in developed countries, particularly in Europe, as final destination for the majority of UNU-MERIT PhD holders. The concentration in European countries is more evident in Figure 3 which zooms in to identify the European Union member countries where at least one UNU-MERIT PhD holder is currently working and living. This simple way to look at the origin of European students joining the programme (panel A) and their destination upon successful completion of the programme (panel B) document the steady move of students from East to West.

For a doctoral training programme that seeks to contribute to innovation research and policy capacity in the global South, not to forget the Institute's mandate as derived from its affiliation to the UNU system, our findings deserve some reflection. The PhD programme has been able to attract talented young scholars from both developed and developing countries; it has positive influence on the prospective carriers of the PhD holders, including in the competitive European and North American labour markets. It is well documented in the literature that developing countries, even those with an advanced degree of development, still find it difficult to offer a research environment, remuneration and working conditions attractive enough for graduates to

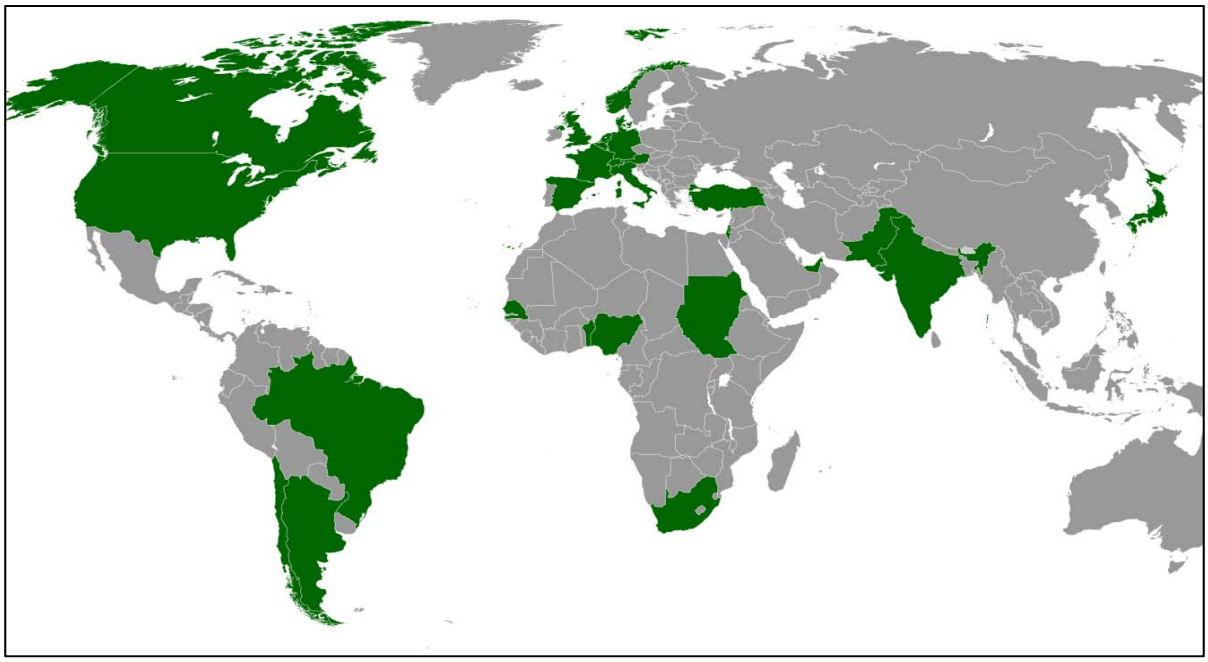
[10] There are 86 graduates in our dataset. If we discard the number of Dutch (19) and German (6) nationals, the remainder nationalities are represented by maximum three graduates (and mostly only one graduate). In this situation very little information was added by using colour codes to represents the frequency of nationalities in the map.

return home upon graduation (Henkel 2004; Velho 2006); the potential for the programme to contribute to a leak of highly qualified human resources from developing to more developed countries is an issue that constraints the Institute's capacity to deliver on its intended goals. Additional research is needed to understand the extent of the contribution of UNU-MERIT PhD holders to the betterment of innovation activities in their countries of origin.

Figure 2: Countries of origin and destination of UNU-MERIT graduates included in this study



Panel A: Country of origin at the start of the program

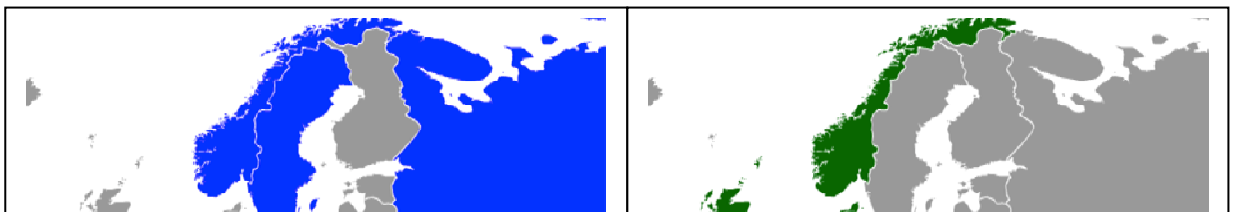


Panel B: Country of residence after graduation

Notes: Nationalities refer to those at start of the programme

Source: Survey of UNU-MERIT PhD holders 2014

Figure 3: Origin and destination of European UNU-MERIT Graduates, 1995-2014



Source: Survey of UNU-MERIT PhD holders 2014

4. CONTRIBUTIONS TO INNOVATION STUDIES

Fagerberg and Verspagen (2009) and Fagerberg et al., (2011) document how scholars in the emerging field of innovation studies have developed a series of systems which provide an identity and legitimation to their work. These systems include a communication system that sets quality standards for the production of community members, and a merit-based reward system to promote the good work. Moreover, the authors have identify a series of meeting places and publication channels that bind the innovation community together, although in a rather diverse set of cognitive communities as described in Fagerberg and Verspagen, (2009). Our dataset provides limited information to attempt an exercise similar to that carried out by those authors. However, it is possible to identify the meeting places and the most important publication channels used by UNU-MERIT PhD graduates. Some of the emerging patterns in our data conform with those observed by Fagerberg and Verspagen, (2009).

4.1. COMMUNICATION CHANNELS

The survey asked UNU-MERIT PhD holders to identify the main publication outlets they have contributed to since graduation; they were given the opportunity to state up to ten of the outlets they consider important, including journals, reports to government or international organisations, book publishers and so on. No predefined categories were provided. The results report 174 unique publishing outlets, of which peer-reviewed journals such as Research Policy, Industrial and Corporate Change, Structural Change and Economic Dynamics were among the most frequently cited –Figure 4 and Appendix 2. The alumni have also published in top general

economics and business journals such as the Academy of Management Journal, Economic Journal and the Journal of the European Economic Association. Oxford University Press, Edward Elgar, Springer and Routledge were the more noticeable among publishing houses. As for organisations, the alumni contribute rather frequently to the work of the European Commission.

Figure 4: Main publication outlets

Notes: Number of unique publishing outlets: 174

Source: Survey of UNU-MERIT PhD holders 2014

4.2. Meeting places

We also asked for names of conferences, associations or meetings that UNU-MERIT PhD holders attend on a regularly basis or, even more so, where they hold some kind of formal affiliation. No predefined categories were provided. The results include 79 unique affiliations or meetings where the alumni contribute to –Figure 5 and Appendix 3. We notice the importance of GLOBELICS, including the annual conference, the PhD academy and the regional associations, LALICS and AFRICALICS. This finding is interesting as GLOBELICS seems to have consolidated as a highly relevant meeting place for UNU-MERIT PhD holders. By contrast, Fagerberg and Verspagen, (2009) had reported such network as still somewhat marginal for the

broader community of innovation scholars. Likewise important for UNU-MERIT PhD holders are DRUID, The Schumpeter Society and the European Economic Association and their respective meetings and conferences.

Figure 5: Membership to learned societies, professional associations

Notes: Number of unique affiliations or meeting places: 79.

Source: Survey of UNU-MERIT PhD holders 2014

5. SOCIALISATION AND SCIENTIFIC NETWORK IN FOCUS

Our discussion so far has centred on who the UNU-MERIT PhD graduates are, where they are and what they currently do. An important question is whether graduates maintain relations with the Institute and if so, how can we characterise those relationships; hence, we are interested in the extent of social and scientific contacts after graduation. As discussed in our introductory section, these interactions underpin the science and technology social capital of UNU-MERIT alumni as members of the broad innovation community. Our questionnaire involves a special section where we asked the respondents to name up to ten social and up to ten scientific contacts (in either case, responses could include fellow students of the cohort, current as well as former UNU-MERIT

researchers, students and administrative staff), their frequency of and reasons for contact.[11] This section summarises the results of this simple network analysis.

Out of 86 graduates we received answers from 49. To summarise the results, the network of social and scientific contacts comprises 128 unique names of which 33 are UNU-MERIT PhD holders who formally participated to the Institute's PhD programme; 24 nodes in the network are PhD holders who only benefited from the supervision of a UNU-MERIT researcher; 36 are researchers currently affiliated to the Institute. There are 22 current students, 6 administrative staff and 7 other names who cannot be associated with any of these groups (for example, fellow students who are yet to complete the PhD programme, former researchers, visiting students and so on). On average PhD graduates have 3.3 social and 2.7 scientific contacts (median values are 3 and 2 respectively). We observe that 13 out of 49 graduates who responded the survey reported zero contacts. Rather surprising as it seems, the result is not by mistake. The questions were asked in two stages; first whether the respondent keeps contact with the institute and second, if yes, what are the names of those social and scientific contacts. We find strong cohort and time effects, while geographical distance is irrelevant for maintaining contacts with the Institute.

Table 2 reports summary results. In almost all cases the average number of social contacts is larger than the average number of scientific contacts; however, a simple mean comparison test fails to reject the hypothesis that the mean values differ between social and scientific contacts. We analyse the results following a two-prone approach. First we compare the group of graduates officially part of the programme, row block (3), to the ones who were not officially part of the programme, row block (2). The table documents the strong sense of belongingness to the programme. Graduates who were part of the PhD programme report a larger number of social and scientific contacts. Second, we explored possible time effects; it could be the case that it is much easier to maintain contacts for graduates who have completed their doctoral degree at a much later stage. We initially choose two periods, from 1992-2003 and 2004-2013, and further looked into those who have graduated in the past five years, 2009 to 2013. The results corroborate the presence of a strong time effect. In both cases, group and time effects, the results are much stronger for social contacts as compared to scientific contacts. In other words, compared to scientific contacts, average changes in the case of social contacts are the greatest in value, when different groups and time periods are considered.

[11] We limit the number social and scientific contacts to ten to induce responders to name the most important contacts. There are only a few responders who stated 10 names.

There can be several explanations to why recent generation of PhD students are more connected. Apart from being simply a time effect it could be the case that the world has become more connected (i.e., there are more means such as Facebook, LinkedIn, e-mail, etc.). Since the recent generation is born in to rich communication technologies it may be easier for them to keep connected after graduation. It could also be the case that UNU-MERIT has been acting to increase cohort/collegiality feeling to establish a stronger network. Our findings state strong time effects but we are unable to identify the reasons of stronger connections for the recent generation empirically.

Table 2: Descriptive statistics of the social and scientific networks of UNU-MERIT PhD alumni

	Social network	Scientific network
(1) Whole sample (n=49)		
Average	3.27	2.69
Median	3	2
Number of zero links	13	13
(2) Only received supervision (n=16)		
Average	2.19	2.19
Median	1.5	1
Number of zero links	7	5
(3) Officially part of the programme (n=33)		
Average	3.79	2.94
Median	3	3
Number of zero links	6	8
(4) Graduate 1992-2003 (n=14)		
Average	2.43	2.50
Number of zero links	6	5
(5) Graduate 2004-2013 (n=35)		
Average	3.60	2.77
Number of zero links	7	8
(6) Graduate 2009-2013 (n=23)		
Average	3.91	3.04
Number of zero links	3	5

Note: The minimum number of contact is 0 and the maximum number of contacts is 10. Both numbers are observed in our sample in both cases of social and scientific contacts.

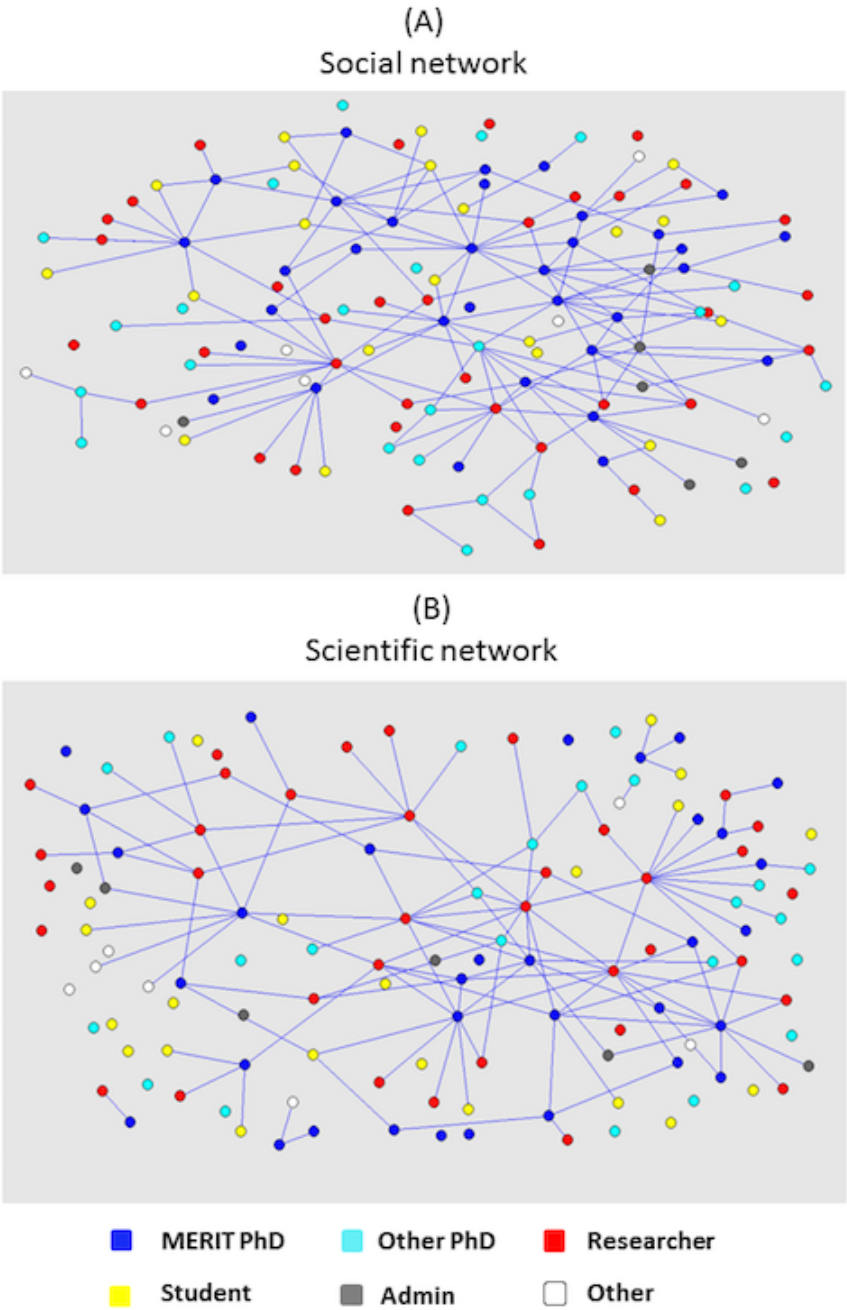
Source: Survey of UNU-MERIT PhD holders 2014

Figures 6 and 7 depict the social and scientific networks established by UNU-MERIT alumni. For simplicity we merged the social and scientific contacts such that, as stated earlier, we end up with a group with 128 unique names. In the figures the unconnected nodes do not necessarily represent nodes without connection. They also represent the nodes that may not be present in either social or scientific network. Figure 6 is split in two panels. Panel A shows the social network and panel B the scientific network. The social network includes all possible contacts established between the nodes except those related to scientific collaboration, for instance to greet someone, sleepovers, having a drink together, touristic visits, friendship, catching-up and so on. By contrast, the scientific network captures interactions which involve joint-projects, co-authorship, organising a conference, co-workers, job referral and general advice on different academic activities.

Figure 7 depicts each network where each node is weighted by the score of betweenness centrality. Betweenness centrality is an indicator that reflects the importance of a node in knowledge exchange (e.g., Wasserman and Faust, 1994; de Nooy, Mrvar and Batagelj, 2011). Thus we can see how important a node is for the knowledge exchange among two otherwise disconnected nodes. In each figure the nodes are divided into six groups represented with different colours: MERIT-PhD (official student of the programme), other PhD (those not formally registered in UNU-MERIT PhD programme), current researchers, students, and administrative staff; finally, a very small group of nodes that does not fit in any of the groups above.

Several pertinent observations result from Figure 6. First, a comparison between panel A and panel B suggests that the social network is much denser than the scientific network, as the former shows more nodes and more connections between the nodes. This result is merely an alternative visualisation of the results in Table 2; the finding makes sense because it would be difficult to have scientific contacts without a social contact (although we recognise that possibility), while it is probable that graduates have social contacts without having scientific contacts. Second, almost every group of people linked to the Institute as identified earlier is represented in the social network. Yet the scientific network is more selective, it includes mostly researchers, MERIT PhD holders and current PhD students. There is only one disconnected cluster in the social network. A strong country bias explains this finding; the nodes share the same country of origin, they are socially connected among themselves but not with the rest of the network. By contrast, there are four disconnected nodes in the scientific network.

Figure 6: Social and scientific network of UNU-MERIT PhD Programme Graduates



Notes: MERIT PhD involves only the ones that are graduated from the "economics of innovation" track. Other PhD involves graduates who are supervised by a researcher at UNU-MERIT but who are not officially part of the UNU-MERIT PhD programme. Research, Student and Admin categories represent current researchers, students and administrative staff of UNU-MERIT, respectively. Social and scientific network nodes are merged thus the size of the network is same for panels A and B.

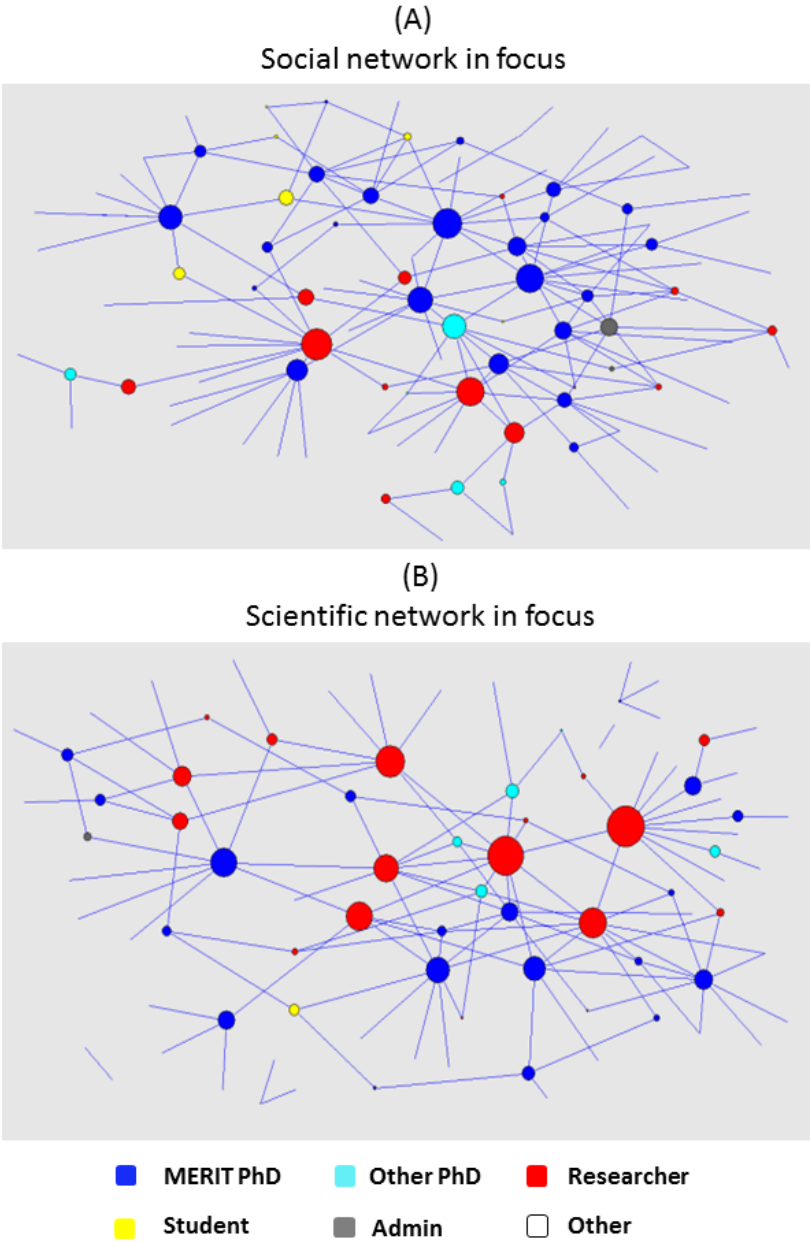
Source: Survey of UNU-MERIT PhD holders 2014

Among the main reasons for social contact between graduates we identified friendship (30%), catching-up (18%) and drinks (17%), parties and so on. It is often very difficult to separate work from leisure, as work related reasons also show up in the list for reasons for contact. Finally we should note the greater importance of administrative staff within the social network, as compared to the scientific network. Some of the main reasons for scientific interaction involving UNU-MERIT PhD holders include co-authorship (37%), organising conferences (17%), co-worker (7%) and job referrals (9%).

Figure 7 extends the analysis by weighting the size of each node by its betweenness centrality; this is an indicator that shows the importance of the node in knowledge exchange among disconnected nodes. In other words, the indicator tells how important node A is in linking two nodes C and D, which are otherwise disconnected from each other. As can be seen in the figure, this process reduces the size of the network so as to show 'only' the most important nodes. Some of the results that we have discussed above are much more apparent in this figure. The social network of UNU-MERIT PhD holders is much more vibrant compared to the scientific network. It includes more nodes and the connections among the nodes are tighter. In Figure 7, panel A, almost all subgroups are represented, meaning that there is at least one person from each subgroup who is important in information exchange in social matters. However in panel B we see that the scientific network is mainly composed of three sub-groups that include the PhD holders and current researchers. Moreover the links between nodes in panel B are less tight compared to panel A.

A side-by-side comparison between Figures 6 and 7 leads to conclude that almost two-thirds of the nodes are loosely connected, thus not represented in Figure 6. A comparison between panel A and panel B in Figure 7 documents the predominance of nodes coloured in blue (MERIT-PhDs) in panel A; by contrasts, red is the predominant colour in panel B (researchers). We can conclude that the main driver in the social network is PhD graduates but in the scientific network it is the current research staff at the Institute. Note however, the presence of several PhD holders that are vital for knowledge diffusion within the social network, and 2-3 researchers within the Institute which makes them vital for scientific knowledge exchange.

Figure 7: Social and scientific network of UNU-MERIT PhD Programme Graduates in focus



Notes: MERIT PhD involves only the ones that are graduated from the "economics of innovation" track. Other PhD involves graduates who are supervised by a researcher at UNU-MERIT but who are not officially part of the programme. Research, Student and Admin categories represent current researchers, students and administrative staff of UNU-MERIT. Social and scientific network nodes are merged thus the size of the network is same for panels A and B. The sizes of the nodes are weighted by betweenness centrality measure.

Source: Survey of UNU-MERIT PhD holders 2014

A closer examination of the network reveals that UNU-MERIT PhD holders rely on the scientific network they build with fellow cohort and supervisors/lecturers. In the case of those PhD holders who were officially involved in the doctoral programme, 36 individual nodes, we find that 47% of the social contacts are either with fellow cohort or with one plus-minus the cohort. In other words, a student that joined the programme in 2003 has good connections with fellow students in the same batch but also with the ones in the batches of 2001 and 2005. About 29% of the contacts are with doctoral supervisors or with researchers in key management positions, for example the former and current director of the Institute, or with the dean of graduate studies. This means that about 80% of the social contacts are with fellow cohort, supervisors or senior management. Thus, a strong cohort effect is seemingly accompanied by a relatively limited diversification of social contacts. The social contact base of PhD holders within UNU-MERIT is pretty much the same as it were when they were UNU-MERIT PhD students.

If we look at scientific contacts, we find that almost 60% of the graduates' scientific contacts are current researchers. Only 17% of all scientific contacts are with fellow cohort students, or with students of adjacent batches as described above. It seems that scientific contacts among graduates are rather weak, considering also the fact that seven of these students have zero scientific contacts, and that the graduates rely on the network they build during their stay in Maastricht. PhD holders have social contacts within cohort or even between cohorts, but it is rare that they collaborate on scientific research matters; a point that it would be pertinent to investigate further.

6. CONCLUDING REMARKS

The borders of the republic of science are in an endless state of change and expansion, shaping and reshaping. Thanks to the actions of scientific entrepreneurs, and often as a response to demands imposed by a changing society, disciplinary fields transform, adapt or are born to reflect the changing nature of knowledge and by extension, of the processes of knowledge production, distribution and use (Fagerberg et al. 2011; 2012). The emergence of the community of innovation scholars is a new event that contributes to the transformation of scientific activities. This study concurs with previous contributions to the literature which show how the creation of different institutions, from research organisations, learned societies and meeting places facilitate interaction, promote collaboration and underpin the work of the rapidly growing community of innovation scholars. The finding discussed in this paper thus resonate with Fagerberg and Verspagen's (2009) note on the processes underpinning the emergence of scientific fields, outside

formalised academic structures; the search for 'legitimation' of the new community occurs at the fringe of established permanent organisational units or academic departments.

Our main contribution to the literature stems from our focus on the role that doctoral training plays in the process of training young innovation scholars who will be responsible to continue the consolidation and expansion of innovation studies. Doctoral training thus plays a dual role, on the one hand, it introduces students to the field's knowledge base(s); on the other hand, it provides students with the tools, contacts and codes of conduct needed to legitimise their membership to the scientific community. Based on the experience of UNU-MERIT PhD programme in Economics and Policy Studies of Technical Change, we show that young scholars tend to follow a strategy of 'standing in the shoulders of giants' linking to prominent scholars in the field. This conclusion is consistent with some findings in previous contributions to the literature; at the same time, it draws attention, in effect, it corroborates the relevant role of supervisors for the development of young scholars[12]. Arguably, the mentoring role extends beyond the graduation ceremony, it has major impacts on the consolidation (or not) of the new skills acquired by graduate students and their future research careers. In effect, is it possible that the strong link between the students and their mentors in channelling their career path may be a solid reason for non-return to home countries? This finding invites more detailed research into the short- to long-term dynamics established between supervisors and graduate students.

A pertinent contribution of this paper is the distinction and contrast of networking activities in terms of social and scientific activities, which is expected to shed light on the effectiveness of social network as well as social capital. To our knowledge, previous studies on the emergence of the field of innovation studies had limited attention to the case of social interactions. An additional question for future research is to better understand the different stages of career building by those PhD holders that 'choose' to link with already well-established scholars. Relatedly, how likely is for the predominantly social bonding between PhD alumni to gain relevance as the basis for more scientific interactions as the alumni progress in their careers. In other words, how likely is that friendship and social interactions may eventually lead to academic collaboration? The answer to this question would shed light on the cohesiveness of the innovation scholars trained at UNU-MERIT.

[12] Hilmer and Hilmer (2011) offer an interesting counter-argument based on publishing behaviours, an aspect that we did not dealt with in this paper. A more in-depth study of publishing and co-authorship behaviours of UNU-MERIT PhD holders is left for subsequent research.

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APPENDIX 1: UNU-MERIT PHD HOLDER'S SURVEY

Dear colleague

In 2014 the United Nations University – Maastricht Economic and Social Research Institute on Innovation and Technology (UNU-MERIT), will celebrate a quarter of a century since the launch of its predecessors, UNU-INTECH (25 years) and MERIT (26 years), the latter as part of the University of Maastricht. To date, 86 PhD students have graduated from UNU-MERIT's diverse doctoral training activities. This study aims at qualifying the contribution of UNU-MERIT's alumni to the development of the field of economics of science, technology, innovation and development. We are especially interested in the existence of a cohesive alumni community and the strength of their interactions.

Thank you in advance for your contribution, this survey should not take more than 20 minutes of your time. All answers will be handled in confidentiality and only for the purpose of this study. Should you have any concerns, please contact any of the three members of the research team, all holders of an UNU-MERIT PhD degree.

Please send your answers by September 30th, 2014.

Fernando Santiago (email), Semih Akcomak (email) and Abraham Garcia (email)

Thank you very much in advance for your participation,

* Required

1. About yourself

1.1 What is your nationality? *

1.2 What is your name? *

Please tell us your first and last name, no titles please

1.3 Are you male or female? *

Mark only one oval.

- o Female
- o Male

2. PhD Studies

2.1 When did you start your PhD? *

Please indicate the year in format YYYY

2.2 Did you attend any courses part of an UNU-MERIT PhD programme? *

(The alumni is composed of people who were formally enrolled in coursework at the Institute, while others obtained their degree from the Institute without formal attendance to coursework)

Mark only one oval.

- o Yes
- o No

2.3 When did you successfully defend your PhD? *

Please indicate the year in format YYYY

2.4 Name of supervisor(s) *

Please indicate first and last name only, no academic or other titles. If more than one, divide using commas (e.g. Jose Pekerman, Didier Deschamps)

2.5 Name of Promoter(s) *

Please indicate first and last name only, no academic or other titles. If more than one, divide using commas (e.g. Louis van Gaal, Joachim Loew)

2.6 Please indicate up to three main fields of research for your PhD dissertation *

Check all that apply.

- o Clusters and economic geography
- o Entrepreneurship, start-ups and spinoffs
- o Financial markets and innovation funding
- o Government policy for innovation for development
- o Green innovation and sustainable development
- o Human capital, skills and work-organisation
- o Inclusive innovation, gender and development
- o Indigenous knowledge, informal sector and innovation
- o Industrial dynamics and technical change
- o Innovation in emerging economies
- o Innovation, economic growth and catching-up
- o Innovation: conceptual framework
- o Innovation management
- o Learning, spillovers and dynamic capabilities
- o Measuring innovation

- National, regional and sectoral innovation systems
- Networks and innovation
- Organisational learning, firm capabilities and innovation
- R&D, knowledge and innovation dynamics (micro)
- Science, technology and innovation policy and politics
- Trade, FDI, value chains and innovation
- University and industry relations
- Other:

3. Work status

3.1 What is your employment status? *

Mark only one oval.

- Unemployed Skip to question 17.
- Self-employed Skip to question 11.
- Employed full time Skip to question 11.
- Employed part time Skip to question 11.

4. Current affiliation

4.1 What is your main current institutional affiliation? *

If currently unemployed please write 'None'

4.2 Country in which the organisation is based *

4.3 Please tell us the type of organisation *

Mark only one oval.

- Central Government
- Regional/Local Government
- Financial Institutions (Banks, insurance, Micro-credit, etc.)
- Public Service/Utility Providers (Healthcare, Education, Waste Management, etc.)
- Academic/Research Institution
- International/Regional Development Organisation
- Not-for-Profit Non-Government Organisation (NGO)
- Private Sector
- Other:

4.4 How would you best describe your functions at work? *

Mark only one oval.

- o Information & Knowledge Dissemination
- o Management
- o Programme/Project Implementation
- o Provision of Services
- o Research & Analysis/Policy Inputs
- o Public service
- o Teaching
- o Other:

4.5 Do you have any other affiliation? *

Mark only one oval.

- o Yes
- o No

4.6 If yes, how many more?

Please indicate the number of additional affiliations

5. Work history

Please list your work history after completion of your PhD. Start from the most recent to the oldest

5.1 Organisation *

5.2 Country in which the organisation is based *

5.3 Please tell us the type of organisation *

Mark only one oval.

- o Central Government
- o Regional/Local Government
- o Financial Institutions (Banks, insurance, Micro-credit, etc.)
- o Public Service/Utility Providers (Healthcare, Education, Waste Management, etc.)
- o Academic/Research Institution
- o International/Regional Development Organisation
- o Not-for-Profit Non-Government Organisation (NGO)

- o Private Sector
- o Other:

5.4 How would you best describe your functions at work? *

Mark only one oval.

- o Information & Knowledge Dissemination
- o Management
- o Programme/Project Implementation
- o Provision of Services
- o Research & Analysis/Policy Inputs
- o Public service
- o Teaching
- o Other:

5.5 Do you want to add other organisation?

Mark only one oval.

- o Yes Skip to question 22.
- o No Skip to question 66.

6. Research activities

6.1 Do you continue to do research? *

Mark only one oval.

- o Yes Skip to question 67.
- o No Skip to question 68.

7. Research fields

Please list up to three main areas of research/themes you work on related to science, technology and innovation

7.1 Please indicate up to three fields/themes of research that you work on related to science and technology

Check all that apply.

- o Clusters and economic geography
- o Entrepreneurship, start-ups and spinoffs

- Financial markets and innovation funding
- Government policy for innovation for development
- Green innovation and sustainable development
- Human capital, skills and work-organisation
- Inclusive innovation, gender and development
- Indigenous knowledge, informal sector and innovation
- Industrial dynamics and technical change
- Innovation in emerging economies
- Innovation, economic growth and catching-up
- Innovation: conceptual framework
- Innovation management
- Learning, spillovers and dynamic capabilities
- Measuring innovation
- National, regional and sectoral innovation systems
- Networks and innovation
- Organisational learning, firm capabilities and innovation
- R&D, knowledge and innovation dynamics (micro)
- Science, technology and innovation policy and politics
- Trade, FDI, value chains and innovation
- University and industry relations
- Other:

8. Publishing

Please write down up to 10 publishing outlets (Academic Journals, book chapters, scientific/policy reports) where your most influential research appeared. For journal publications write the title of the journal e.g., Research Policy; for book/book chapters write the publisher e.g., Oxford University Press; for any kind of reports write the title of institution e.g., World Bank; European Commission.

9. Social contact with UNU-MERIT people after completion of your PhD. You may consider (current or former) PhD students, researchers and administrative staff

For easier reference, please visit: alumni:

http://www.merit.unu.edu/training/alumni/unu-merit-phd-programmeme-alumni/ and/or http://www.merit.unu.edu/training/alumni/other-phd-alumni/ and staff: http://www.merit.unu.edu/about-us/people/

9.1 What is the frequency of your social contact with UNU-MERIT People? *
Please consider (current or former) researchers, PhD students and administrative staff
Mark only one oval.

- o Few times a week Skip to question 79.
- o Few times a month Skip to question 79.
- o Few times a year Skip to question 79.
- o Even less frequent Skip to question 79.
- o None Skip to question 100.

10. List the most frequently contacted (up to) ten names of UNU-MERIT People for social events after completion of your PhD. Please no academic titles, for each main social contact only write first and last name (e.g. Arjen Robben), main reason for contact and frequency.
Please limit your answer to social events such as joint trips, parties and so on. In a later question we ask information about those you work with in scientific-related matters. For easier reference, please visit: alumni:
http://www.merit.unu.edu/training/alumni/unu-merit-phd-programmeme-alumni/ and/or http://www.merit.unu.edu/training/alumni/other-phd-alumni/ and staff: http://www.merit.unu.edu/about-us/people/
10.X Social contact X
10.X Main reason for social interaction with contact X

10.21 For each main social contact, please indicate the frequency of interaction.
Mark only one oval per row.

	Few times a week	Few times a month	Few times a year	Even less frequent
Main social contact 1				
Main social contact 10				

11. Scientific contacts with UNU-MERIT PhD people after completion of your PhD. You may consider (current or former) PhD students, researchers and administrative staff

For easier reference, please visit: http://www.merit.unu.edu/training/alumni/unu-merit-phd-programmeme-alumni/ and/or http://www.merit.unu.edu/training/alumni/other-phd-alumni/

What is the frequency of your scientific contact with UNU-MERIT PhD holders? *

Mark only one oval.

- o Few times a week Skip to question 101.
- o Few times a month Skip to question 101.
- o Few times a year Skip to question 101.
- o Even less frequent Skip to question 101.
- o None Skip to question 123.

12. List the most frequently contacted (up to) ten names of the UNU-MERIT people for scientific purposes after completion of your PhD, and the frequency. You may consider (current or former) PhD students, researchers and administrative staff. Please no academic titles, for each main scientific contact only write first and last name (e.g. Guillermo Ochoa), main reason for contact and frequency.

For easier reference, please visit: http://www.merit.unu.edu/training/alumni/unu-merit-phd-programmeme-alumni/ and/or http://www.merit.unu.edu/training/alumni/other-phd-alumni/

12.11 Main reason for scientific contact with UNU-MERIT PhD people after completion of your PhD. You may consider (current or former) PhD students, researchers and administrative staff.

For easier reference, please visit: http://www.merit.unu.edu/training/alumni/unu-merit-phd-programmeme-alumni/ and/or http://www.merit.unu.edu/training/alumni/other-phd-alumni/

Mark only one oval per row.

	Co-worker	Co-author	Job referral	Organise event (conference, workshop, etc.)	Other
Scientific contact 1					
Scientific contact 10					

If other, please specify scientific contact 1

If other, please specify scientific contact 10

12.12 For each main social contact, please indicate the frequency of interaction.
Mark only one oval per row.

	Few times a week	Few times a month	Few times a year	Even less frequent
Main scientific contact 1				
Main scientific contact 10				

13. Among other researchers in your field but who are or have not been formally associated with UNU-MERIT, name (at most) 5 researchers from whom you get informed about the UNU-MERIT community or activities. No academic titles please, for each main scientific contact only write first and last name (e.g. Samuel Eto'o, David Luiz)

14. Meeting places

Write down the academic conferences on "science, technology and innovation studies" in particular that you have attended in the last three years (e.g. Globelics, MEIDE, DRUID, Schumpeter Society, etc.) Please use commas (,) between items.

15. Professional affiliations

Please list the name and the duration of any professional association you may belong to since completion of your PhD (e.g. Globelics, Schumpeter Society, DRUID society, etc.) List most important affiliation at position 1, least important affiliation at position 5. Follow the format: Affiliation, years

15.1 Affiliation 1

16. Final comments

16.1 Do you have any comments?

APPENDIX 2: UNIQUE PUBLISHING OUTLETS REPORTED BY UNU-MERIT PhD HOLDERS

1. Academy of Management Journal
2. African Journal of Science Technology Innovation and Development
3. African Technology Development Forum Journal
4. American Bar Association
5. Applied Economics
6. Applied Research in Quality of Life
7. Ashgate Publishing Limited
8. AWT Advisory Reports to the Dutch Government Series
9. Bedrijfskunde
10. BIEN
11. Biomass and Bioenergy
12. Biosocieties
13. California Management Review
14. Cambridge University Press
15. Central Planning Bureau Special Publication Netherlands
16. City of Seattle
17. Climatic Change
18. Common Ground Publishing
19. Communications and Strategies
20. De Economist
21. Ecological Economics
22. Economia Industrial
23. Economic and Political Weekly
24. Economic and Political Weekly
25. Economic Inquiry
26. Economic Journal
27. Economic Letters
28. Economic Modelling
29. Economic Systems Research
30. Economics Bulletin
31. Economics of Education Review

32. Economics of Innovation and New Technologies
33. Economics of Transition
34. Edward Elgar
35. Elsevier
36. Energy Economics
37. Energy Policy
38. Entrepreneurship and Regional Development
39. Entrepreneurship Theory and Practice
40. Environmental Science and Policy
41. ESB
42. Europe Asia Studies
43. European Association of Agricultural Economists
44. European Commission
45. European Competition Law Review
46. European Economic Review
47. European Journal of International Management
48. European Management Journal
49. European Patent Office
50. European Scientific Journal
51. Expert Review Molecular Diagnostics
52. Foro Consultivo Científico y Tecnológico
53. Frances Pinter
54. Global Carbon Project
55. Global Competition Litigation Review
56. Global Environmental Change
57. Gower Applied Research
58. Health Policy and Planning
59. Holland Management Review
60. Human Sciences Research Council Press
61. Iktisat, Isletme ve Finans
62. Imperial College Press
63. Industrial and Corporate Change
64. Industry and Innovation
65. Information Economics and Policy

66. Innovation and Development
67. Inter-American Development Bank
68. International Development Research Center
69. International Economics and Economic Policy
70. International Journal of Biotechnology
71. International Journal of Emerging Markets
72. International Journal of Health Care Finance and Economics
73. International Journal of Technological Learning
74. International Journal of Technology
75. International Journal of Technology and Globalisation
76. International Regional Science Review
77. Journal for East European Management Studies
78. Journal of Business Finance and Accounting
79. Journal of Business Venturing
80. Journal of Climate Change Control
81. Journal of Conflict Resolution
82. Journal of Development Studies
83. Journal of East-West Business
84. Journal of Econometrics
85. Journal of Economic Behavior and Organisation
86. Journal of Economic Interaction and Coordination
87. Journal of Economic Surveys
88. Journal of Evolutionary Economics
89. Journal of Human Resources
90. Journal of Industrial Ecology
91. Journal of Industrial Economics
92. Journal of Institutional Economics
93. Journal of International Business Studies
94. Journal of Macroeconomics
95. Journal of Management Studies
96. Journal of Manufacturing Technology Management
97. Journal of Mental Health Policy and Economics
98. Journal of Modern Economy
99. Journal of Network Industries

100. Journal of Poverty Analysis
101. Journal of Product Innovation Management
102. Journal of Science and Technology Policy in China
103. Journal of Social Network Mining
104. Journal of Technology Transfer
105. Journal of the European Economic Association
106. Journal of the South African Institute of Mining and Metallurgy
107. Juta Academic Press
108. Kluwer Bedrijfswetenschappen
109. Latin American Business Review
110. Linde Verlag
111. Long Range Planning
112. Macmillan
113. Macroeconomic Dynamics
114. Manchester School
115. Me Judice
116. Minerva: A Review of Science Learning and Policy
117. Nature Climate Change
118. Organisation for Economic Cooperation and Development
119. Organisation Science
120. Organisation Studies
121. Oxford Development Studies
122. Oxford Economic Papers
123. Oxford Journals
124. Oxford University Press
125. Palgrave Macmillan
126. Papeles de Economia Española
127. Philosophy Ethics and Humanities in Medicine
128. Plos Medicine
129. R&D Management
130. Real Estate Research Quarterly
131. Regional Science
132. Regional Science and Urban Economics
133. Renewable and Sustainable Energy Reviews

134. Renewable Energy
135. Research Evaluation
136. Research Policy
137. Review of International Economics
138. Revue de l'Observatoire Français des Conjonctures Economiques
139. Routledge
140. SAGE
141. Science and Public Policy
142. Science as Culture
143. Scientometrics
144. Sloan Management Review
145. Small Business Economics
146. Social Indicators Research
147. Socio-Economic Review
148. Sociology of Health and Illness
149. Springer
150. Statistics Canada
151. Strategic Management Journal
152. Structural Change and Economic Dynamics
153. Sundridge Park Management Review
154. Sustainable Seattle
155. Swiss Patent Office
156. Technological Forecasting and Social Change
157. Technology in Society
158. Technovation
159. Telecommunications Policy
160. Telematics and Informatics
161. Textual / Universidad Autonoma Metropolitana
162. The Developing Economies
163. The International Journal of Innovation and Knowledge Management in Middle East and North Africa
164. The Journal of Development Studies
165. The Journal of Science
166. The Journal of Science Technology and Society

167. The Journal of the Knowledge Economy
168. Tpedigitaal
169. U.S. Environmental Protection Agency
170. UNCTAD
171. UNIDO
172. UNU-MERIT Working Paper Series
173. World Development
174. World Journal of Science Technology and Sustainable Development

APPENDIX 3: AFFILIATIONS REPORTED BY UNU-MERIT PhD HOLDERS

1. 4S
2. Academy of International Business
3. Academy of Management
4. AFRICALICS
5. African Econometric Society
6. African Renewable Energy Alliance
7. African Studies Centre Leiden University
8. Alumni association London Business School
9. American Economic Association
10. American Political Science Association
11. Arab Fund for Economic and Social Development Distinguished Scholar Awards Post-Doctoral Fellows
12. ASTP-Proton Knowledge Transfer Europe
13. Atlanta Conference on Science and Innovation Policy
14. Austrian Economic Association
15. Basic Income Earth Network
16. CMI Community-Work Group on Knowledge Economy Job Creation and Government Policies
17. Community Alliance for Global Justice
18. DIME
19. DRUID
20. Dutch Association of Competition Lawyers
21. EAEPE
22. EASST
23. Ecological Economics
24. EcoMod
25. Economic Modelling Network
26. Economic Society of South Africa
27. EGOS
28. Eindhoven University of Technology
29. EMAEE
30. EPIP

31. EU Meetings
32. European Association of Development Research and Training Institutes
33. European Economic Association
34. French Cliometric Society
35. GCW
36. Global Entrepreneurship Congress
37. GLOBELICS
38. Governance of a Complex World
39. Group of Research in Innovation for Inclusive Development
40. Indian Association of Social Sciences and Health
41. INFORMS
42. International Association of Energy Economics
43. International Association of Wine Economists
44. International Conference on Innovation and Management
45. International Input-Output Association
46. International Institute for Applied Systems Analysis
47. International Telecommunications Society
48. InterNations
49. ISEI
50. IZA Bonn
51. Koninklijke Vereeniging voor Staathuishoudkunde
52. LALICS
53. Marseille Center for Mediterranean Integration
54. MEIDE
55. Mercator Research Institute on Global Commons and Climate Change
56. METEOR Maastricht
57. National Business Incubation Association
58. Netzwerk Nachhaltige Ökonomie
59. New Economy Network
60. Nigerian Economic Society
61. NSI Maastricht
62. OECD
63. PIDE
64. PSDM

65. Red de Talentos Mexicanos en Holanda
66. Regional Studies Association
67. Royal Economic Society
68. Schumpeter Society
69. Science Section of the Anthroposophic Society
70. SKOPE Oxford University
71. South African Institute of Mining and Metallurgy
72. Spanish Association of Professionals in The Netherlands
73. STAR Communities
74. Systems of Innovation and Rural Transformation in China and India
75. Tilburg University
76. Verein für Socialpolitik
77. WEHIA
78. Western Regional Science Association
79. WISERD

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