

AC 2007-162: HP, WFEO AND CWIT: BUILDING ENGINEERING CAPACITY IN AFRICA

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Abstract

Engineering, including Information and Communication Technology (ICT), catalyzes economic growth for developing as well as developed countries. Engineering education and capacity building help build knowledge-based economies and alleviate poverty. This paper describes the role that HP University Relations, the World Federation of Engineering Organizations (WFEO) and the Center for Women and IT and its associated International Taskforce on Women and ICT are playing in Africa, leveraging and adapting a model developed by HP, WFEO and partners in Latin America. The paper describes specific activities to recruit and align HP internal stakeholders, to recruit government, university and industry stakeholders, to develop an African beachhead and a prototype for regional capacity building, to build in gender equity at each stage of the process, and to design for scaling throughout Africa, based on stakeholder engagement. The innovation for engineering education consists of building and leveraging multi-stakeholder megacommunities focused on building sustainable capacity through engineering education through strategic co-leadership by the private sector.

I. Introduction – on capacity building, technology infrastructure and innovation

The process of capacity building and the role of technology infrastructure and innovation is discussed more thoroughly in “HP University Relations: helping build engineering capacity in Latin America.” In her paper Morell presents the multistakeholder model developed in Latin America, which the African program leverages, and which this paper complements.

The World Bank recommends that nations which wish to develop knowledge-based economies concentrate their efforts on four major areas: education and training, communication and information infrastructures, economic incentives and institutional regime, and innovation systems.¹ Knowledge has become a primary factor of production – many economists would argue the most important component - in addition to capital, labor and land. For a small, natural resource poor, landlocked emerging economy, knowledge may be the only factor of production.² Most globalization experts agree that technology is critical for meaningful economic development across the globe. Many engineering educators argue further that engineering education is therefore a critical key to capacity building for the knowledge economy. Economic studies conducted before the information-technology revolution show that as much as 85 percent of measured growth in U.S. income per capita was due to technological change³. Economic miracles in Ireland, Finland and Singapore bear out the significance of technology and engineering education.^{4 5}

II. HP University Relations and Engineering for the Americas (EftA)

In her aforementioned paper, Morell discusses in depth the role of HP University Relations (UR) and the Engineering for the Americas initiative, summarized here.

Hewlett-Packard Company engages with the higher education community at over 100 academic institutions around the globe in many ways. From joint research and student recruitment, to customer relationships and policy advocacy - numerous HP organizations and hundreds of HP employees advance the company's interests with higher education globally.

To build capacity in Latin America, the UR team has collaborated with the World Federation of Engineering Organizations to focus on quality assurance for engineering education and professional mobility throughout the region. In seven years, grassroots conversations and projects led by our director for Latin America Lueny Morell⁶ and Russ Jones⁷, Chair of the Capacity Building Committee of WFEO, scaled to involve multiple stakeholders from industry, universities, governmental and non-governmental agencies (such as engineering education and accreditation agencies). The Organization of American States became a sponsor, and a presentation to the OAS Ministers of Science and Technology resulted in their declaration of support for this regional approach. The US Trade and Development Association recently supplemented corporate funding for a regional conference to expand and scale the country efforts, and to increase inter-country and regional integration.

The remainder of this paper describes a work in progress, the very beginning and first year of a multi-stakeholder effort to build engineering education in Africa leveraging the EftA model, and leveraging the UR team's involvement in and the emergent mega-community for gender equity in engineering and ICT. Deliberately departing from academic convention, it is told in the first person using active verbs, naming names and providing email addresses in end notes. The medium is the message. Medium and message illustrate three points. First, this effort and the mega-communities that support and are informed by it occur because real people have dreams that they act upon; it is not because organizations with charters somehow produce the work. Second, personal relationships are the sinew, conversation the blood and informal networks the bones of the communities out of which complex multi-year sustainable work arises. Third and finally, we invite others to connect with us and join the conversation and community.

Personal experience of some of us current and former academics suggests that academic convention blunts our own capacity building. Third person descriptions, passive voice and emphasis on organization charters often obscure how things really happen, mute the passion which fuels much of our action; and bury the invitation to collaborate which is the purpose of our talks.

III. 'Engineering Africa!'

The effort to adapt the EftA lessons learned in Latin America to Africa has helped us clarify critical steps in this grassroots capacity building process. The model consists of these steps, which proceed not only sequentially but also in parallel: (1) Start with your own passion and find others who share it; (2) Find partner organizations where at least one individual shares your passion and commitment and can commit the organization at least in name; (3) Form a core team to plan a small workshop or conference to expand the conversation to local

stakeholders who can guide it to align with and enhance current ongoing local and regional efforts and organizations; (4) Articulate the largest vision you see to inspire, shape and be shaped by your program; (5) Learn other sectors' ways of operating; (6) Build megacommunities to inform and scale your program until your program scales to become itself a megacommunity; and use your program to inform and build other megacommunities; (7) Repeat the effort with a larger workshop or conference in the country; repeat the effort in other countries; constantly cross reference all efforts across countries for regional and Africa-wide integration and impact.

1. Start with your own passion and find others who share it.

My commitment of 5 decades to civil rights and the women's movement, played out in the last two and a half decades at Hewlett Packard and including adventures raising our two African-American children adopted at birth, are the subject of my book *Soul in the Computer*, available to you in hard copy for free and online⁸. Two years ago, that commitment profoundly deepened. My daughter's boyfriend, and the father of their unborn son, was murdered. That he had planned his own funeral, in parallel with plans for his new family, shook me to the core. I have since learned that funeral plans are a fact of life for many African-American youth in American inner cities. (In some of these, as I learned from a sign on the back of a bus in Washington DC, the U.S. capital, HIV infection rates surpass that of some sub-Saharan countries.) I committed to tackle apartheid by race, class and gender with renewed focus, and with deeply compassionate and inspired support from my manager Wayne Johnson⁹, VP of University Relations at HP. I made this commitment to save my own soul, to diminish the tragedies to individuals, families and communities that rob millions of their hopes, dreams and futures; and to help increase participation in the knowledge economy. Quite simply, those countries that overcome apartheid by race, class and gender will be more competitive in the global economy than those whose practices, policies and investment schemes commit them de facto to apartheid, robbing them of the potential of half or more of their human capital. My new focus is on African American engineering education in the US, and internationally on Africa in the initiative I am calling for now 'Engineering Africa!,' the subject of the remainder of this paper.

Where to start? I'd never even been to Africa! I began by seeking other internal stakeholders in HP, through conversations. My first call to our General Manager for HP Africa, Olivier Suinat¹⁰, more than compensated for a few others that began with astonishment or skepticism: "Why Africa?" Olivier expressed great enthusiasm for anything we could do to create more engineers. On par with many European markets, Africa is one of the biggest and fastest growing emerging market regions in HP's Europe, Middle East and Africa geography. This fact astonished me and even executives I subsequently share it with. How could we not know? Are we so blinded by the 12/1 ration of negative to positive press on Africa cited by a recent researcher that we can't even see our own success? According to popular media, the continent is hopelessly lost to civil wars, corruption, famine, AIDS and other diseases. However, high tech business people working in Africa tell a story of phenomenal growth. Massive investment in capacity building, much of it from China, India and the Middle East, rather than from the obvious former colonial powers, is accelerating the growth. Intra regional trade and cooperation is expanding as well. Africa's 53 countries have experienced an unprecedented CAGR of over 6% GDP over the past few years. As in the rest of the world, some regions are performing better than others, and characterizations

fo the continent as a whole, or even as a ‘country’ as some do, grossly misrepresent the realities. As in the West, in Africa we observe increasing gaps in wealth & development, although the average improves. The lack of skilled workers and the constant turnover caused by fierce competition for scarce talent stymies more aggressive progress on infrastructure. Olivier and others in the region stress the urgent need to develop engineering education for capacity building.

Oliver connected me with our new GM for West Africa, Lloyd Atabansi.¹¹ Our first hour typified this new friendship: it expanded to six! Born in Nigeria, raised in the US, a graduate of Howard, and Bowie State, with a Masters and a Ph.D., Lloyd has lectured in universities throughout the U.S. including CMU, Johns Hopkins and the University of Maryland; worked for IBM and Accenture; and is part of the Diaspora returning with their families to help build Africa. Sharing our commitments and our dreams with each other, Lloyd and I envisioned ‘Engineering Africa!’ a multi-stakeholder quality assurance process to build engineering education throughout Africa, beginning in West Africa, in Nigeria, and leveraging all we’ve learned from EftA.

Olivier, Lloyd and I continued to identify HP stakeholders in Africa. A key stakeholder emerged from my own UR team. Arnaud Pierson¹², working with UNESCO, had developed a capacity building initiative in South East Europe for Brain Gain. Universities in the region have lost as much as 80% of their faculty and students through attrition during the war. By equipping key universities in the region with high-end servers, PCs, printers and networking, and money for travel related to joint research and exchange visits with the Diaspora around the world, universities upgraded their research, increased enrollment and retention, and joined the global university research community. I asked Arnaud if we could expand the project to Africa, given our new focus in UR. Conversations with UNESCO and HP Philanthropy were already underway. The UNESCO team has selected Algeria, Nigeria, Ghana, Senegal, Kenya and Zimbabwe to receive grants. Education ministers in these countries will select key universities to participate in the African Brain Gain initiative.¹³ Stakeholders in that initiative have joined the leadership of ‘Engineering Africa!’

2. Find partner organizations where at least one individual shares your passion and commitment and can commit the organization at least in name.

Engineering Africa! existed in Lloyd’s and my dreams and conversations, and as a set of power points for many weeks, slowly gathering momentum in the U.S. and in Africa as we shared our ideas with others. Momentum accelerated when I shared the vision with Russ Jones, chair of the Capacity Building Committee of the World Federation of Engineering Organizations (WFEO), and key thought leader in the EftA effort. Russ¹⁴ suggested HP and WFEO collaborate, and that we all lead the effort with WFEO as our face. This approach offered several advantages. First, it’s easier for other companies to join an effort not labeled HP. Second, as in the rest of the world, so in Africa: engineering academics prefer to join an effort championed by engineering educators and professionals than one driven by corporations. Finally, WFEO includes representatives from 90 countries, including many in Africa.

Russ invited me to share the Engineering Africa! vision at the Capacity Building Committee of WFEO in South Africa. This committee unanimously endorsed the joint project with great

enthusiasm, perhaps overly so in the words of one African delegate, “This will be the greatest thing that has ever happened in Africa!”

3. Form a core team to plan a small workshop or conference to expand the conversation to local stakeholders who can guide it to align with and enhance current ongoing local and regional efforts and organizations.

A core team of all the HP stakeholders and Russ Jones of WFEO set to work. Through his many networks, Russ invited co-sponsors, including the Nigerian Society of Engineers, the African Engineering Education Association, and the UNESCO Regional Bureau for Science and Technology in Africa, as well as key faculty in Nigeria and throughout the continent. HP invited companies based in Nigeria, in Africa and globally, as well as Nigerian ministers.

The focus of the meeting is technical capacity building for economic development through engineering education in Africa, beginning in Nigeria. The fifty invited participants come from four major sectors: engineering educators, industry leaders, government officials, and related non-governmental organizations, including the World Bank and several local foundations. Keynotes, panels and discussions will explore industry need for technical workers, the current situation of engineering and engineering education, economic development, and university, industry and government partnerships. We anticipate that a larger conference, expanding on these topics, could occur late in 2007 at the time of the annual meeting of the Nigerian Society of Engineers.

4. Articulate the largest vision you see to inspire, shape and be shaped by your program.

Writing in the Kauffman Foundation’s Thoughtbook for 2006¹⁵, Wayne Johnson shared a vision for the world that inspires me like so many others, and encompasses our work building economic capacity, and even inventing, making and selling ICT. In his vision, knowledge supply chains and innovation ecosystems enable global innovation and prosperity. The current state of national and regional innovation systems demonstrates that there is much work to be done. In developed countries innovation ecosystems are running out of steam: fragmented, piecemeal, bureaucratic, and silo’d. In developing countries they are opportunistic, partial and disconnected. In both developed and developing countries, innovation systems are massively sub optimizing. Wayne envisions multi-stakeholder regional and country innovation ecosystems or megacommunities growing the global innovation ecosystem.

5. Learn other sectors’ ways of operating

Globalization has created unprecedented complexity: an exponentially increased density of cross-sector relationships to the point that the old and more formal methods of multi-sector collaboration characterized by hierarchy and contracts has broken down. Concurrently, issues facing each sector are now so complex and interconnected with other sectors that silo’d approaches are grossly inadequate to face them. In place of formal structures and agreements to resolve issues to the benefit of each stakeholder – an approach that on most complex problems only exacerbates the issues, informal networks and collaborations have emerged to optimize for the benefit of the network and indirectly improve the odds for each stakeholder.

An example illustrates the impetus for and dynamics of these informal collaborations. Consider ‘recruiting’ in Africa. Companies compete for too few graduates, create turnover for each other, and escalate wages for their industries to the point that growth stalls and/or they decide to leave the country or region for lower-wage greener pastures. Competitors are finding that only by cooperating to optimize for a larger labor pool – one that will benefit not only the country, the universities and the graduates, but also their competitors - will they get their individual needs met. In fact, HP University Relations has had no problem recruiting competitors to partner on capacity building efforts in the areas where we do business. These multi-sector informal networks optimizing for the benefit of the whole we call megacommunities.¹⁶ They require all sectors to learn new values and ways of operating.

The private sector offers significant benefits to non-profit stakeholders with which we collaborate. Most importantly, we work with engineering educators to shape the curricula for the jobs industry has to offer and thereby enable the sustainability of the new educational capacity. Sustainability occurs when companies employ graduates, who in turn form an educated local professional and managerial class that remains in the country or region rather than emigrates.

The private sector offers another critical near-term benefit as well: the rigors and benefits of strategic planning, meetings designed for decision-making and results, project management and all the other skills so critical to organizational development.

Given what it has to offer, the private sector often assumes the upper hand in multi-sector engagements, to the detriment of the collective work. The private sector must learn from the civic sector, the values, skills and abilities it has honed: community building, grassroots leadership, and consensus building. In fact, the emergent paradigm of the best leadership training in the private sector incorporates just these lessons, but this paradigm is only just beginning to penetrate the cubicle walls. Below are some distinctions that differentiate the paradigms of organizational development, dominant in the private sector and community organizing, more prominent in the civic sector.¹⁷ Clearly, the best leaders and processes in either sector use both paradigms, and certainly there are parts of the non-profit sector that surpass corporations for bureaucracy, hierarchy and tops-down approaches. Stakeholders can identify their underlying assumptions and increase their abilities to collaborate.

| Feature | Private Sector | Civic Sector |
|-----------------------------------|---------------------------------------|--|
| Change Paradigm | Organizational Development | Community Organizing |
| Structure | Hierarchy | Informal Network |
| Leadership: power/metaphor/method | Position/Navy Captain/Bold Directives | Influence/Gardener/Big Questions |
| Connection/Disconnect | Reporting Relationships/Reorgs | Trust/Betrayal |
| Communication | Tops down/broadcast/get | Listening at all levels/conversation/co-creation |

| | | |
|--|---|---|
| | buy-in | |
| Strategy: process/method/assumption | Linear drive to end point/project management /predictability | Successive Approximation/Discovery Process/probability |
| Planning | Precise Planning/ Linear/Incremental | Successive Approximation/Action- Reflection cycles/Disruptive |
| Change | Manage it | Catalyze emergence |
| Decision-Making | Leader decides | Consensus emerges |

In the context of the foregoing discussion, the goal of Engineering Africa! is to support and accelerate the emergence of an African innovation ecosystem by helping to build the African engineering education megacommunity. To do so, stakeholders in the megacommunity must value each other's methods and values.

6. Build megacommunities to inform and scale your program until it scales to become itself a megacommunity; Use your program to inform and build other megacommunities.

One emergent megacommunity I'm helping to build, which in turn informs my beginning work in Africa consists of conversations, conferences and projects coalescing for gender equity in engineering and ICT in all levels of education and the workforce and marketplace. The leader of the network through consensus and pressure on her to be our public face and shepherd of our collective efforts is Claudia Morell, Executive Director of the Center for Women and IT at the University of Maryland, Baltimore County. Leader of a stellar local effort for Maryland, Claudia held a conference in June 2005 to which she invited representatives from 38 countries to expand the context and impact of her local efforts. As a result of her conference, I joined her Advisory Board and HP became a corporate sponsor of her work. Other results illustrate how building megacommunities can inform and shape a new project that in turn informs and shapes the megacommunity.

A. Research

At Claudia's Baltimore conference I met key thought leaders who would inform my work and commitment in Africa, including Claudia herself, Nancy Hafkin, former Coordinator for the UN African Information Society Initiative and Sophia Huyer, Executive Director of Women and Global Science and Technology (WIGSAT), and Researcher for the Gender Advisory Board of the UN Commission on Science and Technology for Development. Named the book of the month by Harvard's Belfer Center for Science and International Affairs, Nancy's and Sophia's Cinderella or Cyberella¹⁸, makes the case for multi-stakeholder initiatives that include grassroots women's groups along with government, university and industry. The authors urge us to define baselines and progress metrics to reverse failure and accelerate success on achieving the Millennium Development Goals related to girls and women. Their research and friendship has renewed my commitment and urgency to inclusion of grassroots leadership in multi-stakeholder work, and to progress with research, metrics and indicators.

B. Ghana & Situation of Women Entrepreneurs

All participants at the Baltimore conference were invited to Ghana for the Pan-African Women Innovators and Inventors celebration in 2005. Claudia and I attended – the first trip to Africa for us both. HP University Relations agreed to sponsor the conference. In Accra Claudia and I met women entrepreneurs from all over Africa and learned first hand of their urgent need for internet access to communicate, network, source supplies, expand their markets and scale their businesses. We learned as well of the barriers to access: urban women experience harassment and physical danger when they venture into the ubiquitous internet cafes, which have replaced pinball arcades as the local youth hangouts. Rural women must travel far, and often at great cost and/or peril, to even confront the dangers of the internet cafes. We learned as well of government commitments to gender equity, expressed so well in the words of the opening welcome by the Minister of Trade and Industry, Honorable Alan Kyeremateng, “When African leaders recognize the key to African economic development is women, Africa will start waking up.”¹⁹

C. International Taskforce on Women and ICTs / Paris

Another result of the Baltimore work informed by and informing work on Africa was the formation of a five-year task force, the International Taskforce on Women and ICTs.²⁰ Representing over 80 government, business, education, and non-government organizations, the Taskforce coalesces the fragmented ad hoc groups into a megacommunity to increase local and global impact, reach, and effectiveness in achieving shared goals. I belong to the core group or Steering Committee of the Network which has helped us collectively to collaborate on identifying successful projects, baseline and critical components required for success; metrics for gauging progress; and critical areas for policy reform and advocate for it as one voice. Speaking as one voice and led by Claudia is a portal, funded by a grant from the National Science Foundation (NSF), that organizes curriculum modules, metrics, programs and resources. A user can search the database by country, region, language, level of education, theme, workplace or marketplace.

A year later in Paris in November '06, in a meeting supported by UNESCO, the European Commission, the NSF, HP, Texas Instruments and Cisco, the Taskforce formalized an agreement for cooperation among its members to achieve agreed upon goals, which includes enlarging the network of support for women in Africa. Further goals include mapping out the critical gatherings where global and regional issues that concern women are deliberated, often with no women present and/or no mention of women and girls. A Taskforce representative will attend each critical meeting, join relevant study groups, and comment on significant reports that omit or misrepresent the issues for women and girls. Two members recently wrote to thank Mr. Wolfowitz and the authors of a recent report, a 328-page flagship publication, *Information and Communications for Development: Global Trends and Politics*. They also pointed out that the report fails even to mention the ICT gender divide, and mentions women at all only once.

D. WSIS, Tunis

Leveraging contacts in the gender-equity megacommunity, Claudia and I organized two workshops for a pre-conference sponsored by HP University Relations at the World Summit on the Information Society in Tunis. The first workshop presented HP's programs to address

economic development. The second highlighted gender equity programs around the world. Proceedings of the workshops form chapters in the book resulting from the conference.²¹

In Tunis I hosted a dinner to introduce Claudia , the leader of the International Taskforce, to Russ, chair of the capacity building committee of WFEO. Russ invited us both to join his committee, and subsequently Claudia agreed to organize and lead the WFEO international colloquium in Tunis, “International Colloquium on Empowering Women in Engineering and Technology,” June 6 – 8, 2007”²² and I agreed to be on the Steering Committee. This conference will focus on women in Africa and the Middle East and will recruit as well 2 women from each of the 90 member countries of WFEO. Several speakers for the Tunis conference will attend ‘Engineering Africa!.’

As Engineering Africa! grows through the International Taskforce megacommunity, it also feeds it.

7. Repeat the effort with a larger workshop or conference in the country; repeat the effort in other countries; constantly cross-reference all efforts across countries for regional and Africa-wide integration and impact.

I will report progress on this step real-time. We will propose to attendees two steps to enlarge the conversation in Nigeria. First we will suggest meetings by HP and WFEO and other stakeholders with the new government in May, shortly after the April elections. Second, we will offer to organize a summit to expand the conversation before, during or after the annual meeting of the Nigerian Society of Engineers, which draws 4,000 engineers from throughout Nigeria, in December 2007. In addition, we will explore the interest of representatives from other countries in holding similar initial workshops in their own countries. By June, when this paper is given, we will know the outcomes of the Abuja meeting; and may have held the meeting with Ministers in the new government and have more planned in other countries.

IV. Summary: This paper has described the first year of a multi-stakeholder effort to enhance engineering education in Africa leveraging a model that has succeeded in building capacity in Latin America. It describes steps in the model and the activity of building and being shaped by megacommunities and the informal networks that characterize them.

¹The World Bank. *World Development Report: Knowledge for Development*. New York: Oxford University Press, 1998. www.worldbank.org/eca/knowledgeeconomyreference

² Murenzi, Romain and Mike Hughes, “Building a Prosperous Global Knowledge Economy in Africa: Rwanda as a Case Study.” *International Journal of Technology and Globalisation 2* (2006) nos. 3-4: 254-267.

³ *Rising above the gathering storm: energizing and employing America for a brighter economic future: Committee on Prospering in the Global Economy of the 21st Century: an agenda for American science and technology; Committee on Science, Engineering, and Public Policy*. Washington, D.C.: National Academies Press, 2006.

⁴ Morell, Lueny, “HP University Relations: helping build engineering capacity in Latin America” submitted to ASEE, 2007.

⁵ Jones, Russel, “Engineering Capacity Building in Developing Countries” submitted to ASEE, 2007.

⁶ Lueny Morell, lueny.morell@hp.com

⁷ Russ Jones, rcjonespe@aol.com

⁸ Waugh, Barbara, *Soul in the Computer*. Maui, HI: Inner Ocean Publishing, 2001; http://web.hpl.hp.com/personal/Barbara_Waugh/

⁹ Wayne Johnson, wayne.johnson@hp.com

¹⁰ Olivier Suinat, Olivier.Suinat@hp.com

¹¹ Lloyd Atabansi, Lloyd.Atabansi@hp.com

¹² Arnaud Pierson, Arnaud.Pierson@hp.com

¹³ http://portal.unesco.org/en/ev.php-URL_ID=34273&URL_DO=DO_TOPIC&URL_SECTION=201.html

¹⁴ Russ Jones, rcjonespe@aol.com

¹⁵ *ThoughtBook 2006*. Kansas City, MO: Marion Ewing Marion Kauffman Foundation, 2006.

¹⁶ Gerencser, Mark, Fernando Napolitano, Reginald Van Lee “The Megacommunity Manifesto, *Strategy+Business* 43 (Summer 2006): 80-91.

¹⁷ These distinctions derive from conversations over many years with these friends and reading their books and websites: Brown, Juanita, David Isaacs, The World Café. San Francisco, Berrett-Koehler, San Francisco 2005; Wheatley, Meg, Leadership and the New Science: Discovering Order in a Chaotic World Revised, Berret-Koehler, San Francisco, 2001; and Wheatley, Meg, Finding Our Way: Leadership for an Uncertain Time, Berrett-Koehler, San Francisco, 2007; Karen Stephenson, www.netform.com

¹⁸ Hafkin, Nancy, Sophia Huyer, eds., *Cinderella or Cyberella: Empowering Women in the Knowledge Society*. Bloomfield, CT: Kumarian Press, 2006.

¹⁹ Pan-African Women Invent and Innovate (PAWII) Exhibition, Conference and Awards Ceremony, September 7-9, 2005, Accra, Ghana. <http://africa.gwiin.info>

²⁰ www.umbc.edu/cwit/global.html

²¹ Shrum, Wesley, Keith Benson, Wiebe Bijker, Klaus Brunnstein, eds. *Past, Present & Future of Research in the Information Society*. New York: Springer, 2007.

²² <http://www.wfeo.org/women/index.html>