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UNESCO Chair in Technologies for Development
2014 INTERNATIONAL CONFERENCE

TECHNOLOGIES FOR DEVELOPMENT : WHAT IS ESSENTIAL ?

4–6 JUNE 2014
EPFL, LAUSANNE
SWITZERLAND

http://cooperation.epfl.ch

REACT @ #T4D2014

CONFERENCE VENUE

SWISSTECH CONVENTION CENTER ◦ Route Louis Favre 2 ◦ 1024 Ecublens/Lausanne ◦ +41 21 693 42 42 ◦ +41 21 693 42 68 ◦ www.tstcc.ch

Legend:
- SwissTech Convention Center
- SwissTech and Starling Hotels
- Metro M1 stations
- Metro M1 line
- Highway

↑ MORGES PRÊVERENGES

→ GENÈVE

A1 Autoroute Lausanne-Genève

CFF

Av. du Tir-Fédéral

SwissTech CONVENTION CENTER

ECUBLENS

SAINT-SULPICE

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

METRO M1 EPFL STATION

EPFL

SwissTech Hotel

Av. du Tir-Fédéral

M1

→ BERNE

Rue du Jura

Starling Hotel

Route Cantonale

Route de la Sorge

UNIL Université de Lausanne

CHAVANNES-PRÈS-RENENS

METRO M1 RENENS STATION

M1

RENENS GARE

CFF

Sortie A1 EPFL-UNIL

LAC LÉMAN

BOURDONETTE

Av. du Chablais

CFF

Rue de Lausanne

LAUSANNE

OUCHY ↓

→ LAUSANNE

METRO M1 LAUSANNE FLON STATION

HOW TO GET TO THE CONFERENCE VENUE

From Lausanne Railway Station (Lausanne Gare CFF):
- Metro M2 to Lausanne Flon (direction Croisettes),
- Change to Metro M1 (direction Renens-Gare) to EPFL

From Renens Train Station (Renens Gare):
- Metro M1 to EPFL (direction Lausanne Flon)

Contents

Lausanne, June 2014

Dear Participants of the third UNESCO Technologies for Development Conference,
Dear Colleagues,

Welcome to the third UNESCO Chair Conference on Technologies for Development!

This year we will focus on the question: "What is Essential?" Indeed, in a world where we are permanently connected and bombarded with a wealth of information, there is undeniably a need to find out what is important and to set priorities. This is particularly true in the field of development where so many challenges remain. How can we effectively reduce poverty? What is the role of technologies? How can they be successfully developed and deployed? How can their impact best be evaluated? This will be the focus of our discussions over the next three days.

We encourage you to attend as many sessions as you can, as a wealth of ideas will emerge during the presentations of the 125 papers that will be presented. Please take part in the discussions and thereby contribute to knowledge generation and exchange.

This Conference is also conceived to be a networking platform. However, more often we talk to the people we already know. Please make an effort to talk to someone new everyday. There are coffee breaks and lunch breaks and our social event in the UNESCO World Heritage Vineyards are perfect opportunities to get to know someone new over a glass of local wine.

We would like to thank all the people who contributed to make this Conference a success.

First of all, a big thank you to the session leaders and paper presenters who have put in a lot of time and energy to make their sessions a success. Secondly, we would like to thank Emmanuel Estoppey and his team from the Lavaux UNESCO World Heritage Site who have gone out of their way to welcome us to the Lavaux Vineyards for the sessions on Thursday afternoon followed by a social event in the wonderful village of Epesses. We would also like to thank the team from Ingénieurs du Monde who have supported us on many levels. In addition, there are a number of people who have contributed to the organization of this Conference all of whom are warmly thanked!

Finally, we are very grateful for the generous patronage of our all our conference sponsors. Their support and their partnership is critical to the achievement of our common mission which is to identify innovative solutions that are able to reduce poverty and lead the way toward more suitable development at a global level.

Silvia Hostettler   Eileen Hazboun
UNESCO Chair Conference Director   UNESCO Chair Coordinator

Welcome by Prof. Philippe Gillet
Vice-President of Academic Affairs, EPFL

Dear Participants of the third UNESCO Technologies for Development Conference,
Dear Colleagues,

On behalf of EPFL, it is my pleasure to welcome you today to this conference on the EPFL campus. We are proud to host the UNESCO Chair in Technologies for Development since 2007 and its biennial conference has become a flagship event, drawing an ever-increasing audience.

In today's world, 30% of the global population tries to survive with less than 2 USD per day. This means that many families cannot access healthcare, electricity, safe water or send their children to school. In addition, the gap between rich and poor is widening, and climate change and economic crisis endanger/jeopardize the progress made in recent years. At EPFL we believe that a high level of education and scientific excellence are fundamental for sustainable development. We are convinced of the development potential of Massive Open Online Courses (MOOCs). By offering access to high-quality teaching content to thousands of African students online, the impact of education can be up-scaled in an impressive way. Technology allows us to think about innovative ways of teaching and to leverage knowledge in new and exciting ways.

We also believe that EPFL has both the technological expertise and the ethical obligation to use it in order to support the sustainable development of the Global South.

According to the World Health Organization (WHO) "about 70% of the more complex medical devices do not function when they reach their destination in developing countries". One of the main causes has been identified as the instability of the equipment when it has to resist sudden changes in electrical current, because it succumbs to heat, dust or moisture, or simply because there is no one on the spot who knows how to use or maintain it. Clearly, this type of technology is not adapted to the needs of many developing countries. As this is being recognized, a number of research teams, among them *EssentialTech* at CODEV, are developing medical equipment that is low-cost, robust, easy to use and most importantly; developed in partnership with the beneficiaries and the industry. Therefore, successful innovation for development is moving closer to the context of 'Base of the Pyramid' users. This means that we have to test technologies in the local environment of developing countries, which is often characterized by poor infrastructure, unreliable energy supply, bad transport or limited digital access. In order to develop appropriate technologies, the EssentialTech team at EPFL has launched the University Centre for Research and Energy for Health, a joint lab in Cameroon, with the Ecole Nationale Supérieure Polytechnique de Yaoundé where technologies are developed locally.

The *EssentialTech* program goes even further by developing an entire value chain from the technical design to the deployment business model, which includes manufacturing, logistics, commissioning, usage, maintenance, waste and recycling. This requires an interdisciplinary approach and partnerships with global and local players in the private sector together with public authorities and civil society. It is however inevitable that a compromise will have to be made between adapting technology within a specific local context and the objective of large-scale deployment. This represents an important challenge because the perspective of large-scale industrial production requires standard designs to keep costs down, while some level of adaptability to local specificities still needs to be maintained. Therefore, it is fundamental to aim not only at developing appropriate

technologies but also to draw up the appropriate strategy to develop, implement and maintain them. Such an approach is essential to reach the ultimate objective/goal of technologies for development, namely the reduction of poverty.

This UNESCO Conference will examine **three guiding questions** during the next two and a half days:

1. **What are the needs for essential technologies?**
   How can we define essential technologies? Are essential technologies those that meet the basic needs of the poorest segments of the population? What kind of needs require what kind of technologies? Who defines the needs and who will have access to these technologies? What are the technical challenges?

2. **What are successful processes to develop and deploy essential technologies?**
   What frameworks, incentives, catalysts and policies are required to foster the required innovations and collaborations at all levels of the value chain?

3. **How can we evaluate the impact of technologies? How do we move from innovation to impact?**
   How can we evaluate the impact of technologies on the ground? To what extent did they contribute to poverty reduction? What process will be used to collect data and measure impact? What are the deciding factors for technological breakthrough? What can we learn from failures?

These are some of the questions we will examine in the days to come. We brought together researchers, decision-makers, the industry and the civil population; because it is from this dialogue that the most appropriate technological solutions will emerge.

I am delighted to have the opportunity to welcome all of you, who have come together from all around the world, to generate new knowledge on these issues and to work together with the aim of reducing poverty and contributing to sustainable development.

I wish you inspiring discussions, efficient networking and a great time discovering the vineyards of Lavaux tomorrow during the social event.

Welcome by Prof. Jean-Claude Bolay
Director, Cooperation & Development Center, EPFL

Dear Participants of the third UNESCO Technologies for Development Conference,
Dear Colleagues,

EPFL has been active in cooperation for development for decades, in various and complementary ways: admission of students from the South, partnerships with universities and research centers in Africa, Asia and Latin America, and numerous internationally recognized scientific and technological productions.

This work was made possible, and is currently expanding, through, first of all, the commitment of many researchers and students, but also long-established relations of trust with the Swiss Agency for Development and Cooperation (SDC), the State Secretariat for Education and Research (SER), private foundations, NGOs, without forgetting international organizations, among which UNESCO should be highlighted as, in 2007, it bestowed upon us the Chair in Technologies for Development.

The UNESCO Chair in Technologies for Development is actively engaged in three areas:

- **In research**, through the promotion of projects which aim to adapt technologies to the context of developing countries, by bringing together EPFL laboratories and foreign partners, on priority issues for their countries – although not exclusively – such as: Technologies for the Sustainable Development of Habitat and Cities; Information and Communication Technologies for the environment; Science and Technology for Disaster Risk Reduction and Technologies for sustainable energy;

- **In continuing education**, with two Certificates of Advanced Studies: one in Management of Development Projects, and the other in Disaster Risk Reduction; both promoting a transdisciplinary approach with a view to finding innovative solutions for sustainable development;

- **A platform to exchange** knowledge and expertise in a spirit of international solidarity, and this primarily by convening biennial international conferences that bring together researchers, professionals and decision-makers from around the world, and highlighting the results achieved, learned lessons and recommendations which promote science for the benefit of development.

Three current initiatives epitomize, in my view, our ambitions and the methods used to reach our goals:

Info4Dourou is an excellent example of what can be done within the frame of an Inter School Project, working with two labs of EPFL, EFLUM (hydrology) and LCAV (audiovisual communication) and two technical partners in Burkina Faso (2IE + PRCCU):

- First phase: a research project that enables innovative information and communication technologies for the management of the natural resources of the Dourou-Singou watershed and supports the local community in their natural resource management (funded by private foundations);

- Second phase (2012-2014): Application Phase 2.0 has had a core objective to develop a soil humidity management system, in favor of irrigation perimeters in the rural regions of Burkina Faso (with the support of SDC and the Velux Foundation);

- In the long-term, if our assumptions are fulfilled, farmers in Burkina Faso will be informed, in real time, of changing weather conditions and could adapt their irrigation system to rainfall, potentially saving up to 40% of water used for this purpose.

As for **RESCIF**, it is a Francophone Network of Excellence in the Engineering Sciences, founded at the Summit of the French-speaking community held in Montreux in September 2010, on the initiative of the Swiss Government. It comprises 14 technological universities from Europe, Canada, Haiti, Africa, the Middle East and Vietnam. In terms of its objectives and scope, it is focused on four priority areas:

- Creating an enduring partnership between "emerged" and "emerging" universities;
- Using the French-speaking culture as a tool for innovation in science and technology;
- Promoting international cooperation in four main sectors: water, nutrition and food security, energy and sustainable development;
- Fostering partnerships with the "Global Leaders University Forum" (GULF) and the "Agence universitaire de la Francophonie" (AUF) (Francophone University Agency).

To this end, four main lines of action are followed:

- Creation of two joint laboratories in the universities of the Ho Chi Minh City University of Technology, Vietnam (Asian Center of Research on Water, Care) and at the Ecole Nationale Supérieure Polytechnique of Yaoundé, Cameroon (Center of Research on Energy in Health, CURES);
- Setting-up joint educational programs and student exchanges;
- Developing partnerships with industry;
- Research cooperation with the University of Quisqueya of Port-au-Prince, Haiti.

It is a challenge, that of further advancing science, to increase its performance and adapt it to the needs of emerging and developing countries, by involving high-standard institutions from all continents that genuinely work together, with their own resources and the contributions of private and public sectors.

The final example, **EssentialTech**, is the most recent program launched by EPFL in order to foster the development of technologies which are most essential for development and can significantly promote and/or accelerate the reaching of one or several of the 8 Millennium Development Goals. It stems from collaboration with the EssentialMed Foundation, a partner of EPFL. We have adopted their principles and methods and shall extend them to all EPFL's key areas of focus.

The fundamental philosophy guiding the development of appropriate essential technology is the following:

- The technology or product must be affordable to acquire and maintain;
- The technology or product must be durable and sustainable;
- The technology or product must be adapted to the context;
- The technology or product must be scientifically sound.

All these examples show how EPFL envisions the future in a globalized society, in which our responsibilities, as scientists and more broadly as academic institutions, consist in producing knowledge, innovative technologies, and high-level graduates that are aware, adapted to global challenges as well as equipped to cooperate with our colleagues from the four corners of the world, especially where serious problems of survival, development and progress remain to be solved.

Conference Organizing Committee

HAZBOUN, Eileen
UNESCO Chair Coordinator

HOSTETTLER, Silvia
UNESCO Chair Conference Director

With the support of

BAUER, Nataly
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L a u s a n n e

A small city by comparison to many, Lausanne nevertheless prides itself on being one of the great cities of the world on more than one count. As the "Olympic Capital", a world centre of sports administration, a research and training centre of world renown, and a city that belie-ves firmly in sustainable and balanced growth, Lausanne wants to draw attention to its many assets for the benefits of both its inhabitants and its partners.

CITY OF KNOWLEDGE

City of Lausanne

www.lausanne.ch

Knowledge is essential to the dynamic development of the city. The higher education institutions constitute a key resource by the innovation they provide for business and industry, the youthful vigour they bring into the citylife and the international visibility they provide. Sustainable develop-ment, for example, is a major sphere of collaboration between the City of Lausanne and its academic partners.

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Program

DAY 1 – Wednesday 4 June 2014 – Afternoon

Time	Program / Details / Key Persons		Location
10:00 onwards	**Registration opens** **Welcome Coffee**		SwissTech
12:30-13:30	**Standing Lunch** **Poster Session**		*Level Garden* SwissTech
13:30-14:30	**Welcome Address** · Prof. Philippe Gillet, Ecole Polytechnique Fédérale de Lausanne · Dr. Jean-Bernard Münch, Swiss Commission for UNESCO		*Auditorium B Level Campus* SwissTech
	Keynote Address · Dr. Shashi Buluswar, LIGTT: LBNL Institute for Globally Transformative Technologies, Lawrence Berkeley National Lab, United States		
14:30-17:00 **15:45-16:15 Coffee Break**	**TH1-SE01-01 Habitat**	**Water and Sanitation Technologies for Sustainable Urban Development** · Dr. Christian Zurbrügg, Department of Water and Sanitation in Developing Countries (SANDEC), Eawag: Swiss Federal Institute of Aquatic Science and Technology, Switzerland · Dr. Hung Nguyen-Viet, Center for Public Health and Ecosystem Research (CENPHER), Hanoi School of Public Health, Vietnam	*Room 3C Level Garden* SwissTech
	TH2-SE02-01 DRR	**Developing Appropriate Contexts for Successful Deployment of Essential Technologies for Disaster Risk Reduction** · Ms. Marie-Valentine Florin, International Risk Governance Council (IRGC), Switzerland	*Room 4C Level Garden* SwissTech
	TH2-SE02-05 Energy	**Up-Scaling Sustainable Pro-Poor Energy Solutions: Addressing Stumbling Blocks** · Dr. Albrecht Ehrensperger, Centre for Development and Environment, University of Bern, Switzerland · Dr. Lucy Stevens, Practical Action, United Kingdom	*Room 5C Level Garden* SwissTech
	TH2-SE02-11 ICT	**The Openness Paradigm: How Synergies Between Open Access, Open Data, Open Science, Open Source Hardware, Open Drug Discovery Approaches Support Development?** · Dr. Sachiko Hirosue, School of Life Sciences, Ecole Polytechnique Fédérale de Lausanne, Switzerland · Dr. Denisa Kera, National University of Singapore	*Room 1A Level Garden* SwissTech
	TH2-SE02-17 Medical	**Appropriate Medical Devices: From Lab to Bedside in Resource-Constrained Contexts** · Dr. Klaus Schönenberger, EssentialTech Programme, Cooperation & Development Center, Ecole Polytechnique Fédérale de Lausanne, Switzerland	*Room 1C Level Garden* SwissTech
	TH3-SE03-05 Special Sess.	**Development Engineering: A Unified Approach to Tech4Dev** · Dr. Temina Madon, Development Impact Lab, University of California Berkeley, United States	*Room 2C Level Garden* SwissTech
17:00-18:00	**Welcome Aperitif** · Prof. Laurent Goetschel, University of Basel, Switzerland · Dr. Christian Zurbrügg, SANDEC, Eawag, Switzerland		*Auditorium B Level Campus* SwissTech
	Event hosted by the Commission for Research Partnerships with Developing Countries (KFPE), Switzerland		*Hall* SwissTech

Note: "BREAKOUT SESSIONS" appears vertically spanning the breakout session rows (14:30-17:00 block).

DAY 2 – Thursday 5 June 2014 – Morning

Time	Program / Details / Key Persons		Location
08:30 onwards	**Walk-in Registration** **Welcome Coffee**		SwissTech
09:00-10:00	**Return of Sessions Day 1**		*Auditorium B Level Campus* SwissTech
	Keynote Address · Dr. Jean-Yves Pidoux, City of Lausanne · Prof. Karen Scrivener, Laboratory of Construction Materials, Ecole Polytechnique Fédérale de Lausanne		
10:00-10:30	**Coffee Break**		*Level Garden*
BREAKOUT SESSIONS **10:30-12:30**	TH2-SE02-06 Energy	**What are the Techno-socio-economic Aspects that are Influencing the Success of the Development, Implementation, Maintenance and Spreading of Appropriate Technologies for Access to Energy ?** · Mr. Bertrand Klaiber, Cooperation & Development Center, Ecole Polytechnique Fédérale de Lausanne, Switzerland	*Room 1C Level Garden* SwissTech
	TH2-SE02-07 Habitat	**Community-Driven Innovation: Communicating Living Labs Essentials in the Developing World** · Ms. Tunde Kallai, Prolog GmbH, Switzerland, European Network of Living Labs (ENoLL) · Mr. Konte Papa Amadou, Dakar City Municipality, Senegal	*Room 2C Level Garden* SwissTech
	TH2-SE02-13-a ICT	**How can we Co-design Technologies with (and not for) Vulnerable and Poor Communities?** · Dr. Andrés Felipe Valderrama Pineda, Aalborg University, Denmark · Dr. Maria Catalina Ramírez, Universidad de los Andes, Colombia	*Room 3C Level Garden* SwissTech
	TH2-SE02-14 Medical	**Technology in Global Health: Exploring New Paradigms** · Dr. Leo Anthony Celi, Harvard Medical Institute, Massachusetts Institute of Technology, United States · Dr. Vipan Nikore, Cleveland Clinic Foundation, United States	*Room 5C Level Garden* SwissTech
	TH3-SE03-02 ICT	**Tools and Techniques for Measuring Technology Impact: From Wireless Sensors to Experimental Field Trials** · Prof. Ashok Gadgil, Lawrence Berkeley National Lab, University of California Berkeley, United States	*Room 4C Level Garden* SwissTech
12:30-13:30	**Standing Lunch** **Poster Session**		*Level Garden* SwissTech
13:30-14:00	**Introduction to the Terraced Vineyards of Lavaux** Mr. Emmanuel Estoppey, Lavaux UNESCO World Heritage Site		*Auditorium B Level Campus* SwissTech
14:00-14:30	**Departure of the Busses from the SwissTech Convention Centre to 5 sites in Lavaux where the breakout sessions will be hosted** *Note: Staff in red T-shirts holding a sign with the session name will be available to guide you to the right bus. Please be sure that you get on the right bus of the session that you wish to attend! Your conference badge should be worn at all times.*		*Level Garden* SwissTech

DAY 2 – Thursday 5 June 2014 – Afternoon

Time	Program / Details / Key Persons	Location
BREAKOUT SESSIONS		
14:30-16:30	**TH1-SE01-02 Habitat** — **What Technologies are Essential for Megacities of the Future to be Sustainable?** ・Dr. Justin Bishop, Department of Engineering, University of Cambridge, United Kingdom	
	TH2-SE02-02 DRR — **Politics, Society and Technology Integration: How Does Policy Making Affect Governmental and Local Use of ICTs for Disaster Risk Reduction?** ・Dr. Paula Lytle, The World Bank, United States ・Mr. Charles Martin-Shields, Ministry of Communications and Information Technology, Independent Samoa	
	TH2-SE02-03 ENERGY — **Up-Scaling and Mainstreaming Renewable Energy Technologies for Energy Security, Climate Change and Economic Development** ・Dr. Pankaj Agarwal, Panitek AG, Liechtenstein ・Dr. Kinsuk Mitra, InsPIRE Network for Environment, India	
	TH2-SE02-15 Medical — **Facilitating and Stimulating Inclusive Design and Innovation** ・Prof. Prabhu Kandachar, Faculty of Industrial Design Engineering, Delft University of Technology, Netherlands	
	TH3-SE03-04 ICT — **Sustainable Development of Technology Solutions in Emerging Countries: Case Studies** ・Ms. Jennifer Brant, Innovation Insights, Switzerland	Breakout Sessions: Aaran, Grandvaux, Cully, Chexbres, Rivaz Visit Wine Cellars & Cocktail Reception: Epesses LAVAUX – UNESWORLD HERITAGE SITE
16:30-17:00	**Guided Tour of the Lavaux Region** *Guides from the UNESCO World Heritage Site will oversee and accompany the 5 groups to give further details on Lavaux's history, wealth and heritage*	
	Group 1 – From Aran to Epesses => Tourist Train Lavaux Express Group 2 – From Grandvaux to Epesses => Tourist Train Lavaux Express Group 3 – From Cully to Epesses => On foot Group 4 – From Chexbres to Epesses => Tourist Train Lavaux Panoramic Group 5 – From Rivaz to Epesses => Train CFF	

16:30	**Departure of the Bus from the SwissTech Convention Centre for the Cocktail Reception in Epesses** *(for those not attending the breakout sessions in the afternoon)*	*Level Garden* SwissTech

From 17:00	**Visit of the Wine Cellars in Epesses (Lavaux)** **Cocktail Reception – Mix & Mingle**	*Epesses*
19:47 or 20:47	**Return by Train to Lausanne Main Station**	

DAY 3 – Friday 6 June 2014 – Morning

Time	Program / Details / Key Persons		Location
08:30 onwards	**Walk-in Registration** **Welcome Coffee**		SwissTech
09:00-10:00	**Return of Sessions Day 2**		*Auditorium B Level Campus* SwissTech
	Keynote Address · Dr. Anil Sethi, Swiss Extension GmbH		
10:00-10:30	**Coffee Break**		*Level Garden* SwissTech
10:30-12:30	**TH1-SE01-03 Energy**	**Identifying Opportunities and Constraints for Women in the Renewable Energy Sector** · Dr. Bipasha Baruah, Department of Women's Studies and Feminist Research, University of Western Ontario, Canada · Dr. Mini Govindan, Social Transformation Division, The Energy and Resource Institute (TERI), India	*Room 2C Level Garden* SwissTech
10:30-12:30	**TH2-SE02-08 Habitat**	**Implementing Living Labs Concepts to Strengthen the Innovation Ecosystem for Social Innovation in Rural Areas and Cities** · Dr. Hans Schaffers, Center of Knowledge and Innovation Research (CKIR), Aalto University, Finland	*Room 3C Level Garden* SwissTech
10:30-12:30	**TH2-SE02-10 ICT**	**Low-Cost, High-Tech and Crowd-Sourced Solutions for Better Water Management – Opportunities and Challenges** · Dr. Tobias Siegfried, hydrosolutions Ltd., Switzerland · Mr. François Münger, Corporate Domain Global Cooperation, Swiss Agency for Development and Cooperation (SDC), Switzerland	*Room 5C Level Garden* SwissTech
10:30-12:30	**TH2-SE02-13-b ICT**	**How can we Co-design Technologies with (and not for) Vulnerable and Poor Communities?** · Dr. Andrés Felipe Valderrama Pineda, Aalborg University, Denmark · Dr. Maria Catalina Ramirez, Universidad de los Andes, Colombia	*Room 1C Level Garden* SwissTech
10:30-12:30	**TH2-SE02-16 MEDICAL**	**Strategies for the Successful Implementation of Mobile Health (mHealth) in Low-Resource Settings** · Dr. Walter Karlen, Stellenbosch University, South Africa and University of British Columbia, Canada	*Room 4C Level Garden* SwissTech
10:30-12:30 *	**Water Hackathon & Workshop**	**Water Hackathon: Open Source Technologies for Rivers, Oceans and Lakes** · Ms. Gabriela Levine, Interactive Telecommunications Program Tisch School of the Arts, United States · Mr. Nur Akbar Arofatullah, Gadjah Mada University, Indonesia	*Room 3A Level Garden* SwissTech
12:30-13:30	**Standing Lunch** **Poster Session**		*Level Garden* SwissTech

The leftmost column is labeled vertically **BREAKOUT SESSIONS** spanning the 10:30-12:30 rows.

* The Water Hackathon starts at 10:30 am and continues in the afternoon until 15:00.

DAY 3 – Friday 6 June 2014 – Afternoon

	Time		Program / Details / Key Persons	Location
BREAKOUT SESSIONS	**13:30-15:15**	TH2-SE02-04 Energy	**Catalyzing Innovation through Targeted Scientific Training and Capacity Building** • Prof. Federico Rosei, UNESCO Chair in Materials and Technologies for Energy Conversion, Saving and Storage, Institut National de la Recherche Scientifique (INRS), University of Quebec, Canada	*Room 1C* *Level Garden* SwissTech
	13:30-15:00	TH2-SE02-09 ICT	**Low Cost Data Communications for Sustainable and Environment Sound Development** • Prof. Ermanno Pietrosemoli, Abdus Salam International Centre for Theoretical Physics, Italy and Fundacíon "EsLaRed", Venezuela	*Room 3C* *Level Garden* SwissTech
	13:30:15:00	TH2-SE02-18 MEDICAL	**Medical Devices for the Base of the Pyramid: Where are they?** • Mr. Zach Friedman, LIGTT: Institute for Globally Transformative Technologies, Lawrence Berkeley National Lab, University of California Berkeley, United States	*Room 5C* *Level Garden* SwissTech
	13:30-15:00 *	Water Hackathon & Workshop	**Water Hackathon: Open Source Technologies for Rivers, Oceans and Lakes** (Cont.) • Ms. Gabriela Levine, Interactive Telecommunications Program Tisch School of the Arts, United States • Mr. Nur Akbar Arofatullah, Gadjah Mada University, Indonesia	*Room 3A* *Level Garden* SwissTech
15:00-15:30			**Coffee Break**	*Level Garden* SwissTech
15:30-17:00			**Return of Sessions Day 3** **Wrap-up and Closing** • Dr. Silvia Hostettler, Cooperation & Development Center, Ecole Polytechnique Fédérale de Lausanne, Switzerland	*Auditorium B* *Level Campus* SwissTech

* The Water Hackathon starts at 10:30 am and continues in the afternoon until 15:00.

Scientific Committee

Pankaj Agarwal
Panitek AG, Liechtenstein

Pankaj Agarwal is a cleantech entrepreneur with over 20 years' experience in financing, business development and commercialization of renewable energy technologies with a focus on emerging markets. Pankaj has worked as a research scientist at the Ecole Polytechnique Fédérale de Lausanne, Switzerland. He holds a PhD from the University of Florida, Gainesville and an MBA from the Rotterdam School of Management. He has a Bachelor's Degree in Chemical Engineering from the IIT, Kanpur, India. He heads a renewable energy financing advisory based in Liechtenstein and India.

Bipasha Baruah
Department of Women's Studies and Feminist Research, University of Western Ontario, Canada

Bipasha Baruah holds the Canada Research Chair in Global Women's Issues at Western University in Canada. She specializes in gender and development; gender and globalization; women and work; and social, political and economic inequality. Dr. Baruah's publications appear in World Development, Development in Practice, Progress in Development Studies, Canadian Journal of Development Studies, Labor Studies as well as other journals and anthologies. Her 2010 book Women and Property in Urban India was published by the University of British Columbia Press. She also has 10 years of non-academic professional experience in international development.

Justin Bishop
Department of Engineering, University of Cambridge, United Kingdom

Justin Bishop is a Research Associate in Transport Analysis in the Energy Efficient Cities Initiative of the University of Cambridge, Department of Engineering. Previously he was James Martin Research Fellow in the Oxford Martin School Institute for Carbon and Energy Reduction in Transport at the University of Oxford. His research interests include electric power generation, transport and the built environment.

Jennifer Brant
Innovation Insight, Switzerland

Jennifer Brant, a principal of the consulting firm Mercator XXI, provides policy analysis and strategic advice to companies, NGOs, and inter-governmental organizations on global market access and regulatory issues, notably in the areas of innovation, technology, intellectual property, and trade. She is the Director of Innovation Insights, a cross-sectoral initiative aimed at sharing business perspectives on innovation and technology diffusion with policy-makers and other stakeholders. Jennifer has advanced degrees in International Development, and Economics and International Law.

Leo Anthony Celi
Massachusetts Institute of Technology, United States

Dr. Celi has practiced medicine in 3 continents, giving him broad perspectives in healthcare delivery. In addition, he pursued master's degrees in biomedical informatics at MIT and in public health at Harvard. He founded and directs Sana (sana.mit.edu) and currently leads the research at the Laboratory of Computational Physiology, both at MIT. Finally, he is one of the course directors for HST.936 - health information systems to improve quality of care in resource-poor settings.

Albrecht Ehrensperger
Centre for Development and Environment
University of Bern, Switzerland

Albrecht Ehrensperger is Head of the Cluster Innovation for Sustainable Development at CDE. He was coordinator of the ERA-ARD research project on Bioenergy in Africa (2009-2012) and currently coordinates the Eastern and Southern Africa Partnership Programme. Recently, the R4D research proposal on Knowledge Support for Sustainable Renewable Energy Policies in Eastern Africa that he and partners in Switzerland and Africa submitted to the SNF has been approved. He is a geographer and received his PhD from the University of Bern.

Marie-Valentine Florin
International Risk Governance Council, Switzerland

Marie-Valentine Florin spent the first part of her career in an international socio-cultural research and marketing consulting firm. Before joining IRGC in 2006, she was advising local authorities on strategies and practices for sustainable development and was involved in philanthropic and humanitarian organizations. Marie-Valentine Florin graduated from Science Po in Paris (Political Science and Public Administration), and then earned a post-graduate diploma in marketing strategy from the same institute. She later studied sustainable development and environmental diplomacy at University of Geneva.

Zach Friedman
LIGTT: Institute for Globally Transformative Technologies,
Lawrence Berkeley National Laboratory, United States

Zach is a Program Director at LIGTT and is interested in the potential of technologies to lead growth in Sub-Saharan Africa. Prior to LIGTT, Zach worked in East Africa, helping local NGOs and government ministries develop and launch entrepreneurship-training programs for youth in rural areas. Zach also worked with and continues to serve as an advisor for Kenyan mobile payments startup Kopo Kopo. Zach has also worked in Argentina, Chile and Mexico. Prior to his international work, Zach was a consultant in Deloitte's Strategy and Operations practice where he focused on telecommunications, healthcare, and consumer goods companies. Zach received an MBA from the Haas School of Business at the University of California, Berkeley, and holds a BA in economics from Washington University in St. Louis.

Ashok Gadgil

Lawrence Berkeley National Laboratory
*University of California Berkeley, United States*

Dr. Gadgil is the Rudd Family Foundation Distinguished Chair Professor of Safe Water and Sanitation, in Civil and Environmental Engineering at UC Berkeley, and Director of the Environmental Energy Technologies Division at Lawrence Berkeley National Laboratory. He has a distinguished record of inventions and innovations, and received many honors, awards and recognition including the Sustainability Pioneer Award by SAG/SAM (2010), European Inventor Award (2011), Zayed Award (2012), Lemelson-MIT Global Innovator Award (2012), and the PSIPW Award (2013) among others.

Mini Govindan

Social Transformation Division
The Energy and Resources Institute, India

Dr. Mini Govindan is a research fellow at the Social Transformation Division of The Energy and Resources Institute (TERI) in New Delhi, India. She earned her PhD in Development Studies in 2007 from the Institute for Social and Economic Change in Bangalore. She specializes in gender analysis and social impact assessment of water and energy policy. She has consulted extensively for the Indian government and international organizations such as UN Women, UNDP, World Bank, DANIDA, SDC, IUCN and DFID.
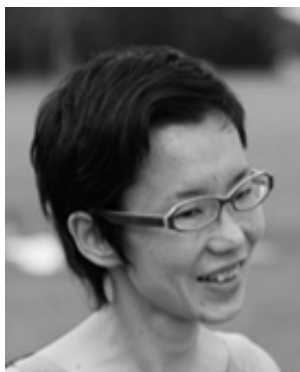
Sachiko Hirosue

School of Life Sciences. Ecole Polytechnique
Fédérale de Lausanne, Switzerland

Sachiko Hirosue works as a researcher at the interface of biomaterials and lymphatic physiology in the Institute of Bioengineering, School of Life Sciences at EPFL. Her interests in bioart derive from the encounter at the Subtle Technologies Festival (Toronto, Canada), which she co-chaired from 2005-2008. At EPFL, she heads the international collaborative student research project BIO-DESIGN for the REAL WORLD, bringing a bit of DIY culture in academia.

Silvia Hostettler

Cooperation & Development Center, Ecole Polytechnique
Fédérale de Lausanne

Silvia Hostettler has a background in environmental science and development studies. From 2008 to 2012 she was based in Bangalore, India as Executive Director of swissnex, a Swiss House for Science. Since 2012, she is Deputy Director of the Cooperation and Development Center (CODEV) at EPFL where she is responsible for coordinating research activities and for the UNESCO Chair in Technologies for Development Conference. She is also in charge of postgraduate education offered by CODEV and gives lectures in the field of cooperation and development. Her research interests include migration, livelihood strategies, technologies for development, watershed management, land use change and tropical forest ecology.

Tunde Kallai
Prolog GmbH, Switzerland, Founder of the
European Network of Living Labs (ENoLL)

Tunde Kallai is a Senior Expert on research and open innovation on "smart cities" and living labs related models, concepts, strategies and applications. She has been involved as a project evaluator for EU research and innovation projects since 2003 and is a registered independent expert by DG INFSO & Media since 2002 in different size of projects (IPs, SSAs, Craft, STREP). Ms. Kallai assisted and initiated the set-up of 12 Living Labs in Hungary, Malta, Switzerland, Saudi Arabia, Turkey and Senegal (2006-2012).

Prabhu Kandachar
Faculty of Industrial Design Engineering,
Delft University of Technology, The Netherlands

Prabhu Kandachar is extensively involved in designing and prototyping products and services for the Base-of-the-Pyramid (BoP). With inclusive innovation as principle, he has covered several issues such as drinking water, energy, housing, etc., in various developing countries. He has also directed research work on healthcare issues of the poor in developing countries, including on rural China. He has given several keynote lectures, has organized an international conference, edited a book and a special issue of a journal on this topic.

Walter Karlen
Stellenbosch University, South Africa &
University of British Columbia, Canada

Walter Karlen earned a M.Sc. degree in micro-engineering and a Ph.D. in Computer, Communication and Information Sciences from EPFL. He is currently a post-doctoral researcher at the Electrical and Computer Engineering in Medicine research group at the University of British Columbia in Vancouver, Canada and at the Biomedical Engineering Research Group at the University of Stellenbosch. Dr. Karlen holds an Advanced Researcher Fellowship from the Swiss National Science Foundation and is an awardee of the Rising Stars in Global Health program of Grand Challenges Canada. Dr. Karlen's aim is to increase the ability to diagnose, monitor and treat major global health burdens by developing personalized methods, devices and efficient systems that can be used at the point-of-care. His current research projects include the implementation of biomedical sensors on mobile phones for global health applications and decision support systems.

Denisa Kera
National University of Singapore

Denisa Kera is an Assistant Professor at the National University of Singapore. Her present research brings together history of science, philosophy and design, and combines issues and methodologies from Science Technology Society studies and interactive media design. She tries to create design probes and tools for deliberation and public participation in science. She follows and supports science community labs and alternative R&D places across the world with a special focus on DIYbio movements, consumer genomics and various citizen science projects.

Bertrand Klaiber
Cooperation & Development Center, Ecole Polytechnique Fédérale de Lausanne, Switzerland

Bertrand Klaiber holds a Master's degree in Electrical Engineering from EPFL and an MBA from the University of Lausanne. He worked for 15+ years in industrial firms, from Electronics Engineer at Motorola, Project Manager at Logitech, to Strategy and Marketing Manager at LEM, an international leader in electrical measurement products. In 2010, he was promoted Worldwide Business Development Manager for Energy Solutions at LEM. In 2012, he launched the EssentialTech program at EPFL, including the University Research Centre on Energy for Health Care in Cameroon and the development of appropriate technologies such as an innovative power supply for x-ray medical devices.

Papa Amadou Konte
Dakar City Municipality, Senegal

Mr. Konte Papa Amadou pursued his secondary education at the Military School of Saint-Louis. After obtaining his Bachelor, he professionalized in the business of IT since 1986. Since then combining higher education (Senegal, Israel, Belgium), international seminars (WSIS/Tunis, UNGAID/New York) and business travels (Geneva, Washington DC), he was/is still involved in the ICT sector acting and serving not only in Senegal but the African continent. Currently he runs every Sunday a broadcast entitled "ICT and Development" at the Pan-African Convergence in Radio FM 103.9 in Dakar.

Paula Lytle
The World Bank, United States

Dr. Lytle is currently working in the Africa region, including on projects and analytical work on climate-change and adaptability/resilience. She has introduced the use of simple GPS devices into 900 person surveys in Liberia and Burundi, has piloted use of ICT-enabled social feedback mechanisms in Botswana and Ghana, and has supported the work on measuring and modeling the vulnerability of urban poor in Mozambique to climate change risks. Her Ph.D. is from Yale; she has worked extensively in the Balkan.

Temina Madon
Center for Effective Global Action University of California Berkeley, United States

Temina Madon directs the Center for Effective Global Action (CEGA), a research network headquartered at the University of California, Berkeley that designs and tests policies, programs, and technologies for economic development. In this role she also co-directs the Development Impact Lab, a USAID-funded academic initiative bringing science and engineering innovation to global development. She has been an advisor to the World Health Organization and has held positions in science policy at the Fogarty International Center, National Institutes of Health (NIH) and the U.S. Senate Committee on Health, Education, Labor and Pensions, where she served as a AAAS Science and Technology Policy fellow. She holds a PhD in health sciences from UC Berkeley and an SB in engineering from MIT.

Charles Martin-Shields
Ministry of Communications and Information Technology, Independent Samoa

Charles Martin-Shields is currently serving as a Fulbright-Clinton Fellow in Samoa's Ministry of Communications. In this role, he is advising on technology and communication policy for disaster risk reduction, and doing research on how Samoans in rural areas gather and share information locally about natural disaster response and preparedness. He is currently completing his Ph.D. at George Mason University (Virginia, USA); his research focuses on the political economy of using ICTs in crisis response.

Kinsuk Mitra
InsPIRE Network for Environment, India

Kinsuk Mitra is a natural resource economist. After completing his PhD from the Food and Resource Economics Department at the University of Florida in 1995, he has worked in the development sector on issues ranging from resource management, renewable energy applications and climate change mitigation and adaptation. Dr Mitra manages several initiatives of the Indian government as well as externally aided projects in India and the region. He heads a not-for-profit think tank based in New Delhi.

François Münger
Corporate Domain Global Cooperation
SDC - Swiss Agency for Development and Cooperation

François Münger, is the head of the global Water Initiatives Division of the Swiss Agency for Development and Cooperation (SDC), based in Bern, Switzerland. He holds masters in mineralogy and geophysics (Uni Lausanne), master in hydrogeology (Uni Neuchatel) and European Master in environmental engineering (with specialization in biotechnologies) (EPFL), as well as a post-graduate certificate in geological hazards (Uni Geneva). He is a senior expert in water management as well as in water, sanitation and environmental issues. He has worked previously as a scientific researcher for the Swiss Federal Institute of Technology of Lausanne (EPFL) in charge of an international project of energy storage in aquifers, as manager in a project of dams for agriculture and deep boreholes in Africa, as chief of SDC water Program in Central America and as a senior water specialist in the World Bank (based in Washington and West Africa).

Hung Nguyen-Viet
Center for Public Health and Ecosystem Research (CENPHER), Hanoi School of Public Health, Vietnam

Dr. Nguyen is the lead researcher of The Center for Public Health and Ecosystem Research (CENPHER) at Hanoi School of Public Health (HSPH), which conducts and strengthens interdisciplinary research. His activities focus on three main pillars - Research, Training and Services - to develop links between technologies, health risk and environmental impact at the national and regional level.

Vipan Nikore
Cleveland Clinic Foundation, United States

Dr. Nikore is a physician, software developer, and social entrepreneur. He is a physician at Cleveland Clinic and founder of uFLOW, an NGO empowering low-income youth to develop service projects to solve community problems. He has led projects at IBM, Sun Microsystems, Citibank, UCLA, WHO, UNICEF, and the Ontario Ministry of Health. He volunteers with Sana and worked clinically in Ghana, Peru, India, and Nepal. He completed his residency at Cleveland Clinic, MD at University of Illinois-Chicago, MBA at Yale, and BSc-Computer Science at Western Ontario.

Ermanno Pietrosemoli
Abdus Salam International Centre for Theoretical Physics, Italy & Fundación "EsLaRed", Venezuela

Ermanno is a researcher at the Telecommunications/ICT for Development Lab of the ICTP in Trieste, Italy, and President of Fundación "EsLaRed", a non-profit organization that promotes ICT in Latin America through training and development projects. Ermanno has been deploying wireless data communication networks focusing on low cost technology, and has participated in the planning and building of wireless data networks in Argentina, Colombia, Ecuador, Italy, Lesotho, Malawi, Mexico, Morocco, Nicaragua, Peru, Spain, Trinidad, Uruguay, USA, Venezuela and Zambia.

María Catalina Ramírez
Universidad de los Andes, Colombia

María Catalina Ramirez is an Associate Professor at the Engineering School of the Universidad de los Andes, Bogotá, Colombia. She is an Industrial Engineer, BSc and MSc. She obtained her PhD from Milano's Polytechnic. Founder and Director of Ingenieros Sin Fronteras Colombia since 2009. During her lifetime as a researcher and consultant, she has taken part in different projects. The main subjects of these projects include Engineering without Borders (http://isfcolombia.uniandes.edu.co/), public administration, active learning engineering, performance systems, incentive systems, engineering innovation and effectiveness teamwork. She is part of the Steering Committee of REEN – Research Engineering Education Network from 2010 and ALE Active Learning Engineering from 2001.

Federico Rosei
UNESCO Chair in Materials and Technologies for Energy Conversion, Saving and Storage, Institut National de la Recherche Scientifique, University of Quebec, Canada

Prof. Rosei is the holder of the newly established UNESCO Chair in Materials and Technologies for Energy Conversion, Saving and Storage, Director and Professor. He is a physicist with wide-ranging interests that bridge from fundamental studies of surfaces and interfaces to novel functional oxide photovoltaics and dye-sensitized solar cells. He has published over 160 papers in refereed journals and delivered more than 150 invited talks at international conferences. Since 2011, he has been the Director of INRS-EMT.

Hans Schaffers

Centre of Knowledge and Innovation Research,
Aalto University, Finland

Visiting professor at Aalto University and managing director of Adventure Research. Formerly: research manager at Telematica Instituut, senior policy expert at TNO Policy Studies, and assistant professor at Erasmus University Rotterdam. Key areas of experience and expertise: technology foresight, policy studies, Future Internet, Smart Cities, living labs innovation, innovation ecosystems, urban and regional development, social innovation. Has been coordinator of living labs activities in the Collaboration@Rural integrated project under FP6: Living Labs in rural areas, including South Africa. Chief Editor of the book "Living Labs and Rural Development" (2010). Recently and currently project coordinator of smart city, living labs and future internet projects. In the past, involved at UNIDO Technology Foresight activities in South-America. Has worked on social cost-benefit methods for evaluating technology options in developing countries.

Klaus Schönenberger

EssentialTech Programme,
Cooperation & Development Center,
Ecole Polytechnique Fédérale de Lausanne, Switzerland

Klaus Schönenberger obtained a PhD (1996) from EPFL on medical technology. After a post-doc at Lawrence Livermore National Laboratory, he spent over 10 years working in the medical devices industry in leading positions. His last appointment was as Global Vice-Resident of Research and Technology in a company with a turnover of $1bn. In 2010, he started EssentialMed, an innovative non-profit venture, which he is now leading as CEO. In 2011, he joined EPFL to launch EssentialTech, a program directed at developing technologies and business models to fight poverty.

Tobias Siegried

hydrosolutions Ltd., Switzerland

Tobias Siegfried obtained an MSc degree in Environmental Physics at the Swiss Federal Institute of Technology and an MSc degree in International Relations from the London School of Economics and Political Sciences. He carried out his PhD at the Institute of Environmental Engineering at the Swiss Federal Institute of Technology. During this time, he was developing optimal allocation and sharing mechanisms for transboundary groundwater resources. These were applied to the problem of non-cooperative groundwater use in Northern Africa. Siegfried spent 5 years teaching and doing research at the Earth Institute at Columbia University in the City of New York. Siegfried's work is interdisciplinary, with strong ties to academia, the private sector and governments in the corresponding regions of interest. He has extensive work experience in Sub-Saharan Africa, the Middle East and Northern Africa region, India, Central Asia, the United States of America and in Europe. He publishes his scientific work in leading journals of the respective fields.

Lucy Stevens
Practical Action, United Kingdom

Dr. Lucy Stevens is Senior Policy and Practice Adviser for Practical Action, where she has worked for the last 12 years. Practical Action has been involved in implementing energy projects across Africa, Asia and Latin America over more than 30 years. These have covered a range of types of energy supplies and services including extensive work on mini-grids from micro-hydro and wind, household electricity, and cooking solutions. We have become widely known for our publication of the Poor People's Energy Outlook, and as one of the few NGOs actively engaging in the SE4ALL initiative at the international level. Practical Action has been part of the working group together with the World Bank working on the Global Tracking Framework, inputting our ideas around Total Energy Access. As well as working on energy access issues, Lucy has a particular interest in urban poverty. She was educated at Oxford and Sussex Universities, with a doctorate from the School of Geography and the Environment, Oxford University.

Andrés Felipe Valderrama Pineda
Aalborg University, Denmark

Andrés Valderrama is a postdoc at the Center for Design and Innovation for Sustainable Transitions at University of Aalborg, Copenhagen Campus, Denmark. His research is in Design with People, Engineering Education and Sustainable Transitions. He teaches in the engineering masters programs Sustainable Design and Sustainable Cities. He coordinates the PhD course Theories of Sustainable Transitions. He is a regular visiting scholar at Universidad de los Andes in Colombia and at the Colorado School of Mines in the United States. He is the co-founder of Ingenieros Sin Fronteras Colombia and member of the coordinating committee of Engineering for Social Justice and Peace.

Christian Zurbrügg
Department of Water and Sanitation in Developing Countries, Eawag: Swiss Federal Institute of Aquatic Science and Technology, Switzerland

Dr. Christian Zurbrügg heads the Department of Water and Sanitation in Developing Countries (Sandec) at Eawag. He has been conducting applied research on waste treatment technologies for the last 15 years. All this research has taken place in the countries of concern and Switzerland. He is author of many scientific papers on organic waste recycling and books on composting, market development and research and microbial risks.

Speakers

## Welcome Address – DAY 1 – Wednesday 4 June 2014

Philippe Gillet
Vice-Presidency for Academic Affairs

Philippe Gillet completed his undergraduate studies in Earth Science at Ecole normale supérieure de la rue d'Ulm (Paris). In 1983 he obtained a PhD in Geophysics at Université de Paris VII and joined Université de Rennes I as an assistant. Having obtained a State Doctorate in 1988, he became a Professor at this same university, which he left in 1992 to join Ecole normale supérieure de Lyon.

Philippe Gillet is also active in science and education management. He was the Director of the CNRS Institut National des Sciences de l'Univers (France), the President of the French synchrotron facility SOLEIL and of the French National Research Agency (2007), and the Director of Ecole normale supérieure de Lyon. Before joining EPFL he was the Chief of Staff of the French Minister of Higher Education and Research.

Keynote Address – DAY 1 – Wednesday 4 June 2014

The Role of UNESCO for Development and Sustainability: The Potential of Science and Education
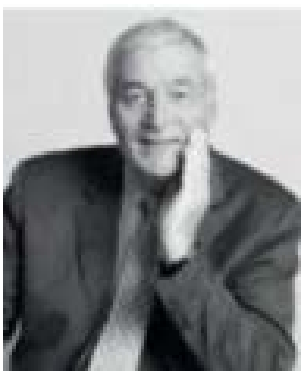
Jean-Bernard Münch
Swiss Commission for UNESCO

An international consultant, Jean-Bernard Münch has worked in the field of broadcasting all his life. He obtained a PhD in political sciences from the Institut Universitaire de Hautes Etudes Internationales in Geneva. He then studied financial management at Oxford and St-Gallen.

He started at the SRG SSR (Swiss Radio and Television) in 1969 as assistant to the director of the Télévision Suisse Romande. He rose within the ranks to become director of finances and management in 1981. From 1990 until 2002, he was the General Secretary of the European Broadcasting Union, an association of national broadcasters. Appointed president of the SRG SSR in 2002, he occupied that position until 2011. Since January 2012, he is the president of the Swiss Commission for UNESCO.

Jean-Bernard Münch defends broadcasting in a highly competitive market. He has advised many organizations, amongst others in central and eastern Europe, as well as in Africa. He also represents the Eurosport Consortium. He has always committed himself to ensuring a strong cultural offer in the media and to promoting cultural diversity, as much at the national as international levels.

Keynote Address – DAY 1 – Wednesday 4 June 2014

The 50 Most Transformative Technological Breakthroughs Required for Sustainable Global Development

Shashi Buluswar
LIGTT: Institute for Globally Transformative Technologies, Lawrence Berkeley National Laboratory, United States

Shashi Buluswar is the founder and Executive Director of LIGTT, the Institute for Globally Transformative Technologies, at the Lawrence Berkeley National Lab (LBNL) in California, USA. LIGTT was launched in 2012; its mission is to bring scientific and technological breakthroughs to address global poverty and related social ills, through advanced research, robust and user-centric product engineering, sustainable business models, and a broad global network of partnerships. In its first year, LIGTT has developed the world's first portable solar-powered vaccine refrigerator, an ultra-low-cost infant incubator, an early version of a low-cost DNA-based diagnostic device for TB, and an early version of a low-cost technology to remotely detect groundwater. Shashi and his colleagues at LIGTT are authoring "The 50 most transformative scientific and technological breakthroughs needed for sustainable global development", a comprehensive look at a broad range of problem in global development, and what kinds of breakthrough technologies are required to address them; this study will be published in early 2014.

Prior to joining LIGTT, he was a Partner at Dalberg Global Development Advisors, a mission-driven strategy consulting firm which serves a broad spectrum of clients in international development such as NGOs, corporations, foundations, governments, social entrepreneurs, and international agencies like the UN. At Dalberg, Shashi work included helping the Gates Foundation launch and manage large-scale agriculture programs in Africa, helping the US Government reshape its agricultural development strategy in Afghanistan, developing the global strategy for an international NGO that provides entrepreneurship training to youth, assessing the impact of a large city-level climate change initiative in China, helping the UN's Department of Peacekeeping develop a plan to restructure its global support operations, and helping several corporations create innovative strategies for social responsibility, double-bottom-line supply chain management, and emerging markets entry.

Prior to joining Dalberg, Shashi was an Associate Partner at McKinsey & Company, and a Visiting Professor at Northwestern University. He holds a PhD from the University of Massachusetts in Robotics, and an MBA from Northwestern University's Kellogg School of Management. Beyond his professional interests, Shashi spent a decade competing on the Indian national rowing team, and recently made a critically acclaimed documentary film about the India-Pakistan conflict (which has been featured on National Public Radio, Al Jazeera and several international film festivals). He also teaches international development at the University of California at Berkeley, and is authoring a textbook on strategic approaches to global social impact. Shashi was born and raised in India, and has traveled to more than 70 countries.

Keynote Address – DAY 2 – Thursday 5 June 2014

A Promising Essential Technology Travelling from Cuba to India via Switzerland: The Case of the Low Carbon Cement (LCC) Project

Karen Scrivener
Laboratory of Construction Materials
Ecole Polytechnique Fédérale de Lausanne, Switzerland

Karen Scrivener graduated from the University of Cambridge in 1979 in Materials Science. She went on to do a PhD on "The Microstructural Development during the Hydration of Portland Cement" at Imperial College, remaining there until 1995 as Royal Society Research Fellow and then lecturer. In 1995, she joined the Central Research Laboratories of Lafarge near Lyon in France.

In March 2001, she was appointed as Professor and Head of the Laboratory of Construction Materials, Department of Materials at the Ecole Polytechnique Fédérale de Lausanne in Switzerland. The work of this laboratory is focused on improving the sustainability of cementitious building materials.

She is the founder and coordinator of Nanocem, a Network of industry and academia for fundamental research on cementitious materials and Editor in Chief of Cement and Concrete Research, the leading academic journal in the field.

She is President of the EPFL-WISH foundation, which seeks to promote the careers of women scientists connected to EPFL.

Keynote Address – DAY 2 – Thursday 5 June 2014

Lausanne: Energy Policy as a Public Policy
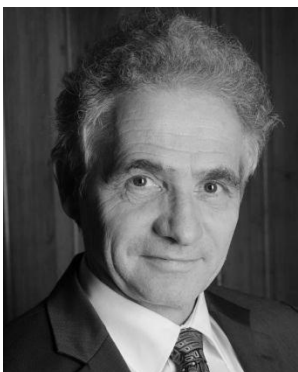
Jean-Yves Pidoux
City of Lausanne, Switzerland

Dr. Jean-Yves Pidoux, a sociologist by training, was an associate professor at the Institute of Anthropology and Sociology at the University of Lausanne. In 2006, he assumed office as Municipal Councilor and Managing Director of District Power Production and Distribution Company of the City of Lausanne (Service industriels, SiL). Since 2002, he also holds a seat on the cantonal parliament of Vaud as a representative of the Green Party.

Keynote Address – DAY 3 – Friday 6 June 2014

Frugal Innovation - Opportunity at the Bottom of the Pyramid

Anil Sethi
Swiss Extensions GmbH, Switzerland

Anil Sethi, a serial entrepreneur, founded Flisom, one of the leading flexible photovoltaic companies in the world. Anil took the technology from an idea at Swiss Institute of Technology in Zurich and led the company as the CEO and CFO from its inception in 2005 to 2012. He led four rounds of funding, raising some CHF 80 million, and built a team of over 20 people to transition the technology to the market.

Anil was recognized for his efforts by way of honors by various entities along the way. These included being honored as a Technology Pioneer by the World Economic Forum and an invitation to attend WEF in Davos in 2007. He was also invited to be part of the delegation led by President Doris Leuthard in 2010 to Washington, to help the United States in clean-energy related employment generation. Bilan also recognized Anil as one of Switzerland's 300 most influential people in 2010.

Anil has been invited by various forums in Europe, Asia and the United States as a speaker, including at the EU's Energy R&D policy in Brussels in 2011 and at the Global Summit on Innovation and Entrepreneurship in Dubai.

In 2012, Anil founded Swiss Extensions with the vision to provide skills to one million people a year within 10 years. Anil also acts as an Advisor to ETH Zurich at their ieLab initiative (Innovation & Entrepreneurship Lab). Anil holds an MBA from the London Business School, United Kingdom.

Special Events

Development Engineering:
A Unified Approach to Tech4Dev

Event Hosted by Development Impact Lab, University of California, Berkeley

When:	➢ Wednesday 4 June ➢ 14:30-17:00 (includes 30 minutes coffee break)
Location:	➢ SwissTech Convention Centre ➢ Room 2C – Level Garden
Session Leader:	➢ Dr. Temina Madon Development Impact Lab, University of California Berkeley, United States
Speakers:	➢ Prof. Ashok Gadgil Lawrence Berkeley National Lab, University of California Berkeley, United States ➢ Dr. Amos Winter Global Engineering and Research Laboratory, Massachusetts Institute of Technology, United States

Science and technology have great potential to promote economic development in low-resource settings. However, technologies that perform well in pilots can fail to achieve impact in the "real world", often because of market failures, social and behavioral barriers, and environmental constraints.

To overcome these challenges, engineers are beginning to integrate insights from economics and the social sciences along the entire arc of technological innovation -- from ideation and prototype development to manufacture at scale.

To formalize this approach, an academic field of "Development Engineering" (Dev Eng) is proposed. The establishment of a new discipline could help to formalize training in the design, evaluation, and scale-up of pro-poor technologies. Downstream, it is expected to foster closer linkage between technological advances and the social or economic interventions needed to achieve lasting development impact. Recently, several universities have begun piloting degree programs and courses in Dev Eng (some using the term "global engineering").

This session will review a sample of graduate courses and degree programs being piloted at U.S. universities, with instructors sharing their experiences and lessons learned.

We also will invite a discussion of how learning from Tech4Dev, ICT for Development, and frugal engineering (and related movements) can be leveraged to improve and accelerate innovation for the poor.

Welcome Aperitif

Event Hosted by the Swiss Commission for Research Partnerships with Developing Countries (KFPE)

When:	➢ Wednesday 4 June ➢ 17:00-18:00
Location: *SwissTech Centre*	➢ Presentation by Prof. Laurent Goetschel (Auditorium B) ➢ Case Study by Dr. Christian Zurbrügg (Auditorium B) ➢ Aperitif (Level Campus – Entrance Hall)

KFPE is celebrating its 20th anniversary in 2014. The EPFL-UNESCO Conference is a good opportunity to celebrate this anniversary with an international audience and to present KFPE's mission and activities.

Mission: KFPE promotes efficient, effective, and equitable research cooperation with developing and transition countries. By doing so, KFPE contributes to sustainable development and to solving global problems.

Activities: Strengthening research partnerships through support, knowledge brokering, and sensitization.

KFPE promotes high standards in North-South research. It does so by providing conceptual and methodological **support**, ensuring the availability of adequate resources, and ensuring that the research is put to use. At the core of this work is the development and promotion of ethical and methodological foundations for research partnerships with poorer countries. The 11 KFPE principles are widely recognized and applied internationally. KFPE wants to continue to stimulate reflection and debate about how research partnerships can be further improved and their effectiveness increased.

KFPE acts as a **knowledge broker** between research partners as well as between researchers and practice-oriented actors in government, administration, and business. It is the information hub for "North-South" research, both for researchers and for the target audience of the research. This includes development agencies, institutions that promote research, government, and business.

KFPE **sensitizes** the research community, political decision-makers, and the public to the necessity and concerns of research in and with poorer countries as a contribution to solving global problems. It takes on an early warning function by pointing out new, important topics and referring them to the relevant target group. In this sense, KFPE also plays an advisory role. KFPE engages with the public when it deems this necessary to fulfil its tasks.

Membership and Affiliation: The Commission's members are experienced in the field of research partnerships with developing and transition countries. The associated institutions include the main Swiss institutions conducting North-South research, as well as selected NGOs, corporate foundations, and government bodies. KFPE is a Commission of the Swiss Academy of Sciences (SCNAT).

Funding: KFPE receives core funding from the Swiss Agency for Development and Cooperation (SDC), the Swiss National Science Foundation (SNSF), and the SCNAT, as well as contributions from its associated institutions. In addition, KFPE accepts mandates which it either carries out itself or assigns to its associated institutions.

http://www.kfpe.ch

Lavaux Vineyards – UNESCO World Heritage Site

Thursday 5 June – Afternoon Sessions and Social Event

The sessions on Thursday afternoon will be hosted in the Lavaux Vineyards, followed by a social event in the village of Epesses.

Lavaux is located in the Canton of Vaud, in the heart of French-speaking Switzerland. The Lavaux Vineyards have been part of the UNESCO World Heritage Programme since 2007. The vineyard terraces of 830 hectares cover the vertiginous shores of Lac Leman between Montreux and Lausanne and offer one of the most beautiful panoramas in the world. They comprise 400 kilometers of walls and 10,000 terraces spread over 40 levels. This cultural landscape, worked since the 11th century, constitutes Switzerland's largest vineyards and encompasses 14 well-preserved villages. The Lavaux Vineyards mainly produce Chasselas wines, which are fruity and dry with subtle aromas.

We hope that you will be able to join us to experience the splendor of the region!

Important Logistical Information!

Registration for the Afternoon Sessions
- Due to limited space, it is essential that attendees register for the relevant sessions at the Registration Desk in the morning on 4 or 5 June. **Registrations will be taken on a first come, first served basis**!

Departure from EPFL for the Afternoon Sessions:
- Busses for the breakout sessions will leave **at 14:00 precisely** in front of the SwissTech Convention Centre. Staff in red T-shirts holding a sign with the session name will be available to guide you to the right bus. Your conference badge should be worn at all times.
- Once the afternoon sessions are finished, guides will accompany you to Epesses.

Departure from EPFL for the Cocktail Reception in Epesses
- Conference participants who will not be attending the afternoon sessions in Lavaux, and accompanying guests, can catch the bus leaving **at 16:30 precisely** in front of the SwissTech Convention Centre [Route Louis Favre 2 – Ecublens].

Attire
- To add color to the event, attendees are encouraged to wear their national dress.
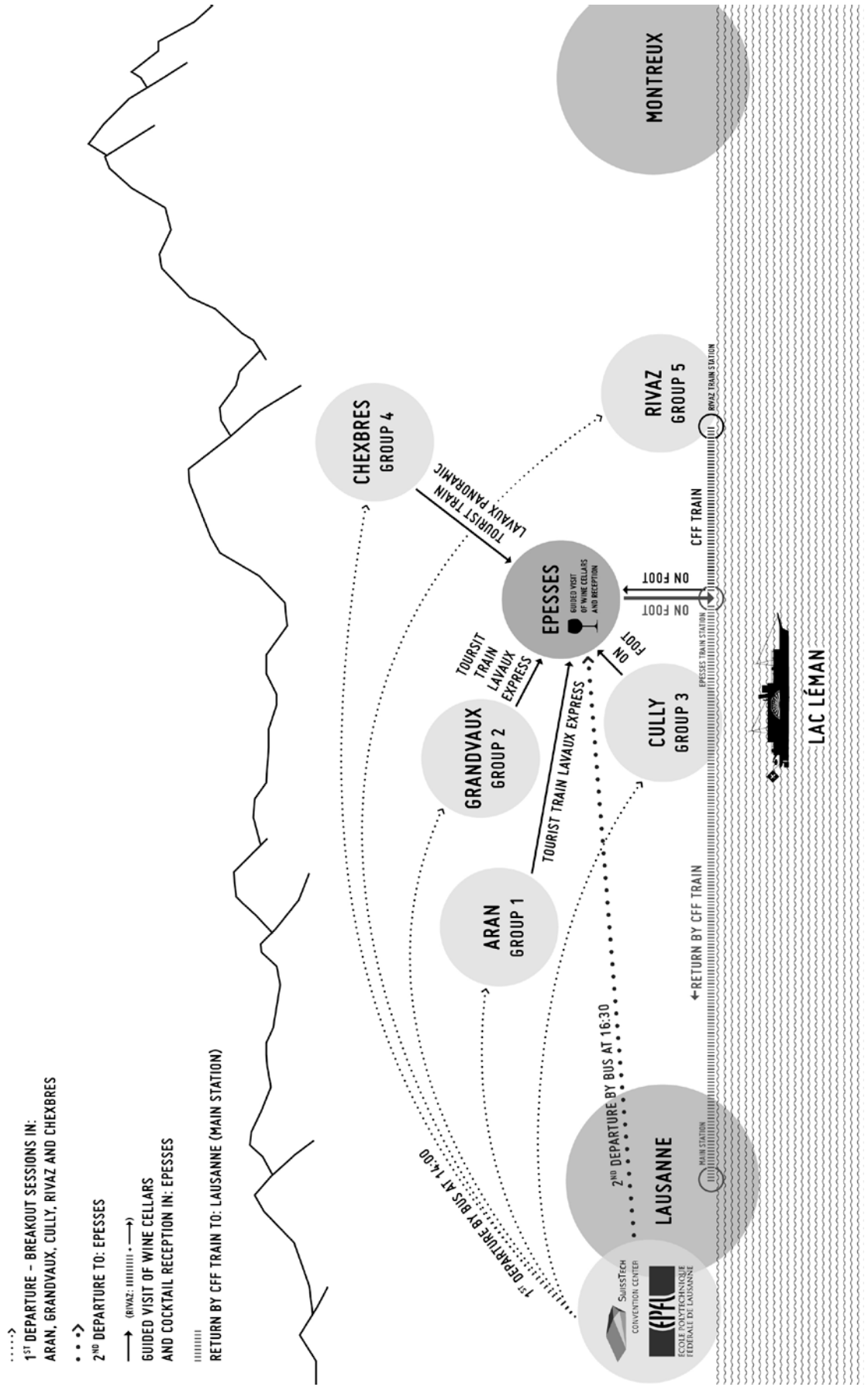
Return to Lausanne after the Cocktail Reception in Epesses
- At the end of the evening, attendees will return by train to Lausanne Main Station either at 19:47 or at 20:47 (journey time 15 minutes).
- Staff wearing red T-shirts will be posted at strategic locations to handle the necessary distribution of train tickets as well as provide any assistance required.
- Please note that the train station in Epesses is some 10 minutes on foot from where the Cocktail Reception will be hosted.

Accompanying Guests
- Accompanying guests (non-registered conference participants) are welcome to join us for the cocktail reception in Epesses at an additional cost of CHF 50.-/person payable in cash at the Registration Desk.
- Please be sure to register your guest at the Registration Desk in the morning on 4 or 5 June. Your guest will receive a badge which should be worn at all times.
- Guests will need to catch the bus leaving **at 16:30 precisely** in front of the SwissTech Convention Centre [Route Louis Favre 2 – Ecublens].

Thursday 5 June – Afternoon Sessions and Social Event
Lavaux Vineyards – UNESCO World Heritage Site

· · · · · >
1ST DEPARTURE – BREAKOUT SESSIONS IN:
ARAN, GRANDVAUX, CULLY, RIVAZ AND CHEXBRES

· · · >
2ND DEPARTURE TO: EPESSES

→ (RIVAZ: ⅠⅠⅠⅠⅠⅠⅠⅠ · →)
GUIDED VISIT OF WINE CELLARS
AND COCKTAIL RECEPTION IN: EPESSES

ⅠⅠⅠⅠⅠⅠⅠⅠ
RETURN BY CFF TRAIN TO: LAUSANNE (MAIN STATION)

MONTREUX

CHEXBRES
GROUP 4

RIVAZ
GROUP 5
RIVAZ TRAIN STATION

TOURIST TRAIN
LAVAUX PANORAMIC

EPESSES
GUIDED VISIT
OF WINE CELLARS
AND RECEPTION

ON FOOT

ON FOOT

CFF TRAIN

EPESSES TRAIN STATION

TOURIST
TRAIN
LAVAUX
EXPRESS

GRANDVAUX
GROUP 2

ON
FOOT

CULLY
GROUP 3

TOURIST TRAIN LAVAUX EXPRESS

LAC LÉMAN

ARAN
GROUP 1

2ND DEPARTURE BY BUS AT 16:30

← RETURN BY CFF TRAIN

LAUSANNE
MAIN STATION

1ST DEPARTURE BY BUS AT 14:00

SwissTech
CONVENTION CENTER
EPFL
ECOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Water Hackathon: Open Source Technologies for Rivers, Oceans and Lakes

Explore the Possibilities of Open Hardware for Open Science Projects

When & Location:	➢ 10:30-15:00 – Friday 6 June SwissTech Convention Centre Room 3A – Level Garden *Day Pass Registration starting at 8:30 am* ➢ 11:00-15:00 – Saturday 7 June UniverCité / hackuarium in Renens
Who:	➢ Interest in Open Hardware for Development, Education and Citizen Science ➢ No prior experience required
Website:	➢ More details and up-to-date information about the hackathon are available at http://hackteria.org/wiki/Tech4Dev

What?

City coastlines and rivers suffer from human activities like oil and chemical leaks, plastic trash, biological wastes and fecal run-offs as well as metal toxins. We all have the capabilities and the technologies to take a hands-on approach to these challenges. Hands-on exploration of open hardware can be integrated into promoting innovation and generating solutions for international development issues.

In this workshop, you will gain an on-the-ground understanding of DIY and the Open Hardware movement and its history. Through discussion and hands-on hardware hacking, we expect open exchange on the implications and possibilities of sharing technology to approach environmental exploration and preservation.

For 2 days of building, hacking, designing, and collaborating, we will build simple robotic floating boats and sensors. We will wire simple electrical circuits, use the Arduino Microcontroller, write simple Arduino code, and plug in environmental sensors, and actuate servo motors and DC motors.

We will head to the water to test our boats and sensors to gather some water samples. Then we will head back to the workshop to modify inexpensive web-cams to take a close look at some of the microorganisms we collected.

Workshop Leaders:

Gabriella Levine is an artist and hardware designer interested in the relationship between technology and ecology. Current work includes Protei.org (open source sailing drones), and Sneel.cc (biomimetic swimming snake robots). She teaches at Interactive Telecommunications Program (ITP) at Tisch School of the Arts New York University, and Copenhagen Institute of Interaction Design (CIID), is President of Open Hardware Association (OHSWA.org), and of Global Open Ocean Collaboration Platform (OCP). She has presented globally at symposia and lectures, received the 2012 Prix Ars Electronica Hybrid Arts Award, and was a fellow of Unreasonable at Sea.

Nur Akbar Arofatullah is a researcher currently studying at the Department of Biotechnology, Gadjah Mada University (UGM) Yogyakarta, Indonesia. His focus is on the field of fermentation techniques in various systems, such as liquid and solid-state fermentation. Several of his main research interests are bioethanol fermentation from sweet sorghum juice, bio fertilizer design and production, organic farming, and silage fermentation for cattle feeds. He is an open hardware enthusiast, an active member of the hackteria network, and has built and shared Open Hardware for both research and educational settings in Yogyakarta and abroad.

In collaboration with:

- UNESCO Chair in Technologies for Development, Organizers of Session [TH2-SE02-11] The Openness Paradigm: How Synergies Between Open Access, Open Data, Open Science, Open Source Hardware, Open Drug Discovery Approaches Support Development?
- hackteria
- Lifepatch
- biodesign for the real world
- Univercité (http://www.univercite.ch)
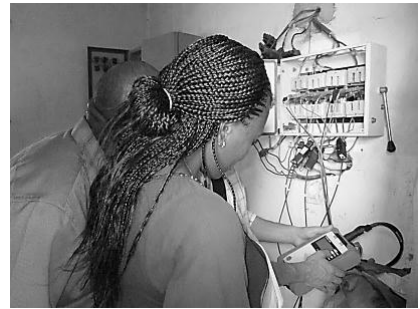- hackuarium

With support from:

- Migros Kultur Prozent
- seeed studio
- Swiss National Science Foundation

Affiliations:

- Open Source Hardware Association
- Creative Commons BY-SA 3.0
- Open Hardware

Abstracts

DAY 1 – WEDNESDAY 4 JUNE 2014 – AFTERNOON

			Water and Sanitation Technologies for Sustainable Urban Development
			Session Leader: Dr. Christian Zurbrügg, Department of Water and Sanitation in Developing Countries (SANDEC), Eawag: Swiss Federal Institute of Aquatic Science and Technology
			Co-Session Leader: Dr. Hung Nguyen-Viet, Center for Public Health and Ecosystem Research (CENPHER), Hanoi School of Public Health, Vietnam
TH1-SE01-01 – Room 3C – Level Garden 14:30-17:00 – Wednesday 4 June 2014	Dutta, Venkatesh	IN	Babasaheb Bhimrao Ambedkar (Central) University (India)	Cleanala-Wet Systems: A Low-Cost Decentralized Technology for Treating Wastewater in a Developing City
	Etter, Bastian	CH	Eawag: Swiss Federal Institute of Aquatic Science and Technology (Switzerland)	VUNA – Scaling Up Nutrient Recovery from Urine
	Larsen, Tove A.	CH	Eawag: Swiss Federal Institute of Aquatic Science and Technology (Switzerland)	Sanitation Innovation for Urban Slums: The Blue Diversion Toilet
	Olschewski, André	CH	Skat Foundation (Switzerland)	The Technology Applicability Framework (TAF) - A Participatory Tool to Validate Low-Income Urban WASH Technologies
	Seck, Alsane & Gold, Moritz	SN	Université Cheikh Anta Diop de Dakar (Senegal); Eawag (Switzerland)	Technology Development of Unplanted Drying Beds for Resource Recovery from Faecal Sludge: Fuel Production in Sub-Sahara Africa
	Tangka, Julius	CM	University of Dschang (Cameroon)	Atmospheric and Ground Water Pollution from Sewage in Douala City Cameroon: Performance Evaluation of an Experimental Waste Water Treatment Plant Coupled with Methane Capture and Use from Septic Systems

			Developing Appropriate Contexts for Successful Deployment of Essential Technologies for Disaster Risk Reduction
			Session Leader: Ms. Marie-Valentine Florin, International Risk Governance Council (IRGC), Switzerland
TH2-SE02-01 – Room 4C – Level Garden 14:30-17:00 – Wednesday 4 June 2014	Xu, Jianhua	CN	Peking University (China)	Risk Perception in Natural Disaster Management
	Figueroa, Raul	US	Carnegie Mellon University (United States)	Reducing the Risk of Building Collapse Catastrophes through Technology and Policy
	Edralin, Monica	PH	Local Emergency Assessment and Response Network, (Philippines)	The Local Emergency Assessment and Response Network: Capacity-Building and Collaboration for Disaster Risk Reduction and Emergency Response
	Hossain, Md Khalid	BD	RMIT University (Australia)	Deployment of Biotechnology for Climate Change Adaptation and the Risk of Maladaptation in Bangladesh: An Agricultural Seed Industry Perspective
	Tiwari, Prakash C.	IN	Kumaon University Nainital (India)	Urban Growth and Assessment of its Natural and Socio-Economic Risks in High Mountain Ecosystems: A Geospatial Framework for Institutionalizing Urban Risk Management in Himalaya

DAY 1 – WEDNESDAY 4 JUNE 2014 – AFTERNOON

TH2-SE02-05 – Room 5C – Level Garden 14:30-17:00 – Wednesday 4 June 2014	**Up-Scaling Sustainable Pro-Poor Energy Solutions: Addressing Stumbling Blocks**			
	Session Leader: Dr. Albrecht Ehrensperger, Centre for Development and Environment, University of Bern, Switzerland			
	Co-Session Leader: Dr. Lucy Stevens, Practical Action, United Kingdom			
	Kung, Kevin	TW	Massachusetts Institute of Technology (US)	Techno-Economic Feasibility of Green Charcoal Production in Kenya: A Case Study
	Gadgil, Ashok	US	Lawrence Berkeley National Laboratory (United States)	Lessons Learned from Up-Scaling Pro-Poor solutions: Energy Efficient Light-bulbs, Drinking Water Treatment, and Cook Stoves
	Zappia, Maria Teresa	IT	BlueOrchard Finance S.A. (Switzerland)	Microfinance Innovation to Foster Green Technology Development
	Mirza, Bilal	PK	COMSATS Institute of Information Technology (Pakistan)	Perception and Satisfaction with Renewable Energy Technologies (RETs): The Case of Solar Villages in Pakistan
	Zalengera, Collen	MW	Loughborough University (United Kingdom)	Putting the End-user First: Towards Addressing the Contesting Values in Renewable Energy Systems Deployment for Low Income Households - A Case of Likoma Island in Malawi
	Jain, Abhishek	IN	University of Cambridge (United Kingdom)	Decision Making and Planning Framework to Improve the Deployment Success of Decentralized Rural Electrification in India

TH2-SE02-011 – Room 1A – Level Garden 14:30-17:00 – Wednesday 4 June 2014	**The Openness Paradigm: How Synergies between Open Access, Open Data, Open Science, Open Source Hardware, Open Drug Discovery Approaches Support Development?**			
	Session Leader: Dr. Sachiko Hirosue, School of Life Sciences, Ecole Polytechnique Fédérale de Lausanne, Switzerland			
	Co-Session Leader: Dr. Denisa Kera, National University of Singapore			
	Levine, Gabriella	US	Tisch School of the Arts (United States)	Open Source Hardware Biomimetic Snake Robot as a Toolkit for Monitoring and Exploring Marine Environments
	Arofatullah, Nur Akbar	ID	Gadjah Mada University (Indonesia)	Open Hardware Webcam Microscope and its Impact on Citizen Science Jogja River Project
	Prijambada, Irfan Dwidya	ID	Gadjah Mada University (Indonesia)	Intersection of DIY (do it yourself) and DIWO (do it with others) Approaches in Sharing Microbiology Know-how to Benefit Communities
	Ettinger, Kate	US	University of California, San Francisco (United States)	Open Issues and A Proposal for Open Data Monitoring to Assure Quality, Reliability and Safety in Health Care Devices Targeting Low and Middle Income Countries
	Sambuli, Nanjira	KE	iHub Research (Kenya)	Crowdsourcing Citizen-Generated Data for Open Science: A Case Study from the 2013 Kenya General Elections
	Edmunds, Scott	UK	GigaScience/BGI Hong Kong Ltd. (Hong Kong)	GigaScience: Open Publishing for the Big Data Era

DAY 1 – WEDNESDAY 4 JUNE 2014 – AFTERNOON

	Appropriate Medical Devices: From Lab to Bedside in Resource-Constrained Contexts			
TH2-SE02-017 – Room 1C – Garden Level 14:30-17:00 – Wednesday 4 June 2014	*Session Leader: Dr. Klaus Schönenberger, EssentialTech Programme, Cooperation & Development Center (CODEV), Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland*			
	Velazquez Berumen, Adriana	MX	World Health Organization (Switzerland)	Appropriate and Affordable Medical Devices in Low Resource Countries: A Perspective from WHO and other UN Organizations
	Lecomte, Chloé	FR	Grenoble Institute of Technology (France)	Understanding the "Non Trade-Offs" for a Better Frugal Design in Health Care Sector (India)
	Huijs, Jan	NL	HEART Consultancy (Netherlands)	An Autoclave for the Rest of Us
	Hamner, Samuel	US	D-Rev: Design Revolution (United States)	ReMotion Knee: Scaling of an Affordable Prosthetic Knee for Developing Countries
	Okumu, Fredros	TZ	Ifakara Health Institute (Tanzania)	The Ifakara Wellness Box: A Low-Cost Mosquito Control Device that also Supplies Essential Electrical Power

DAY 1 – Wednesday 4 June – Afternoon

Room 3C - Level Garden - 14:30-17:00

[TH1-SE01-01] Water and Sanitation Technologies for Sustainable Urban Development

Session Leader: Dr. Christian Zurbrügg, Department of Water and Sanitation in Developing Countries (SANDEC), Eawag: Swiss Federal Institute of Aquatic Science and Technology

Co-Session Leader: Dr. Hung Nguyen-Viet, Center for Public Health and Ecosystem Research (CENPHER), Hanoi School of Public Health, Vietnam

Water treatment and sanitation technologies are undoubtedly essential. Nevertheless, provision of water is not always successful when moving from pilot facilities to widespread scaling up. This session will cover the entire chain of technology innovation from initial lab-based research work, to field-testing and highlight ways on how to provide proof of concept for radical technology innovations in the field of water and sanitation. The breakout session will focus on point-of-use treatment options, scalable low-cost user interfaces and low maintenance.

Cleanala-Wet Systems: A Low-Cost Decentralized Technology for Treating Wastewater in a Developing City

Venkatesh Dutta

School for Environmental Sciences (SES), Babasaheb Bhimrao Ambedkar (Central) University, India

Presenting author's email address: dvenks@gmail.com

Biography of presenting author: Dr. Dutta's research interests span urban environmental management, regulatory policy modeling and water resources management. His is research work has integrated analytical tools of environmental sciences and management to understand the spatial and functional order of growing cities and peri-urban areas. He has over ten years of professional experience in areas of urban water systems and environmental management. A former Fulbright Fellow and a British Chevening Scholar, he possesses M.Sc. in Environment Management and a Ph.D. in Regulatory Policy from TERI University, India.

Abstract

This paper presents the outcome of innovative technologies for decentralized wastewater treatment which has been implemented at a community level in Lucknow, India. Cleanala-Wet systems, which combines small-scale domestic treatment plant with constructed wetlands are designed to be low-maintenance and cost-effective for treatment of domestic wastewater at a community scale with a population of 3000. The system works without extensive technical energy inputs and cannot be turned-off intentionally, as opposed to conventional sewage treatment plants (STPs). The system does not require sophisticated maintenance and can be built on the drains as in situ treatment or close to drain boundaries. The results indicate that decentralized methods can be far more effective than large scale centralized treatment plants, with scope for large cost savings. The outcome also indicates that we need to collectively focus on appropriate technology, level of scale, innovation and social and economic sustainability in designing for wastewater treatment systems for communities in developing countries. There is a need for capacity building of urban and peri-urban communities, as well as local institutions in order to become fully successful, scale up and improvise these innovative approaches in the future.

Keywords
decentralized wastewater treatment, urban settlements, innovation, inclusive growth

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VUNA – Scaling Up Nutrient Recovery from Urine

Bastian Etter[1], Kai M. Udert[1], Teddy Gounden[2]
[1] Eawag: Swiss Federal Institute of Aquatic Science and Technology, Dübendorf (Zürich), Switzerland
[2] EWS: eThekwini Water and Sanitation, Durban, South Africa

Presenting author's email address: bastian.etter@eawag.ch

Biography of presenting author: Bastian Etter has worked on nutrient recovery from urine for the past five years. At Eawag, the Swiss Federal Institute of Aquatic Science and Technology, he first started on a nutrient recovery project in Nepal, and then joined the VUNA project as its coordinator from the very beginning. He holds an MSc degree in environmental engineering from EPFL, the Swiss Federal Institute of Technology Lausanne.

Abstract
By recovering nutrients from urine, the VUNA project (www.vuna.ch) aims to contribute to a sanitation system, which is affordable, produces a valuable fertilizer, and reduces pollution of water resources. In the eThekwini Municipality in

South Africa, a system was set up to collect urine from urine diversion dry toilets (UDDT). The collected urine was processed into fertilizer.

In a first set of trials, urine was collected from 700 households, in order to evaluate potential collection systems: An institutionalized system operated by the municipality workers was compared with an incentivized system, where the drop-off of urine at semi-centralized collection points was compensated with monetary incentives. Furthermore, potential collection schemes were analyzed with computer simulations and business models. To recover the nutrients contained in urine, different process technologies were developed and tested: 1) Via *struvite precipitation*, phosphate can be recovered from urine. The process is simple to install and operate, though recovers only part of the nutrients, which can potentially be recovered from urine, i.e. nitrogen and potassium remain in an effluent, which has to be treated. 2) *Biological nitrification combined with distillation* produces a concentrated solution containing all nutrients in urine. The biological process is more complex to operate and needs constant supervision, but ensures a hygienic and complete end product. 3) *Electrolysis* of urine is a novel process to treat urine. In future applications, it is expected to treat urine in compact reactors. However, research is still at an early stage and needs further efforts towards a roll-out. Social acceptance studies ascertained that UDDTs are not necessarily readily accepted by the final users. However, target-specific education and sensitization of toilet users can lay a foundation for a broader acceptance, which can be further strengthened, if excreta is given a value by processing it into reusable end products. The VUNA project has evolved from a strong collaboration between all partners, which has been characterized by an interest in functioning technologies both in South Africa and in Switzerland.

Keywords
sanitation, nutrient recovery, urine treatment, fertilizer production, public health

Sanitation Innovation for Urban Slums: The Blue Diversion Toilet

Christoph Lüthi[1], **Tove A. Larsen**[1]
[1] Eawag: Swiss Federal Institute of Aquatic Science and Technology, Dübendorf (Zürich), Switzerland

Presenting author's email address: tove.larsen@eawag.ch

Biography of presenting author: Dr. Tove Larsen is a senior research associate at Eawag and heads the research group on future sanitation concepts at the Urban Water Management Division at Eawag. Her research focus is on concepts of sustainable urban water management, source control measures in wastewater management and most recently, decentralized technologies for wastewater treatment. She is the Principle Investigator at Eawag for the Gates-funded "Reinventing the Toilet Challenge" project.

Abstract

This paper presents the development of a new human-centered applied research project to 're-invent the toilet' funded by the Bill and Melinda Gates Foundation since 2011. The Blue Diversion toilet developed by Eawag and the design studio EOOS, features a stand-alone, grid-free dry diversion toilet with three separate waste streams: faeces, urine and wash/flush water. Advanced technologies such as membrane separation and electrochemical treatment are combined with robust processes and an attractive toilet design. The paper stresses the importance of field-testing and reality checks in the development of an aspirational end product that meets users' needs and at the same time performs in a sufficiently robust way. The resulting prototype is now undergoing final trials in Nairobi's informal settlements before further steps towards industrialization of a toilet model that can be tested at scale in various locations across Africa and Asia.

Keywords
urban sanitation, source separation, blue diversion

The Technology Applicability Framework (TAF) - A Participatory Tool to Validate Low-Income Urban WASH Technologies

André Olschewski[1], Vincent Casey[2]
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[2] WaterAid, London, United Kingdom

Presenting author's email address: andre.olschewski@skat.ch

Biography of presenting author: André Olschewski has a professional background in rural engineering, business engineering and spatial planning. He has over 18 years of working experience as consultant and project manager in the area of environmental engineering, strategic planning and project management of infrastructure projects. He is currently working as water and environmental sanitation specialist at Skat Consulting. In the Rural Water Supply Network (RWSN) he is engaged as thematic coordinator for accelerating self-supply.

Abstract

Practitioners in the water, sanitation and hygiene (WASH) sector can draw upon a number of different technology options when delivering water supply, sanitation and hygiene services in urban or peri-urban areas. At the same time, there is a serious challenge facing producers, practitioners, communities, governments and development partners whereby the services introduced, struggle to remain in operation or perform optimally for sufficient lengths of time to truly meet user needs. The WASH sector is currently faced with a situation where lessons learned in pilots are not widely transferred. There is little or no feedback loop from communities to producers and implementers of some widely used WASH technologies. Many countries do not have policies or standards in place for assessment and uptake of new WASH technologies, resulting in arbitrary adoption of options that are not fit for purpose, too expensive for users to pay for, not scalable and inadequately supported at local level.

In the EU-FP7 funded project WASHTech two tools for technology validation and introduction were developed and tested: the Technology Applicability Framework (TAF) and the Technology Introduction Process (TIP). The TAF is a comprehensive decision support tool centered around 18 sustainability indicators. In a participatory process, it examines the financial, social, institutional, legal, environmental, technical and capacity conditions in the given context from three perspectives: (i) users/buyers, (ii) producers/providers, and (iii) regulators/investors/facilitators involving all key stakeholders (e.g. municipality, private sector and NGOs). As a result, the TAF determines the match or miss-match of the contextual conditions with the technology being considered and the key requirements for successful introduction. The TAF was field-tested on 13 WASH technologies in three countries: Burkina Faso, Ghana and Uganda. This paper presents the findings from the testing of the TAF and highlights potential and limits of its applicability for assessing sustainable application and scalability of WASH technologies. All relevant documents on the methodology and the testing are accessible in the public domain through www.washtechnologies.net.

Keywords
technology, applicability, introduction, tools, sustainability, scalability

Technology Development of Unplanted Drying Beds for Resource Recovery from Faecal Sludge: Fuel Production in Sub-Sahara Africa

Alsane Seck[1], Moritz Gold[2], Seydou Niang[3], Linda Strande[2], Mbaye Mbéguéré[4]

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[2] Eawag: Swiss Federal Institute of Aquatic Science and Technology, Dübendorf (Zürich), Switzerland
[3] Laboratoire de Traitement des Eaux Usées (LATEU), Institut Fondamental d'Afrique Noire Cheikh Anta Diop (IFAN Ch. A. Diop), Université Cheikh Anta Diop de Dakar, Dakar-Fann, Sénégal
[4] Office National de l`Assainissement du Sénégal (ONAS), Cité TP SOM n° 4, Dakar-Hann, Sénégal

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***Biographies of presenting authors: Mr. Alsane Seck** started his PhD in 2012 at Cheikh Anta Diop University in Dakar, Senegal. He is part of the research group at IFAN-LATEU (Institut Fondamental d'Afrique Noire - Laboratoire de Traitement des Eaux Usées). Mr. Seck, who holds a Master`s degree in chemistry, is currently part of the Eawag Partnership Program (EPP) at Eawag/Sandec. **Mr. Moritz Gold** joined Sandec/Eawag in 2013 as project officer of the Faecal Management Enterprises (FaME) project and holds an Environmental Engineering degree from the University of Stuttgart. At Sandec, he is part of the Excreta and Wastewater Management group and his research focuses on the development of technologies and value chains for resource recovery from faecal sludge.*

Abstract

In Sub-Saharan Africa, sanitation needs for the majority of people in urban areas are met through onsite sanitation technologies (e.g., pit latrines or septic tanks). Currently, the management of the accumulated faecal sludge (FS) is widely characterized by inadequate and unaffordable collection services and dumping of untreated FS directly into the urban environment. Economic incentives throughout the FS service chain are lacking, recovery of the energetic potential of FS as an industrial fuel could provide an economic driver. To achieve this goal, development of cost-effective drying methods is required. Drying beds are relatively inexpensive and easy to operate, however they require a lot of space. The objective of this research was to evaluate methods to reduce the required footprint.

This research was conducted at a pilot-scale research facility at Cambérène Wastewater and Faecal Sludge Treatment Plant in Dakar, Senegal. Twenty drying repetitions with loading rates of 100 kg TS/m^2.ear and 150 kg/m^2*year were monitored over a period of nine months during the dry and rainy seasons. Greenhouses and daily turning were investigated to increase drying times and reduce the required footprint of unplanted drying beds for resource recovery.

Preliminary results showed that it is necessary to have active ventilation in greenhouses to enhance rates of drying. Ventilated greenhouses were only beneficial in the rainy season as a rain-cover, but this was a benefit as otherwise a dryness of 90wt% could not be achieved. Turning the FS on the surface of the beds greatly reduced the drying time, by on average of six days. Hence, turning could reduce the footprint and/or increase the capacity of treatment plants by around 20%. On average, the dried FS had a calorific value of 12.2 MJ/kg*dried solids, which can be recovered in

industrial processes. The sludge currently delivered to the three existing faecal sludge treatment plants could provide 31,403 GJ/a to industries, providing an economic incentive for sustainable sanitation.

Keywords
solar drying, faecal sludge management, sanitation, developing countries, resource recovery

Atmospheric and Ground Water Pollution from Sewage in Douala City, Cameroon: Performance Evaluation of an Experimental Waste Water Treatment Plant Coupled with Methane Capture and Use from Septic Systems

Julius Tangka[1], Viyoi Catherine[1], Fointama Nyongo[2], Shufai Woo Ngairin[3]
[1] Renewable Energy laboratory, University of Dschang, Cameroon
[2] Deprtment of Environmental Science, Institute de Sahel, University of Maroua, Cameroon
[3] Société de Decoupage Formage et Mécanique (SODEFOM) Bonammoussadi, Douala Cameroon

Presenting author's email address: tangkajkfr@yahoo.fr

Biography of presenting author: *Prof Julius K Tangka is head of the Renewable Energy Laboratory, University of Dschang, Cameroon. He holds a Ph.D. in Agricultural Engineering from the University of Ibadan in Nigeria and a diploma in Energy Management from the Maastricht School of Management in the Netherlands as well as a diploma in Advanced Agro technologies from the Ben Gurion University of the Negev in Israel. He also holds a diploma in solar energy technologies from the UNIDO International Centre for Solar Energy Langzhou in China.*

Abstract
The failure of conventional septic tanks to properly treat sewage in the Douala city of Cameroon, due to very high water table and the permeable nature of concrete structures, has given rise to excessive ground water pollution. Bacteria and heavy metal trafficking from septic tanks to underground water, as well as methane gas emissions constitute an environmental concern. Decanter digesters adapted for sewage treatment emit tons of methane gas that contribute to global warming. A pilot plant for sewage treatment coupled with methane capture and storage was developed and tested in the Douala municipal city of Cameroon using a public toilet. The plant works on a five stage filtration system including, grit separation, filtration, anaerobic digestion, bio rock treatment and sand filtration in that order. The plant uses impermeable fiberglass reinforced polyester material with provision for methane gas capture and evacuation. Methane gas was captured and stored in large inner tubes and used by a small community for cooking lighting and heating. The overall plant performance was evaluated by analyzing treated wastewater for bacteria count, COD, BOD, pH, and temperature at the entrance and at the exit of the plant. Results indicated that the plant can treat sewage water to accepted norms before discharge without possibility of underground water pollution. Installation of a methane capture facility did not alter pH, bacteria and mold count. However, BOD and COD values were far above accepted norms if methane gas evacuation was delayed. The high values of BOD and COD obtained were attributed to contamination from back flows due to pressure from gas storage membranes. The plant reduced bacteria and mold colony forming unit from 10^7 to 10^3 CFU/ml. The study revealed that back flow pressures from methane storage units can alter the water treatment efficiency of combined methane capture/water treatment decanter digesters because excessive gas pressures alter residence time of the slurry.

Keywords
biogas, waste water treatment, ground water pollution

DAY 1 – Wednesday 4 June – Room 4C - Level Garden - 14:30-17:00

[TH2-SE02-01] Developing Appropriate Contexts for Successful Deployment of Essential Technologies for Disaster Risk Reduction

Session Leader: Ms. Marie-Valentine Florin, International Risk Governance Council, Switzerland

Understanding the context in which technologies are implemented and mobilizing appropriate governance cultures are important factors for improving the effectiveness of disaster risk reduction. The session will aim to identify what are the prerequisites for essential technologies to succeed in difficult context conditions, for example when: (a) the perception of the technology and how it can contribute to increasing welfare is not positive; (b) interested and affected parties do not agree about the need for ways to deploy a technology, and the resources to be allocated to its implementation (c) infrastructures are lacking; or (d) regulatory framework and incentives are weak.

Risk Perception in Natural Disaster Management

Jianhua Xu[1,2], Yongjing Zhang[3], Bing Liu[2,4], Lan Xue[2,4]
[1] College of Environmental Sciences and Engineering, Peking University, China
[2] Center for Crisis Management Research, School of Public Policy and Management, Tsinghua University, China
[3] Graduate School of Public and International Affairs, University of Ottawa, Canada
[4] School of Public Policy and Management, Tsinghua University, Beijing, China

Presenting author's email address: jianhua.xu@pku.edu.cn

Biography of presenting author: Jianhua Xu is an Associate Professor at Department of Environmental Management, College of Environmental Sciences and Engineering, Peking University. She got her PhD in engineering and public policy from Carnegie Mellon University. Her research interests are in environmental and energy policy, and risk governance.

Abstract

Risk perception, among other factors, is believed to affect people's preparedness for, responses to and recovery from natural disasters, and is important for developing effective risk communication strategies. In the process of coping with the frequently occurring natural disasters, China has gained rich experience in mobilizing and pooling resources to reduce disaster risks. However, its disaster management is dominated by a technocratic paradigm and the social aspect is in general overlooked. From time to time, efforts were made in the name of "for the public's good" but paying no heed to how the public perceives those disasters. As a result, well-intended policies and measures became ineffective or even led to undesired results. Considering and identifying the context in which natural disaster management is designed and implemented is crucial, and taking account of risk perception is absolutely critical.

This study aims to advocate integrating the social aspect into disaster risk reduction practices by using the example of *the role of risk perception in natural disaster management*. Previous studies on people's perception towards and response to natural disasters are synthesized to demonstrate the significance and richness of the subject. A case was developed out of the rainstorm hitting Beijing on July 21, 2012 to illustrate how governmental efforts in early warning may become less effective than expected when the human dimension is glossed over. The case confirms that "people are prisoners of their own experiences" and have difficulties in imagining the extent of the impact of extreme rainstorms which they had never experienced before. It also reveals that people have a hard time in translating jargon-laden warning messages into information conductive to increasing their risk perception. A survey was designed to further test the phenomenon observed in the case study. A total of 510 samples were collected via internet. The results show that (1) the warning messages either were not noticed or were too technical to be understood by more than half of the respondents, and (2) upon receiving the early warning messages, respondents who had experienced natural disasters comparable to the July 21 one before were more likely to be aware that the coming storm was expected to be heavier than the usual ones.

Recognizing the importance of the social aspect in disaster risk reduction is a gradual thing. Technical solutions have always been given more attention in coping with natural disasters, which is well justified, and it is important to identify and implement the best and most essential technologies. However, the technical solutions might not achieve its expected goals without good understanding of the social aspect involved and the human factor. With this article, we advocate paying attention to the social aspect in China's disaster risk reduction practices.

Keywords
risk perception, risk behavior, natural disaster

Reducing the Risk of Building Collapse Catastrophes through Technology and Policy

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Abstract

In developing countries, poor quality construction has led to spontaneous building collapse and, during earthquakes, to major disaster. While reliable building codes are widely used in design, builders in developing countries often fail to meet acceptable standards. Structural defects are frequently identified too late, often after catastrophic collapse. Researchers attribute most of the deaths in Haiti during the 2010 earthquake to the low quality of Haitian construction. In the last decade, dozens of buildings have spontaneously collapsed throughout the developing world causing hundreds of deaths and injuries. Thousands of dangerously weak buildings will be built, and unless better methods are implemented, millions of people in developing countries would likely be exposed to unnecessarily higher risks for generations. This paper examines the level of compliance with construction standards, assesses the risks of building collapse, and proposes solutions to improve resilience. We analyze original data from buildings in Nairobi and develop probabilistic models to estimate the impact of non-compliance on safety. We compare test results reported by laboratories in Nairobi from a sample of new construction projects, to non-destructive-test data collected at the same construction sites, and conduct quantitative elicitation of experts. The risks of collapse is assessed by combining building inventory data from Nairobi, seismic probability estimates, the findings from the investigation into concrete quality, and seismic performance simulations into probabilistic risk models. The data suggests that much of the concrete is weaker than required and that most laboratory reports are not representative of the concrete used in the structures. The risk models suggest that the implementation of corrective measures in 2015 would reduce risks by 2/3 compared to waiting until 2035. Effective strategies should combine reliable but affordable technologies, information systems and incentives to improve governance. Governments should give high priority to solving the problem of unsafe construction practices. With the right institutions and incentives, this could be done in a few years instead of decades.

Keywords
collapse, earthquakes, enforcement, fraud, testing

The Local Emergency Assessment and Response Network: Capacity-building and Collaboration for Disaster Risk Reduction and Emergency Response

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Abstract

The Local Emergency Assessment and Response Network (LEARN) is a tool developed by Hilfswerk der Evangelischen Kirchen Schweiz (HEKS) and carried out in Indonesia by a local partner non-governmental organization (NGO), Yayasan Holi'ana'a. The first phase involved three local partner NGOs, namely, Yayasan Holi'ana'a., Caritas-Medan and Lembaga Pengkajian Dan Pemberdayaan Masyarakat. This phase consists of a series of capacity-building activities and collaborative activities in Sumatra, Indonesia in the field of disaster risk reduction and emergency response. It explores how the project evolved from training individuals from non-governmental organizations within Sumatra, to the creation of a self-sustaining and solid network of disaster risk reduction and emergency response professionals, and thereafter developing into a knowledge-sharing platform that has allowed for an exchange of disaster-related information and technologies. It has since encouraged the continuous practice of available skills and use of technologies, and most importantly forged ties with other sectors working in the field of disaster.
The first component of the project is capacity building. The training for representatives from non-governmental organizations aims to combine standards in international emergency response and the local disaster risk reduction context; therefore embedding local knowledge and wisdom in its modules. The use of technology is a main focus in the training, and is facilitated in such a way that whilst participants understand the use of the technology, they must be able to use this within their own organizations afterwards. Topics on disaster preparedness and emergency response

include the use of communication systems like radio systems, satellite phones, and global positioning devices. The training emphasizes and discusses extensively how communications systems are used to disseminate information for early warning systems, and is critical in the conduct of emergency response. The use of these technologies is used to notify and disseminate information, but should not be limited to government or emergency-related entities, but is available to communities.

The second component is networking and collaboration. LEARN promotes the use of physical and digital platforms for networking such as skills refresher trainings, exchange visits, and relevant social media. LEARN has been working with local governmental bodies to promote the improvement of the overall utilization of disaster knowledge in the information chain. The initiative involves key actors including non-governmental bodies, national government agencies, and local government units as represented by the trained disaster risk committees in the villages. A control center operates as command and information hub, and access to information is open and accessible to all actors.

LEARN aims to establish a network of individuals and organizations capable in emergency response, and in the longer term, provide a good backdrop to initiatives related to disaster risk reduction. Individuals belonging to different organizations are endowed with different core competencies and are located all over the island, making them strategically positioned all over Sumatra to respond to disasters. The approach itself is flexible and open to developments in all directions. It has taken note of what works, and has evolved accordingly. The project has opened up opportunities for collaboration and knowledge sharing within and among like-minded non-governmental organizations, and has been engaging national and local actors. It is a clear example of how building a critical mass creates incentive to engage in other willing groups. The set-up also nurtures an atmosphere of continuous individual and organizational growth in capacities needed to work in the fields of emergency response and disaster risk reduction by keeping abreast in technologies and technical know-how.

Keywords
local emergency assessment and response network, capacity-building, networking and collaboration, disaster risk reduction, emergency response

Deployment of Biotechnology for Climate Change Adaptation and the Risk of Maladaptation in Bangladesh: An Agricultural Seed Industry Perspective

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Biography of presenting author: *Md Khalid Hossain is a PhD Researcher at the School of Management of RMIT University, Australia. He is a Bangladeshi citizen. He is currently an Australian Leadership Award (ALA) scholar. He earned his Master of Diplomacy and Trade degree from the Monash University, Australia as an Australian Development Scholarship (ADS) scholar in 2006. Prior to that, he received Bachelor of Science in Civil Engineering degree from the Bangladesh University of Engineering and Technology (BUET).*

Abstract
While a considerable amount of focus has been given on corporate climate change mitigation strategies like green technology deployment, a negligible focus has been given on the corporate climate change adaptation strategies. This strategy could be defined as the adjustment in business strategy to avert risks along with exploiting beneficial opportunities created by climate change impacts. However, the negligible focus on the issue as a whole has created the possibility of corporate activities that may be beneficial for corporations within the definition of climate change adaptation while bringing no or disadvantageous consequences for the society. This may be due to the deployment of a technology by the corporations for climate change adaptation which other stakeholders would contest as 'maladaptation' due to the imminent disadvantages that technology would bring to the society. Biotechnology is one of such technologies which many corporations observe as a key tool and an opportunity to address the challenges posed by climate change impacts while a number of stakeholders oppose the deployment of biotechnology since they believe that the technology would bring disadvantages to the society. It is therefore imperative to take measures so that legitimate, democratic and accountable corporate governance in relation to the deployment of biotechnology as a climate change adaptation strategy could be ensured. Bearing this in mind, this paper presents a framework of related corporate governance in a vulnerable country context which could be adopted to avoid maladaptation due to the deployment of biotechnology for climate change adaptation by corporations. The paper and the framework presented in the paper are based on a research that has been carried out on the companies in the agricultural seed industry in Bangladesh since direct physical impacts of climate change are prominent on agriculture in Bangladesh in different forms and there is a live debate on deployment of biotechnology by those companies. The research has also taken the expert opinion into consideration.

Keywords
climate change adaptation, maladaptation, biotechnology, agricultural seed industry, Bangladesh

Urban Growth and Assessment of its Natural and Socio-economic Risks in High Mountain Ecosystems: A Geospatial Framework for Institutionalizing Urban Risk Management in Himalaya

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Biography of presenting author: Dr. Prakash Tiwari is Professor of Geography at Kumaon University, India. He is natural resource management, climate change adaptation and disaster risk reduction specialist. He has been Fellow of Japan Society for Promotion of Science, Guest Professor of German Academic Exchange Service, Mercator Fellow of German Research Foundation. He is active member of Mountain Research Initiative, Mountain Forum, Monsoon Asia Integrated Regional Study and Urbanization and Global Environmental Earth System Governance Project and Change and European Land Use Institute

Abstract

Urbanization has emerged as one of the important drivers of global change transforming mountain ecosystems in developing countries where the process of urban growth has been fast but mostly unplanned. Himalaya which is tectonically alive, densely populated and economically underdeveloped has experienced rapid urban-growth during recent years, mainly owing to extension of road network, growth of tourism and   economic globalization. These changes are making urban ecosystems highly vulnerable to a variety of environmental and socio-economic risks, particularly, flash floods and landslides affecting mainly poor and marginalized families. Moreover, climate change has stressed urban ecosystems by increasing the frequency, severity and intensity of natural as well as socio-economic crises. It is therefore highly imperative to evolve an urban risk management action plan using geo-information technology and ensure its application through its institutionalization at micro levels. Study developed a micro-level decision support system for landslides risk management using high-resolution satellite data and geographic Information System with a case illustration of Lake Region in Kumaon Himalaya, India.

Methodology included comprehensive terrain analysis; monitoring urban land-use dynamics using satellite data; and assessment of socio-economic vulnerabilities; preparation of natural and socio-economic risk vulnerability maps; development of geo-spatial support framework, and evolving institutionalized multi-stakeholder governance mechanism. Integration of various socio-economic parameters with landslide risk map indicated that frequency and intensity of incidences of high intensity rainfall, slope-failure and landslides have enhanced with intensification of urban land use as well as with increase in rainfall variability. Areas characterized with low carrying capacity and inhabited by socio-economically marginalized groups have been found highly susceptible to such risks. In view of this, exclusively tailored training programs have also been organized for capacity building of local government departments and communities for assessment and reduction of urban-risks using geo-spatial support system. The system also included a framework for institutionalizing urban-risk governance involving stakeholders from public, government agencies, civil society organizations, NOGs, private sectors and other interest groups.

Keywords

landslides, natural and socio-economic vulnerability, landslides risk management, training programs, institutionalizing urban-risk governance

DAY 1 – Wednesday 4 June – Room 5C - Level Garden - 14:30-17:00

[TH2-SE02-05] Up-Scaling Sustainable Pro-Poor Energy Solutions: Addressing Stumbling Blocks

Session Leader: Dr. Albrecht Ehrensperger, Centre for Development and Environment, University of Bern

Co-Session Leader: Dr. Lucy Stevens, Practical Action, United Kingdom

The session aims at analyzing efforts in up-scaling cleaner and more efficient energy solutions for poor people in developing countries by addressing the following questions: What are factors along the whole value chain and in the institutional, social, but also environmental space that enable up-scaling of improved pro-poor technologies? Are there differences between energy carriers or in different contexts? What are most promising entry points for up scaling?

Techno-Economic Feasibility of Green Charcoal Production in Kenya: A Case Study

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Biography of presenting author: *Kevin Kung is a doctoral student at Massachusetts Institute of Technology. Having earned his Bachelor's and M.Phil. degree in Physics at Princeton University and the University of Cambridge, he is now working at the intersection of waste management and renewable energy with Profs. Ahmed Ghoniem and Alex Slocum. He is the founder of Takachar, a waste-to-energy microenterprise initiative in Kenya. He also has had experience working with technology and design in Uganda, Ghana, and India.*

Abstract

Solid fuel such as charcoal is commonly used for domestic cooking. However, its negative environmental and economic impacts are alarming. Therefore, efforts have been made to investigate ways to replace charcoal by pyrolyzed and waste-derived briquettes. This paper explores the technology, economics, and implementation of charcoal briquettes derived from organic waste through thermal treatments, using the specific case study in Kenya. Given the lack of formal and centralized waste management system in emerging markets, we present a low-cost thermal treatment system to produce charcoal briquettes derived from organic waste. We first present an economic analysis on the domestic cooking fuel consumption pattern, specifically outlining the unmet needs. We then described low-cost technologies that enable the conversion of agricultural residues into substitute charcoal. Subsequently we conducted a survey of commercial efforts to produce green charcoal briquettes from waste, and outline some of the lessons learned from the various business models. Finally, we present a hypothesis on a possible business model that can be utilized by enterprises looking to venture into starting commercial scale operations.

Keywords
waste-to-energy, alternative cooking briquettes, organic waste

New Approaches to Global Energy Technology Development – Lessons Learned from Energy Efficient Light Bulbs, Drinking Water Treatment, and Cookstoves

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Biography of presenting author: *Dr. Gadgil is the Rudd Family Foundation Distinguished Chair Professor of Safe Water and Sanitation, in Civil and Environmental Engineering at UC Berkeley, and Director of the Environmental Energy Technologies Division at Lawrence Berkeley National Laboratory. He has a distinguished record of inventions and innovations, and received many honors and recognitions, including the Sustainability Pioneer Award by SAG/SAM (2010), European Inventor Award (2011), Zayed Future Energy Award (2012), Lemelson-MIT Global Innovator Award (2012), and the PSIPW Award (2013) among others.*

Abstract

Directed development of new technologies to solve specific problems in the developing world is a daunting task. Developing countries can be a wasteland littered with failed technologies sent there with much goodwill and effort from the industrial countries. Drawing on our experience, we summarize our answers to some key questions for the technology designer or developer: How might one go about it? What works and what doesn't? What lessons can one draw from an examination of select successes and failures?

We draw lessons from the development and implementation of three innovations at various stages of development; (1) institutional initiatives to accelerate widespread adoption of compact fluorescent lamps (CFLs) among poor families in poor countries (scaled to seven countries on four continents, now approaching about 100 million customers and saving about $5B annually), (2) UVWaterworks to disinfect drinking water with UV light using low energy at extremely low cost with little maintenance (now reaching over 5 million people daily in 6 countries), and (3) an aspirational and robust energy-efficient cookstove in Darfur, Sudan (32,000 stoves in use, serving 200,000 people and cumulatively saving $58 million in fuel wood costs),

The key lessons from these three examples are: (1) successful technology design and implementation cannot be separated from each other – they are tightly intertwined and the designer must consider the vision and needs for successful implementation from the start, (2) social factors are as critical for a technology's success as factors based on engineering science, and (3) design engineer's ignorance of political economy, behavioral economics, organizational behavior, institutional imperatives, cultural norms and social drivers can prove fatal flaws when the new technology leaves the laboratory and meets the real world.

Keywords
development engineering, water treatment, fuel-efficient cookstoves, CFL

Microfinance Innovation to Foster Green Technology Development

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Biography of presenting author: Before joining BlueOrchard in 2008, Maria Teresa Zappia worked for the European Bank for Reconstruction and Development (EBRD) in Uzbekistan and London. Prior to this, she was a project economist with the Asian Development Bank in Manila, a fellow of the Overseas Development Institute in Swaziland and a trainee at the OECD Development Centre in Paris. She holds a Master of Philosophy in Development Studies from the University of Sussex, and a Master in Economics from the University of Florence.

Abstract
Microfinance institutions and their clients operate in a constantly evolving environment, which has seen financial services become ever more complex. While microcredit in the 1980s and 1990s mainly consisted of small loans to finance basic productive inputs of microbusinesses, microfinance today spans a wide range of products including specialized loans to foster green technology development.

A renewable energy source like solar or wind energy, **biogas** is produced through the breakdown of locally available organic matter, such as manure, sewage or green waste. It can be utilized to produce electricity for cooking, heating and lighting purposes and, when compressed, can replace fossil fuels for use in vehicles. What is more, the fermentation process applied in biogas production yields organic slurry, a secondary product which is highly effective as fertilizer. Thanks to recent developments in applied research, technology solutions such as biodigesters have become widely available for small-scale use across developing nations. While demand for biogas technology has increased markedly, large-scale implementation is hampered by lack of financing as the required investment of USD 400 to 800 often exceeds the capital available to microenterprises and low-income households. Microfinance institutions have therefore started offering specific biogas loans allowing their clients to acquire the necessary equipment for productive purposes.

A study conducted by the BlueOrchard investment team in Asia in 2012 revealed that appropriate biogas financing solutions currently exist in Cambodia, Vietnam, Nepal, Indonesia, India, Bangladesh, Laos and the Philippines, where rural populations at the base of the pyramid have successfully adopted this innovative technology for multiple uses. Microfinance institutions participating in the survey highlighted the proven benefits to their clients, but also underlined the needs for both advisory services and funding to make such products widely available.

Keywords
microfinance, biogas, pro-poor technology solutions, funding, scale

Perception and Satisfaction with Renewable Energy Technologies (RETS): The Case of Solar Villages in Pakistan

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Biography of presenting author: Dr. Bilal Mirza is an Assistant Professor at the Centre for Policy Studies and an affiliated researcher at the UNU-MERIT, Maastricht University, the Netherlands. He holds a PhD in Innovation and Development Studies from Maastricht University, the Netherlands and Masters in Management of Technology from the

Abstract

The main purpose of this paper is to assess the satisfaction towards renewable energy technologies of users and compare it with the perception of renewable energy technologies of non-users. As regards perceptions, we asked questions to nearly 590 rural households in 25 different rural communities from ten different districts of Punjab province in Pakistan, whereas for satisfaction with RETs, we selected two solar villages in the northern part of Punjab province of Pakistan, where solar panels were installed during 2004-2005, as an alternative to on-grid electricity. Our results and discussion highlight some major discrepancies between the perceptions in non-RET communities and actual satisfaction with SHS in solar communities. Recognizing the fact that they might not meet their energy demands by conventional energy sources, rural households in non-RET communities have extremely high expectations of RETs, especially with regard to solar panels/Solar Home Systems (SHS). On the other hand, households that have access to electricity generated by the SHS/solar panels, have high levels of resentment, anger and disappointment with SHS/solar panels.

Keywords

renewable energy technologies; energy access; rural electrification; energy poverty

Putting the End-user First: Towards Addressing the Contesting Values in Renewable Energy Systems Deployment for Low-income Households - A Case of Likoma Island in Malawi

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Biography of presenting author: Collen is a Commonwealth Scholar in the final stages of his PhD research at Loughborough University in the United Kingdom. He is researching novel approaches to development of renewable energy systems for sustainable livelihoods. Collen is a Lecturer of Renewable Energy Technologies at Mzuzu University in Malawi and has experience in design and management of community renewable energy projects. He also served as a member of solar and wind energy committees in the National Project Team on Energy in Malawi.

Abstract

This work is part of an ongoing research in which amongst the objectives, a hybrid photovoltaic-wind-diesel system was modelled for Likoma Island. The modelled hybrid system has potential to reduce the generation cost compared to the existing diesel generators by approximately 34-62% depending on interest rates on financing. However, this would not be enough to reduce the subsidized electricity tariff which is charged at US$0.07 per kWh to users including low-income households. This paper focuses on the energy needs and energy requirements for good well-being; household purchasing-power; prioritization of energy services; and past experiences with traditional and conventional energy sources relating to service satisfaction for households at Likoma Island based on empirical data. The paper discusses potential barriers to meeting the household energy requirements from grid based renewable energy solutions. Approaches for addressing the identified barriers, and the required attributes for new technological solutions are proposed.

Keywords

renewable energy, low-income households, Malawi, Likoma

Decision Making and Planning Framework to Improve the Deployment Success of Decentralized Rural Electrification in India

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Biography of presenting author: Abhishek Jain is a graduate from University of Cambridge with an MPhil degree in 'Engineering for Sustainable Development'. His research and endeavor focus on rural electrification and energy access in developing countries. He is working with an independent research think tank and collaborates with project developers in India to improve rural electrification access in the country. Apart from rural electrification, Abhishek holds experience and interest in enhancing energy and water sustainability in manufacturing industry.

Abstract

300 million people in India lack access to electricity, of which more than 90% live in rural areas. Poor rural household electrification rate (~67%) and lack of electrification infrastructure in remote areas are major challenges. As centralized grid expands, the challenge increasingly becomes to cover the last mile – villages in remote locations with sparse population where grid electrification becomes unfeasible or economically unviable. In the recent past, decentralized rural electrification (DRE), also known as off-grid electrification has emerged as an alternative approach to electrify remote rural areas. The electricity is generated and distributed locally eliminating transmission. Significant number of off-grid projects has been implemented in India by both public agencies and private developers. However, notwithstanding the test of time, more than 20% of commissioned projects are not functional.

To improve the success rate and scaling up of DRE, the present research identifies the factors which played a crucial role in successful translation of off-grid technologies into sustainable solutions. The research involved analysis of existing case studies, unstructured interviews with multiple stakeholders and field visits to DRE sites in India.

The findings indicate that in addition to appropriate technology adoption, the success of DRE depends on successful management of socioeconomic, operational, environmental and economic challenges. This translates to adequate needs assessment, awareness raising, tariff sensitivity to socioeconomic conditions, demand management, capacity building, access to patient capital, high utilization level of plant and sensitivity towards local environment, to enumerate a few.

Based on the research findings, a decision-making framework is developed to assist planning and management of DRE. The multi-tier framework aims to enhance the operational, financial, environmental and social sustainability of projects. It systematically captures the complexity of involved factors which need to be considered for effective decision making of DRE. It is envisaged that improved success rate of projects resulting from implementation of proposed framework would enhance the confidence of policymakers, investors and community in DRE as a sustainable solution to electrify remote rural areas.

Keywords

off-grid electrification, rural electrification, planning and decision making, scaling decentralized electrification

DAY 1 – Wednesday 4 June – Room 1A - Level Garden - 14:30-17:00

[TH2-SE02-11] The Openness Paradigm: How Synergies between Open Access, Open Data, Open Science, Open Source Hardware, Open Drug Discovery Approaches Support Development?

Session Leader: Dr. Sachiko Hirosue, School of Life Sciences, Ecole Polytechnique Fédérale de Lausanne

Co-Session Leader: Dr. Denisa Kera, National University of Singapore

This panel will bring together pioneers and practitioners of various open approaches in science and technology to discuss the opportunities, challenges and synergies in supporting South to South and South to North cooperation for development. Citizen science activities in Yogyakarta (Indonesia) and Bangalore (India) for environmental monitoring, projects, such as the Open Drug Discovery for malaria (Australia) and Open Genomic Data for disaster response (China), but also Open Hardware innovation for affordable laboratory equipment around the world (DIYbio and hackteria networks) define a new paradigm, which needs reflection and evaluation. One of the aims of this panel is to create visibility for these projects, which are successful in their local context, but would benefit from more feedback and support by the international community. They offer a new paradigm for defining an International Development agenda for science and technology cooperation, which involves the Global South as an equal partner. The panel will map and reflect upon these initiatives and case studies.

Open Source Hardware Biomimetic Snake Robot as a Toolkit for Monitoring and Exploring Marine Environments

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Biography of presenting author: Gabriella Levine is an artist and hardware designer interested in the relationship between technology and ecology. Current work includes Protei (open source sailing drones), and Sneel.cc (biomimetic swimming snake robots). She teaches at ITP and CIID, is President of OHSWA.org (open hardware association), and of OCP (global open ocean collaboration platform). She has presented globally at symposia and lectures, received the 2012 Prix Ars Electronica Hybrid Arts Award, and was a fellow of Unreasonable at Sea.

Abstract
Open Source Hardware is an alternative to the patent IP structure. There are many examples of successful businesses openly sharing software, such as Mozilla and Linux, but the rise of the Open Hardware trend is beginning. This growing trend is founded in the belief that sharing ideas, designs, and methodologies can bring technological innovation and manufacturing mainstream on local and global scales, making it easier to engineer new solutions to complex problems. Additionally important to accelerate innovation is applying the practice of Biomimicry that is infusing design and engineering. By taking cues from nature, innovators have increased efficiency of urban infrastructure, proliferated sustainable design, and invented inexpensive and self-replicating materials.
Sneel is an Open Hardware swimming robotic snake, aiming to provide a modular platform for education and research of marine ecosystems. Sneel takes takes a hybrid approach to design by combining the practices of Open Source Hardware and Biomimicry. Sneel's ultimate goal is to lead to massive global impact through modular robotic platforms for education, disaster relief, search and rescue, pipeline exploration, and environmental preservation.

Keywords
open hardware, marine robotics, DIYocean preservation, hacking

Open Hardware Webcam Microscope and its Impact on Citizen Science Jogja River Project

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Biography of presenting author: Nur Akbar Arofatullah (1987) is an independent researcher currently working at the Department of Biotechnology, UGM Yogyakarta, Indonesia. He focused on the field of fermentation techniques in various systems, such as liquid and solid-state fermentation. Several of his main research interests are bioethanol fermentation from sweet sorghum juice, biofertilizer design and production, organic farming, and silage fermentation for cattle feeds. His current research project is an in vitro method for establishing mycorrhizae on elais guineensis trees.

Abstract

The people who hear cannot see, the people who see cannot speak, and the people who speak did not know, such words could simply describe of what currently happen in Indonesia. There is an informational gap between various institutions, which results in regulations that do not benefit people nor match reality, and community practices that do not communicate with the academic knowledge. This presentation will describe projects, which hope to build bridges and offer a model for connecting citizen science and academic efforts to benefit communities.

One such case is the adaptation of the digital webcam cameras to make Digital Microscopes. The principle is very simple, namely, by inverting a readily available commercial webcam lens, we obtain digital images at magnification relevant to microbiology and cell biology. First developed by *Hackteria*, an international art project that focuses on Open Source Biology, the webcam microscope was introduced in 2009 to students at the Gadjah Mada University (UGM). In 2010, we continued the microscopy project in the laboratory and created a DIY Webcam Microscope for the Laboratory of Microbiology, Faculty of Agriculture UGM. Since then, we have built upon and shared new prototypes through workshops from kindergartens to high schools. The aim is to demonstrate the basic principle of microscopy, and to encourage resourcefulness: if you cannot buy one, let us try to build one and learn valuable skills in the process. In conclusion, the progress of DIY lab equipment resulting in various prototypes useful for scientific and community projects also supports education.

Keywords

webcam microscope, water analysis, open hardware, workshops, community development

Intersection of DIY (do it yourself) and DIWO (do it with others) Approaches in Sharing Microbiology Know-how to Benefit Communities

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Biography of presenting author: Joint Universitas Gadjah Mada, Indonesia as Assistant Researcher at Faculty of Agriculture in 1987 but active after completing Ph.D. program in 1996. Actively assist groups of farmers in dealing with their problems, especially in technical matters. Actively support students activities in transferring knowledge develop in laboratories to be available for communities. Since November 2012 was appointed as Deputy Head for Community Services at the Institute for Research and Community Services, Universitas Gadjah Mada to lead community service activities.

Abstract

Universitas Gadjah Mada (UGM) is the oldest public university in Indonesia and one among the mandates it was given is serving community. At the Department of Agricultural Microbiology, Faculty of Agriculture, and the Graduate School of Biotechnology, do it yourself (DIY) and do it with others (DIWO) approaches have been utilized successfully in bridging the university and the communities.

Like many other universities in a developing country which is often constrained by budget, UGM often faces obstacles in the implementation of the learning and research processes due to inadequacy of teaching-learning and research tools and equipment. However, in the spirit of not to give up into insufficiency of funds and equipment, staffs and students of UGM is attempting to establish their own tools for teaching and learning as well as research activities. Clean bench, sterile hood, gel-boxes for electrophoresis, reciprocal shaker, and airlift fermenters were prepared to be used for teaching and learning as well as research activities. The increased availability of open-source DIY inspire us to construct DIY webcam digital microscopes for the same purposes. The constructed DIY webcam digital microscopes have been used to increase the interest of schoolchildren on biological science and the awareness of communities members on water contamination by coliform bacteria. The knowhow on the use of open-source DIY was then also disseminated to vocational high schools.

Results of research conducted using the self-prepared equipment were then disseminated to the needed communities through workshops involving students and communities members with the professor as speakers. One among the projects is odor-reducing techniques for the treatment of cattle dung. The technique, which ensures oxygen adequacy and carbon-nitrogen balance, was disseminated to cattle raiser community using the approach. Soil fertility enrichment at areas affected by Mount Merapi, the most active volcano in Indonesia located at Central Java, Indonesia which erupts regularly, was another project. The volcanic ash which has a low nitrogen content affects crop-yields in the receiving fields. The use of nitrogen fixing and phosphate solubilizing bio fertilizers are important components to enrich soil in a cost efficient renewable way. Workshops have been conducted to make knowledge developed in the laboratory being available to the farmers. Other project is the preparation of silage for cattle feed that can be stored for longer periods of time to be used during the dry season when forage is difficult to be obtained. The conversion of raw materials in the form of forage crops and wastes of agricultural industries such through

fermentation process has been done in hermetically sealed-used chemicals packaging plastic drum for about three weeks. Preparation of bacterial inocula needed to ensure a good quality of silage was also taught in the workshop. Culture media were adapted to inexpensive materials such as molasses, urea and phosphate fertilizer. In this way, farmers can prepare good quality of cattle feeds by themselves using inexpensive resources from their environment. In conclusion, the use of do it yourself and do it with others approaches could benefited local university as well as its surrounding communities.

Keywords
DIY, DIWO, university, community

Open Issues and a Proposal for Open Data Monitoring to Assure Quality, Reliability and Safety in Health Care Devices Targeting Low and Middle-Income Countries

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Biography of presenting author: Kate Michi Ettinger, JD, a Senior Fellow, Center for Health Professions, UCSF, brings over 15 years of cross sector experience to her work at the intersection of health care, bioethics and product design. Kate currently focuses on how to harness new technologies, such as sensors, wireless, mobile – to make it easy, effective and affordable to openly monitor data on quality, reliability and safety for medical devices deployed anywhere in the world.

Abstract
Biomedical engineers and health care entrepreneurs who design medical devices and mobile health applications for deployment in emerging markets face difficulty when deciding whether and how to demonstrate the quality, reliability and safety (QRS) of their products since many middle and low income countries have no uniform system to address QRS issues.
Forty interviews were conducted with multiple stakeholders involved with the product development process.
This paper presents findings from interviews with multiple stakeholders on issues related to quality, reliability and safety (QRS) for medical devices targeting low and middle-income countries. It presents an overview of the current product development process for health care devices designed for low and middle-income markets and illustrates multiple stakeholder perspectives on QRS issues throughout the product development process. From these perspectives, the paper identifies key challenges that entrepreneurs and product designers face when developing products for these markets. Then, the paper describes how a proposed open data monitoring approach to assuring QRS could enable a public-private solution that responds to current market dynamics and builds a robust foundation for future health care tech innovation. Finally, the paper addresses challenges and opportunities to support open science/tech solutions.
There are critical systemic gaps in assuring the quality, reliability and safety of health care devices designed for deployment in low and middle-income countries Open philosophy solutions offer promise in the current market to provide affordable, participatory advances in science and technology. Traditional stakeholders will need to embrace this change in order to foster the full potential of this new open philosophy approach.

Keywords
quality assurance, reliability, safety, bioethics, open data

Crowdsourcing Citizen-Generated Data for Open Science: A Case Study from the 2013 Kenya General Elections

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Biography of presenting author: Nanjira Sambuli is a mathematician, new media strategist and technology enthusiast based in Nairobi, Kenya. She has worked with organizations such as UNEP, Oxfam GB and Global Power Shift, on their pan-African and international new media-based campaigns. On the technology front, Nanjira is the editor of Innovative Africa: The new face of Africa. Nanjira is currently a research manager at iHub, leading the Governance & Technology pillar, where she has developed a framework for the Viability of Election-Centered Crowdsourcing.

Abstract
Crowdsourcing is a participatory activity in which information is collected in a form of small tasks from the crowd over mobile and other ubiquitous devices. In its best form it entails mutual benefit, with the crowdsourcer obtaining

information desired from a vast number of people, preferably in real-time and sharing the findings with the participants. The possibilities afforded by crowdsourcing offer a unique entry point into Open Science, and in particular, Open Research, whose central theme is to make clear accounts of the methodology freely available via the Internet, along with any data or results derived. An active call for participants to engage, a requirement in active crowdsourcing, is a key aspect of opening up the scientific process. Research collaboration, as championed for in Open Science, has a potential to therefore be greatly enhanced through crowdsourcing practices. In this paper, we detail an iHub Research study of crowdsourcing during the 2013 Kenyan general elections and apply our findings to recommendations for Open Science projects, since there are common issues such as the critical number of participants for viability and validity of data. The study found that crowdsourcing could generate valid, useful and verifiable data, even breaking news during elections. A key output of the International Development Research Centre (IDRC)-funded study is a framework for practitioners on the viability, validity, and verifiability of crowdsourced data, which will also help inform future work looking at citizen-generated data in science.

Keywords
crowdsourcing, open science, open research, social media, machine learning

GigaScience: Open Publishing for the Big Data Era

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Biography of presenting author: After training in Biochemistry from Imperial College, and a PhD in cancer genetics at the Royal London Hospital his research mainly focused on cancer cell and molecular biology. After postdocs at the WHO International Agency for Research in Cancer in Lyon and Queen Mary University of London, he was senior scientific editor for the BMC Genomics and Bioinformatics journals before moving in 2010 to set up the GigaScience journal, database and data analysis platform for the BGI in China.

Abstract
Traditional methods of disseminating research such as publication are bottlenecks in the system that are struggling to cope with increasing data volumes, and there is an increasing reproducibility gap that is leading to ever increasing numbers of retractions. New platforms for disseminating data, results and methods are required to maximize knowledge discovery from these precious data resources, and these need to be made freely and conveniently available to the scientific and wider community interested in carrying out curiosity-driven science.

GigaScience is an open-access, open-data journal attempting to revolutionize large-scale biological data dissemination, organization and re-use. Utilizing the experience and data-handling infrastructure of the BGI, the world's largest genomics organization, *GigaScience* links standard manuscript publication with an integrated database that hosts all associated data and provides data analysis tools and computing resources. In addition, open-source platforms such as the popular Galaxy workflow management system are used by *GigaScience* to make publishing more transparent and open by making all of the supporting workflows and methods available, thereby promoting reproducibility which the authors are credited for.

The *GigaScience* platform has already been involved in releasing data during the deadly 2011 German *E. coli* outbreak which aided a global crowdsourcing effort that led to groups around the world, and even bloggers outside of the usual academic environment, to contribute analyses to an open-source GitHub based repository. Many still unpublished genomes have been released to the global community, and workflows and software from a number of scientific papers have been archived and shared in as open, reproducible, transparent and usable form as possible.

With data citation producing evidence of its use in the wider research community, *GigaScience* hopes to revolutionize the publication model with the aim of executable publications, where data analyses can be reproduced and built upon by users without a coding background or heavy computational infrastructure in a more democratized manner.

Keywords
reproducibility, open-data, genomics, crowdsourcing, bioinformatics

DAY 1 – Wednesday 4 June – Room 1C - Level Garden - 14:30-17:00

[TH2-SE02-17] Appropriate Medical Devices: From Lab to Bedside in Resource-Constrained Contexts

Session Leader: Dr. Klaus Schönenberger, EssentialTech Programme, Cooperation & Development Center (CODEV), Ecole Polytechnique Fédérale de Lausanne, Switzerland

What are the key factors in developing, deploying and scaling-up essential medical technologies, for a sustainable impact on public health? For this session, participants are invited to reflect on innovative strategies and key factors of success, as well as the main roadblocks and difficulties undermining the process of developing and deploying essential medical devices in a sustainable way. Four phases can be identified in the process, which are in close interaction with each other. The subject of private sector involvement is pervasive in all these phases and should serve as a common thread: 1) Ideation; 2) Research and Development; 3) Deployment and 4) Scaling-up. Finally but not least, discussing failures may be highly interesting! Case studies and lessons learnt from failures may bring a unique value to the debate.

Appropriate and Affordable Medical Devices in Low Resource Countries: A Perspective from the WHO and other UN Organizations

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Biography of presenting author: Adriana is a Mexican Biomedical Engineer with postgraduate degree in the USA. Has 30 years of professional experience including work in private and public hospitals and being Director of the National Centre for Health Technology in the Ministry of Health in Mexico. Since 2008, she has been working at the WHO leading all the work on medical devices, including areas of innovation, assessment, regulation and management. She coordinates the publication of the medical devices technical series, the compendium of innovative technologies for low resource settings and the Global Forum of Medical Devices.

Abstract

The World Health Organization (WHO) and member states recognize that medical devices are essential for health care delivery in all the continuum of care, from prevention, diagnostics and treatment to rehabilitation; but devices need to be affordable, appropriate, and products of high quality that can be used safely by the patients and health workers .
In the WHO Global Programme of Work 2014-2019, one of the 6 priorities is: Increase access to essential, high quality and affordable medical products (medicines, vaccines, diagnostics and other health technologies). In order to achieve this goal, WHO contemplates 3 main pillars: innovation, regulations and access and safe use, which are to be included in national policies and strategies.
Due to the scientific and technological advances, more than 10,000 types of medical technologies are available in the market, including single use devices, in vitro diagnostics, diagnostic and therapeutic imaging, and many other electro-medical equipment. This extensive variety poses challenging situations from the design and development to fit the needs, the adequate selection, the effective procurement process, the safe use, which mostly depends on the availability of adequate infrastructure and knowledgeable health workers that are trained to use the specific devices and finally the maintenance and decommissioning appropriately.
The 2012 WHO Survey on access to medical device in low resource settings, shows that the two main barriers to product development were lack of financial resources for development and market size to define potential return on investment.
WHO, along with other UN agencies, recognize that the essential medical devices are not widely available, where they need to be affordable and accessible in the health sector, especially in low resource settings, where there is lack of specialized human resources and where the infectious and non-communicable diseases are in the rise. The UN agencies are working together to incentivize innovation and availability of quality medical products. Some examples of these initiatives are: the prequalification of in vitro diagnostics, the dissemination of preferred product profiles to the industry, for specific needs; pricing surveys, transparency in technical specifications and availability of interagency lists of essential medical devices by type of health care facilities and by clinical interventions or for emergencies and disasters, the compendium of innovative technologies for low resource settings and finally programs supporting the local production and technology transfer, considering intellectual property issues and feasibility assessments.
Key factors of success are: understanding the needs, developing user- friendly complex health technologies that can be used for the largest population in the base of the pyramid, and knowing the steps from lab to bed, that have to be considered.
The main roadblocks are unknown market size, regulatory clearances, procurement uptake, trust, availability and compliance of standards, besides the difficulties in deploying essential medical devices in sustainable way.
When designing a medical device it is important to consider that the innovator have not just good academic background but also knowledge of the health care delivery system, so that they can understand the appropriate use

of the technology, determine who the users will be, the context, the difficulties and challenges in regulations, selection, procurement, appropriate use, maintenance and decommissioning, in order to design a better product.

Today, in the XXI century, the needs, challenges and opportunities are many, but the most important is to maintain the values of trust, responsibility, service oriented, accountability and collaboration between UN organizations, academia, and industry and health sector, to be able to give the best health technology appropriate to the final user.

Understanding the "Non Trade-Offs" for a Better Frugal Design in Health Care Sector (India)

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Biography of presenting author: Graduated in 2008 from an engineering school in Cognitive Sciences and Human Factor, Chloé Lecomte started a PhD in 2011 after 3 years working with NGOs and public institutions in Africa. Her PhD research is on frugal innovative practices for the Base of the Pyramid, focusing on socio-technical ecosystem integration into functional requirements. Her field studies are the prosthetics grass root innovation in Vietnam, and energy and health care solutions in India.

Abstract

Designing for low-income population requires new approaches to aim at social, economic and environmental sustainability. Frugal engineering proposes new principles to develop appropriate products for this base of the socio-economic pyramid: by cutting needless costs, one can drastically simplify a product in order to make it accessible. But not surprisingly, "it requires some very sophisticated thinking to arrive at a simple solution". This just-enough approach leads to careful trade-offs, planned during the early phases of product development, to bind the dual objective of lowering costs and increasing utility and quality. Assessment of those trade-offs requires a deep understanding of local context from designers.

We propose a new approach for frugal design. This study aims at understanding the "Non Trades-Offs" that appear while using a product. As Trade Off is defined as an exchange that occurs as a compromise, Non Trade-Off is defined as a " reduced and irreducible set of essential elements that characterize the core of a technological proposal ", i.e. what is not subject to negotiation during design. What is not compromised, in term of functions and features, for designing a frugal technology for low-income population? And can designers integrate these outcomes into their design processes? To answer these questions, we conducted a deep case study of the adaptation of a Health Information System for rural areas in south India. We interviewed the designers involved into the design process to understand what guided their choices. This study was completed with interviews with stakeholders involved around the system to understand their concerns while using it, as well as a review of literature on the Keralais population and the health model. We complete our analysis using other case studies from the same Research-Action project in India and in Vietnam.

The results show that the concepts of value, quality and standards are turned upside down depending on interviewees and contexts. Non Trades-Offs are different from one context of use to another, which define a range of frugal strategies. Practitioners deal with constraints and solutions one by one, making new compromises every time, while designers try to fulfill every requirement equivalently by fitting the new objectives to the specifications of the original system. We propose to combine visions from designers (imposed NTO) and users (emerged NTO) to clarify the space of design possibilities, as well as to gather top-down and bottom-up approach for the Base of the Pyramid.

By fulfilling the core emerging values of users and by understanding the context of design, the product is likely to be acceptable, accessible and affordable. This study gives important insights on essential information for practitioners with providing a reflexive analysis of their expectations and practices, and for researchers by proposing a multi-frugal strategy.

Keywords
frugal design, non trade-off, health device, India

An Autoclave for the Rest of Us

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Biography of presenting author: Jan Huijs is a specialist in health care technology management (and the compilation of standard equipment lists) for health care facilities in low-income countries. He has extensive experience in the preparation of medical equipment tender documents for health facilities; devising rehabilitation programs; planning, implementing and evaluating maintenance structures for health services; installation, repair and maintenance of

health facility equipment in low-income countries; design, programming and implementation of information systems; training in the sterilization of medical supplies; and management of energy use.

HEART was founded by Pieter de Ruijter and Jan Huijs in 1995. Based in the Netherlands, HEART has worked in 18 countries in Africa, Asia and Europe. As well as ministries of health, HEART has worked with bilateral and multilateral organizations, including the UK Department of International Development, the African Development Bank, the European Union, KfW Banking Group, GTZ and the Nordic Development Fund.

Abstract

The international standards for sterile supply are embedded in Western societies; their implementation requires a strong economy. However due to many socio-economic limitations, transferring these standards and the resulting advanced technology to low-income countries is bound to fail. Manufactures are forced to comply with the standards, with a result that appropriate sterilization equipment for this market is not available anymore. Thus, health facilities are forced to either procure highly advanced or cheap substandard equipment. Both choices usually result in poorly or non-functioning equipment.

There is a great need for appropriate sterilization equipment that meets the essential requirements of the standards but which is compatible with local reality. Based on many field visits and training courses on sterile supply in a large number African and some Asian countries, essential specifications were formulated for an appropriate steam sterilizer for resource-poor locations. Key requirements: i) Suitable for typical hospital loads using validated processes; ii) processed load should meet standards in terms of sterility and load dryness and iii) technology and cost should match the socio-economic background.

The essential specifications have been compiled with the objective to receive official approval and thus to provide binding guidelines for manufacturers, procurement officers and health services.

Based on these specifications several prototypes have been developed and successfully field tested. Due to relative high cost and ending of operations of the manufacturer involved, the product did not reach production levels in order to make the design economically viable. In this phase of development the design is to mature with the ultimate goal to market a sterilizer that meets the specifications at a competitive price.

Materials and Suggested Method:
- Fine-tuning the existing design based on an appropriate autoclave of an existing manufacturer. A candidate has been identified.
- Optimize cost while keeping optimal performance, quality and ease of operation.
- Perform additional field tests; adopt design as needed.
- The resulting design should be "open source".
- Marketing the sterilizer to all relevant stakeholders such as (local) manufacturers, procurement agencies, health authorities, NGO's in health care etc.

Envisaged Results:
Improved sterile supply and related positive effects on the health service and thus on the health of the population in target areas.

Discussion and Conclusions:
The large numbers of broken down and poorly performing sterilizers in the field are indicators that there is a great need for approved essential specifications for sterilization equipment. The sterilizer based on the essential specifications should provide a basis for economically viable production and sustainable operation of adequate sterilizers for resource-poor health facilities.

ReMotion Knee: Scaling of an Affordable Prosthetic Knee for Developing Countries

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Biography of presenting author: Sam is motivated to design and implement solutions that reduce poverty, improve access to healthcare and education, and promote social justice. D-Rev's combination of human-centered design, market-driven entrepreneurship, and dedication to sustainable impact made for a perfect fit. Before joining D-Rev, Sam earned his PhD in Mechanical Engineering at Stanford University as part of the Neuromuscular Biomechanics Lab, where he focused on understanding the principles of human movement through simulation. While at Stanford, Sam also co-founded The Pepper Eater, an affordable pepper grinder for women in rural Ethiopia that is now part of Compatible Technology International. Originally, from Florida, Sam also has a BS in Mechanical Engineering from the University of Florida with minors in Material Science and Religious Studies.

Abstract

Amputees living in developing countries have a profound need for affordable and reliable lower limb prosthetic devices. The World Health Organization estimates there are approximately 30 million amputees living in low-income countries, with up to 95% lacking access to prosthetic devices. Effective prosthetics can significantly affect the lives of

these amputees by increasing the opportunity for employment and providing improvements to long-term health and well-being. However, current solutions are inadequate: state-of-the-art solutions from the US and Europe are cost-prohibitive, while low-cost devices have been challenged by poor quality and/or unreliable performance, and have yet to achieve large scale impact. The introduction of new devices is hampered by the lack of a cohesive prosthetics industry in low-income areas; the current network of low-cost prosthetic clinics is informal and loosely organized with significant disparities in geography, patient volume and demographics, device procurement, clinical and logistical infrastructure, and funding. At D-Rev (Design Revolution) we are creating the ReMotion Knee, an affordable polycentric prosthetic knee joint that performs on par with devices in more industrialized regions, like the US and Europe. As of September 2012, over 4,200 amputees have been fitted with the initial version of the ReMotion Knee through a partnership with the JaipurFoot Organization, with an 80% compliance rate after two years. We are currently scaling production of the ReMotion Knee using centralized manufacturing and distribution to serve the existing clinics in low-income countries and increase the availability of devices for amputees without access to appropriate care. At D-Rev, we develop products that target these customers through economically-sustainable models and provide a measurable impact in the lives of the world's amputees.

Keywords
affordable prosthetics, mobility aids, developing countries, above-knee amputees, scaling strategy

The Ifakara Wellness Box: A Low-cost Mosquito Control Device that also Supplies Essential Electrical Power

Fredros Okumu[1], Nancy Stephen Matowo[1,2], Salum Mapua[1], Arnold Mbmando[1], Stephen Mwangungulu[1], Emmanuel Kaindoa[1,3], Edith Madumla[1], Irene Moshi[1], Robert Sumaye[1] and Dickson Lwetoijera[1,3]

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Biography of presenting author: Fredros is a scientist at Ifakara Health Institute, Tanzania. He is trained in public health and in Geo-information Sciences and has PhD in Infectious Tropical Diseases. He researches disruption of human-mosquito interactions, prevention of child malnutrition, quantitative ecology of pathogens and optimization of malaria interventions. His group has developed mosquito control devices baited with synthetic attractants that mimic humans, and innovative housing for marginalized communities. Fredros was awarded the American Society of Tropical Medicine and Hygiene Young Investigator Award in 2009 and is a Wellcome Trust Intermediate Research Fellow in Public Health and Tropical Medicine.

Abstract
Background: Significant efforts have been made to scale up appropriate interventions against malaria, an infectious tropical disease that affects more than 200 million and kills 600,000 people annually, over 80% of them being sub-Saharan African children. Efforts over the past decade have led to significant gains including >50% decline in malaria prevalence in Tanzania. However, there are still major challenges facing malaria elimination, for example the fact that today's best interventions such as long-lasting insecticide treated nets (LLINs) and house spraying with residual insecticides (IRS), mostly target mosquitoes that enter human houses, but are less effective against outdoor-biting and early-biting mosquitoes, as well as insecticide resistant mosquitoes. To achieve malaria elimination there is need to develop complementary strategies that target outdoor malaria transmission not effectively controlled by current indoor interventions.
The idea: We at Ifakara Health Institute (IHI), have developed a new mosquito control device that effectively mimics real humans, and can be used to lure and kill disease transmitting mosquitoes outdoors, thus complementing current malaria prevention methods such as LLINs and IRS that are used indoors. These devices are baited with highly attractive human-derived odors also developed at IHI and proven to attract 4 times more mosquitoes than humans. In addition to attracting and killing potentially infectious and nuisance mosquitoes, this device, which is powered by solar energy, also provides basic household energy for lighting, pupils' home-study and mobile phone charging, making it more useful and acceptable in rural and remote communities, such as rural Tanzania, where mains electricity coverage is <5%.
Research and development: Using locally constructed experimental prototypes, we have completed testing and evaluation on the device, which demonstrated high efficacy of the designs against most disease-transmitting mosquitoes, including major African malaria vectors *Anopheles arabiensis and An. funestus*. We also demonstrated that local communities in rural Tanzania would readily accept, use and even pay for this technology, mostly because of the added value as an energy source.
Deployment and scale-up: Various forms of distribution have been proposed, including market-based financing and government subsidies. We are currently exploring partnerships to produced industrial versions of the device, which could be scaled up in rural and remote communities. To improve usefulness and impact, we will rely on peripheral health facilities, which in most developing countries do not have efficient electricity supply to perform basic

operations, but which would be effective hubs for training and distribution of these devices to neighboring communities.

Expected results and benefits : If these outdoor devices are located in optimally selected sites in malaria endemic villages where majority of people already use LLINs, significant proportions of mosquitoes would be lured and killed nightly, eventually lowering overall malaria vector densities and human biting rates, disrupting transmission, and significantly reducing malaria prevalence in human populations. This hypothesis has already been corroborated through mathematical evaluation, which suggested that in hyper-endemic communities with LLINs, we would need $\geq$20 devices/1000 people, to reduce transmission to malaria elimination thresholds

Keywords
mosquitoes, rural electrification, malaria control

DAY 2 – THURSDAY 5 JUNE 2014 – MORNING

What are the Techno-socio-economic Aspects that are Influencing the Success of the Development, Implementation, Maintenance and Spreading of Appropriate Technologies for Access to Energy?

Session Leader: Mr. Bertrand Klaiber, Cooperation & Development Center (CODEV), Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland

**TH2-SE02-06 – Room 1C – Level Garden
10:30-12:30 – Thursday 5 June 2014**

Stevens, Lucy	UK	Practical Action (United Kingdom)	Towards Universal Energy Access: The Energy Market System Framework
Mayer-Tasch, Lucius	DE	Deutsche Gesellschaft für Internationale Zusammenarbeit (Germany)	Promotion of Productive Use of Energy in Developing Countries – An Overview of Existing Approaches
Mattarolo, Lorenzo	IT	Politecnico di Milano (Italy)	An Integrated Monitoring and Evaluation Approach for the Assessment of Energy Technologies-related Projects
Ngounou, Guy & Gonin, Michaël	CM CH	Ecole Nationale Supérieure Polytechnique de Yaoundé (Cameroon); University of Lausanne (Switzerland)	Holistic Approach to Sufficient, Reliable, and Efficient Electricity Supply in Hospitals of Developing Countries – Cameroon Case Study
Devaux, Rémi	FR	Schneider Electric (France)	Energizing rural communities in Sub-Saharan Africa
Toniniaina Arifenitra, Rakotozanakajy	MG	Assoc. Jeunes Intellectuels Promoteurs et Acteurs de Développ. (Madagascar)	Hydroelectric Network: Villagers, Energy and Environmental Stakes

Community-Driven Innovation: Communicating Living Labs Essentials in the Developing World

Session Leader: Ms. Tunde Kallai, Prolog GmbH, Switzerland, European Network of Living Labs (ENoLL)

Co-Session Leader: Mr. Konte Papa Amadou, Dakar City Municipality, Senegal

**TH2-SE02-07 – Room 2C – Level Garden
10:30-12:30 – Thursday 5 June 2014**

Kaabi, Lotfi	TN	Tunisian Presidency (Tunisia)	Dignity Corps, An Innovative Approach to Eradicate Poverty. The Tunisian Model
Sow, Adama	SN	Media and ICT Expert (Senegal)	Media Living Lab Concept for Sub-Saharan Africa
Pudjiatie, Chandra Rinie	IT	Aflatoun, Child Savings International (Netherlands)	The Co-Production of Aflateen Digital E-Learning Platform
BaOthman, Fatmah	SA	King Abdul Aziz University (Saudi Arabia)	Living-Labs as E-learning Cloud Environment: Reforming GCC Educational System
Pamuksüzer, Ersin	TR	Basaksehir Living-Lab (Turkey)	Living-Labs For Community Development and Start-Up Businesses through the Experiences of Basaksehir Living Lab, Turkey

DAY 2 – THURSDAY 5 JUNE 2014 – MORNING

TH2-SE02-13-a – Room 3C – Level Garden 10:30-12:30 – Thursday 5 June 2014

How Can We Co-design Technologies with (and not for) Vulnerable and Poor Communities?

Session Leader: Dr. Andrés Felipe Valderrama Pineda, Aalborg University, Denmark

Co-Session Leader: Dr. María Catalina Ramírez, Universidad de los Andes, Colombia

Ceperley, Natalie	US	Ecole Polytechnique Fédérale de Lausanne (Switzerland)	Lessons Learned From a North-South, International, Cross-Cultural, Inter-Institutional, and Interdisciplinary Research-Development Project Aimed to Benefit "Base of the Pyramid" Farmers with Hi-Tech Research
Faborode, Michael & Ogunwande, Gbolabo	NG	Obafemi Awolowo University (Nigeria)	Development of a Bio-digester and Biogas stove for Rural Women Entrepreneurs
González Forero, Ana María	CO	FEM Fundation for Multidimensional Education (Colombia)	My Home Is a Lab. UPYA, Post-Disaster Housing Solution in Sincerín, Colombia
Lleras Manrique, Ernesto	CO	Universidad de los Andes (Colombia)	Learning Communities for Local Economic and Technological Development in Bogota
Pedersen, Signe	DK	Aalborg University (Denmark)	Design With People – Locals as Co-Creators
Srinivas, Sudarshan & Shrivastava, Sunil	IN	Reliance Foundation (India)	Co-design is Co-Commitment to Sustainability: Marginal Farming Communities Experiences in Creating Rainwater Harvesting Technologies Jointly with Reliance Foundation
Ndwe, Tembalethu Jama	ZA	Rhodes University (South Africa)	Methodologies Utilized in the Co-design of IVR Systems in Vulnerable and Poor Communities

TH2-SE02-14 – Room 5C – Level Garden 10:30-12:30 – Thursday 5 June 2014

Technology in Global Health: Exploring New Paradigms

Session Leader: Dr. Leo Anthony Celi, Laboratory of Computational Physiology, Division of Health Science and Technology, Harvard Medical Institute, Massachusetts Institute of Technology, United States

Co-Session Leader: Dr. Vipan Nikore, Department of Internal Medicine, Cleveland Clinic Foundation, United States

Meyers, David	US	Tufts University School of Medicine (US)	Creating a Culture of Quality Health Care in Resource Limited Clinical and Community Settings; A Necessary Prerequisite to Technological Intervention
Raghu, Arvind	IN	University of Oxford (United Kingdom)	Lessons from the Evaluation of a Clinical Decision Support Tool for Cardiovascular Disease Risk Management in Rural India
Quesada, Jose Eugenio	PH	Asia Pacific College (Philippines)	Building an Ecosystem to Provide Sustainable eHealth Technical Capability for the Philippines
Springer, David	ZA	University of Oxford (United Kingdom)	Evaluating Open-source mHealth Solutions to Chronic Disease Management in Resource-Poor Settings
Katanu, Jane	KE	Medic Mobile (Kenya)	Mobile Technology as a Tool for Incentivizing Community Health Workers & to Improve Utilization of Maternal and Child Health Services in Low-Income Countries
Bosl, William	US	University of San Francisco (United States)	Integrated Information Technology for Low-cost Community-based Pediatric Psychiatric Healthcare

DAY 2 – THURSDAY 5 JUNE 2014 – MORNING

TH3-SE03-02 – 4C – Garden Level 10:30-12:30 – Thursday 5 June 2014	**Tools and Techniques for Measuring Technology Impact: From Wireless Sensors to Experimental Field Trials** *Prof. Ashok Gadgil, Lawrence Berkeley National Lab (LBNL), University of California Berkeley, United States*			
	Winter, Amos	US	Massachusetts Institute of Technology (United States)	Balancing Depth and Breadth while Experimentally Validating Medical Technologies for Developing and Emerging Markets
	Chang, Angela & Tilahun, Lidet	US ET	Massachusetts Institute of Technology (United States); One Laptop per Child (Ethiopia)	Data Collection for Literacy Tablet Reading Project in Rural Ethiopia
	Das, Abhijit	IN	Kandi Raj College (India)	Essentials in a Technology for Development: From Field Experiences on Arsenic Mitigation Technology Deployment Strategy in India
	Wilson, Daniel	US	University of California, Berkeley (United States)	Comparing Cookstove Usage Measured with Sensors Versus Cell Phone-Based Surveys in Darfur, Sudan
	Thomas, Evan	US	Portland State University (United States)	Use of Electronic Sensors to Improve the Effectiveness of Environmental Health Interventions In Developing Countries

DAY 2 – Thursday 5 June – Morning

Room 1C - Level Garden - 10:30-12:30

[TH2-SE02-06] What are the Techno-socio-economic Aspects that are Influencing the Success of the Development, Implementation, Maintenance and Spreading of Appropriate Technologies for Access to Energy?

Session Leader: Mr. Bertrand Klaiber, Cooperation & Development Center (CODEV), Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland

Universal access to energy involves a comprehensive approach to developing and deploying clean, affordable and reliable solutions in a sustainable and scalable way. This session aims to explore key leanings and success factors to provide access to energy to remote or resource-poor communities in a global perspective. This involves considering a large panel of appropriate technologies from energy production, distribution and storage to safe and efficient usage. The comprehensive outlook requires considering the whole life cycle of the products and solutions as well as the entire value chain including all the stakeholders, from global to local players in the private sector, public authorities and civil society alike.

Towards Universal Energy Access: The Energy Market System Framework

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Biography of presenting author: Dr Lucy Stevens is Senior Policy and Practice Adviser for Practical Action, where she has worked for the last 12 years. As an International NGO, Practical Action has been involved in implementing energy projects across Africa, Asia and Latin America over more than 30 years. These have covered a range of types of energy supplies and services including extensive work on mini-grids from micro-hydro and wind, household electricity, and cooking solutions. We have become widely known for our publication of the Poor People's Energy Outlook, and as one of the few NGOs actively engaging in the SE4ALL initiative at the international level. Practical Action has been part of the working group together with the World Bank working on the Global Tracking Framework, inputting our ideas around Total Energy Access. As well as working on energy access issues, Lucy has a particular interest in urban poverty. She was educated at Oxford and Sussex Universities, with a doctorate from the School of Geography and the Environment, Oxford University.

Abstract

Building on the concept of the energy access ecosystem, this paper presents the "Energy Market System Framework" recently developed by Practical Action to facilitate sustainable energy market creation for improved access to modern energy services in areas of energy poverty. Energy access and energy poverty have been identified as major global challenges to overcoming global poverty and socio-economic inequality. These challenges relate not to the unavailability of technology but rather to its inaccessibility. These are therefore issues of technology justice, which lies at core of Practical Action's work. In efforts to address these challenges, the Energy Market System Framework, versions of which have been trialed in Thailand, Malawi, Nepal and Rwanda, maps and designs specific energy market systems to expand energy access to more and poorer people. The approach begins with an analysis of energy market chains, followed by an analysis of national level policy, capacity and finance dimensions. The framework enables identification of pathways for action towards achieving universal energy access and technology justice in energy provision. This paper outlines the functionality of the Energy Market System Framework, which recognizes a range of energy services as well as multiple levels within each energy market system that collectively can deliver total energy access using a mix of energy sources and a range of technologies.

Keywords
energy access, energy poverty, ecosystem, technology justice, markets, cookstoves, clean cooking, national

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Promotion of Productive Use of Energy in Developing Countries – an Overview of Existing Approaches

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Abstract

Energy access programs are often justified on the basis of expected socio-economic benefits resulting from 'productive uses' of energy such as increased income and additional employment creation. Productive uses of energy (PUE) are important, not only because they act as the main channel for translating energy access into poverty reduction through increased employment and incomes but also because of their role in securing the sustainability of energy access programs. However, public authorities, utilities and development partners are still not systematically integrating PUE promotion in the design of energy access and rural electrification programs. One reason is the general lack of knowledge within electric utilities, energy ministries and energy departments of donor institutions regarding issues not directly related to energy. This paper attempts to start filling the knowledge gap of those in charge of planning and implementing energy access projects about how PUE can be actively promoted. Based on a review of existing experience with PUE promotion, the paper (i) identifies and discusses five different PUE promotion approaches that have been used by governments, utilities and development organizations and (ii) describes the institutions involved in PUE promotion as well as the roles they typically perform.

Keywords

Productive use of energy, electrification, PUE promotion

An Integrated Monitoring and Evaluation Approach for the Assessment of Energy Technologies-related Projects

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Abstract

In order to entail sustainable benefits over time, energy projects for local development should take into account certain local socio-economic aspects that influence the success of the implemented technologies, providing appropriate solutions for target communities. To evaluate the success of new energy solutions, project Monitoring and Evaluation (M&E) should assess the achievement of expected project objectives, but also monitor recipients' roles into project activities and development strategies. Hence, this paper aims to propose an Integrated M&E approach which, relying on already recognized and used frameworks, allows to monitor people-oriented components relevant for the project success. This integration is achieved by combining the M&E phase in the Project Cycle Management provided within the *Logical Framework Approach* and the rational used in the *Sustainable Livelihoods Framework*. While the first represents a widely used tool to assess the achievement of the project steps, the integration with the latter allows: (i) to consider the importance of the recipients' roles within project activities in order to induce livelihoods changes at local level, and (ii) to focus on the target community's livelihoods improvements as key aspect for the project's long-lasting success. From this viewpoint, the Integrated M&E approach may help to setup an effective set of indicators, in order to perform a comprehensive and people-oriented evaluation of the project. The proposed Integrated M&E approach has been applied to a EU-funded Energy Facility project implemented by the Italian NGO COOPI in Malawi.

Keywords

energy technologies-related projects, monitoring and evaluation, logical framework approach, sustainable livelihoods framework

Holistic Approach to Sufficient, Reliable, and Efficient Electricity Supply in Hospitals of Developing Countries – Cameroon Case Study

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Biographies of presenting authors: Guy Ngounou obtained a Certificate of Electrical Engineer and an MSc at the National Advanced School of Engineering of Yaoundé. He is currently a PhD Student at the University Research Center on Energy for Health Care (CURES) based in the same school. Michael Gonin is research coordinator at the University of Lausanne and teaches social entrepreneurship at the EPFL. He obtained his PhD in the field of business ethics at the University of Lausanne (HEC) and is especially interested in issues related to business ethics, business-society relations, social entrepreneurship, as well as the meaning of work in relation to personal values.

Abstract

While health technology has shown constant improvements in industrialized countries, developing countries have not been able to take full advantage of this evolution, partly because of unstable power supplies. According to a WHO study, grid failures are responsible for one third of medical device breakdowns. Therefore, the global slogan "Health for All in the Third Millennium" requires a reliable and sustainable electricity supply in hospitals.

This paper presents a power backup and electricity stabilization system that takes into consideration the technical constraints as well as the socio-economic factors impacting electricity supply in Cameroonian hospitals. The solution needs a robust, cost-effective, and easy-to-operate technology which allows uninterrupted functioning of vital medical equipment and protection from grid failures. At the same time, the implementation of such technological solution requires taking into account the socio-institutional context of the hospital and of its environment. Preliminary sociological studies highlight the impact of organizational culture, hierarchy, and professional education on the ways technical material is installed, maintenance ensured, and failures addressed. From an economic perspective, technical weaknesses imply higher energy costs as well as higher health costs and lower revenues. Conversely, preliminary studies suggest that the costs incurred in the installation and maintenance of a stable electric system can partly be compensated through energy saving and additional medical treatments resulting from increased availability of medical devices.

The Problem Tree Analysis Method used in this paper allows for identifying interactions between technical and socio-economic factors leading to electricity breakdown and hence for developing more holistic solutions to hospital electricity supply. Due to its multi-dimensional nature, this project actively involves scholars from the North and the South specialized in engineering, social and political sciences, as well as management. It is coordinated by the new research center on energy for healthcare (CURES) based at the National Advanced School of Engineering in Yaoundé (ENSPY) in partnership with the EPFL and the University of Lausanne.

Keywords
hospitals, electricity, socio-economic aspects, problem tree analysis

Energizing Rural Communities in Sub-Saharan Africa

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Biography of presenting author: I work as a social business development manager for Schneider Electric's access to energy program, with a focus on decentralized rural electrification. My role is to build and manage partnerships with development aid actors and to start access to energy projects. Prior to this position, I used to work as a sustainability performance manager at Schneider Electric and as a consultant in sustainability strategies at Utopies (Paris).

Abstract

As the global specialist in energy management, Schneider Electric has launched in 2009 a program to bring access to reliable, clean and affordable energy for underprivileged populations. The Group has the capacity to promote access to energy worldwide through a sustainable economic approach. Steered by the Corporate Sustainability Direction, teams, offers, supply chains have been created from scratch with the aim of becoming a recognized leader on the access to energy market and of improving living conditions & sustainable development at the Base of the Pyramid.

In 2010, the Access to Energy program has started to design and develop a low energy photovoltaic solution for villages called Villasol. It aims at meeting the essential energy access and development needs of isolated off-grid villages. Those villages have very limited access to energy: public facilities usually do not have electricity, households use oil lamps or candles for lighting and shops sometimes power a few appliances with diesel generators. With Villasol,

a micro power station installed at the heart of a village offers services to the community such as a cinema, computers, sewing machines, cold beverages, fruit juices or mobile phone charging. Appliances and machines are powered in 220V AC and maintained by a village operator who sells services (and not kilowatt/hours) to the villagers. The operator is trained by Schneider Electric or by local partners.

Private houses are not connected to the minigrid. A service of small battery renting power individual high quality LED lamps fixed on the house walls. When relevant, a solar water pumping station can be added to the solution.

A stress has been put on the local revenue generation to sustain the energy solution: services are all sold at prices set in cooperation with local partners (NGO, village management committee, rural electrification agency, etc.) and must cover all costs in the long run.

The micropower stations (2kW and 4kW) have been tested in the field, standardized and industrialized by Schneider Electric in Egypt to meet the needs of 30 to 100 houses – the size of a majority of Sub-Saharan African villages (200 to 800 inhabitants). When relevant, components such as solar panels or batteries are purchased locally. We develop Villasol where Schneider Electric has local offices (in particular in Senegal, Cameroon, Nigeria and Benin) to ensure technical support and local project management. We work with various partners (NGOs, public authorities and local companies) and on different project types (applications to calls for project, direct sale to public authorities, co-creation of projects from scratch). We financially support the achievement of demonstrators that showcase our technical know-how and prove economic & social benefits in case of high potential partnerships with replicable model.

By end 2013, Schneider Electric has electrified about twenty villages with Villasol – a halftone success for an industrialised solution. What is the learning of Villasol experience? What are the areas for improvement to scale up?

Keywords: decentralized rural electrification, revenue-generating activities, learnings

Hydroelectric Network: Villagers, Energy and Environmental Stakes

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Biography of presenting author: Toniniaina Arifenitra RAKOTOZANAKAJY holds a PhD in Energy from the University of Fianarantsoa in Madagascar. Currently, working for GRET as an eletromechinical engineer and Head of Mission, he participates in the implementation of various hydropower development programs. He also heads the renewable energy course at the University of Fianarantsoa.

Abstract
Where should start to place a decentralized rural electrification based on the renewable energies in Madagascar at the community, regional or intercommunity level?

There was lack of investment on hydraulics power during decades and most of thermal using diesel is increased considerably; its effect is returning the sector vulnerable facing the external fluctuations of the barrel prices.

In Madagascar, the rate access into the electricity is low, according to the Instat (National Statistical Institute); this rate was around 12% on 2010 (among the lowest rate in the world). The contrast between rural and urban area are respectively 4.8% and 39%. Indeed, our contribution wants to draw up an effort list leaded at the community, intercommunity or regional level, within the decentralized rural electrification sector where renewable energies causes a particular interest from Malagasy government, the financial backer, organization of development and privates operators.

Actions in favor of the renewable energies development in Madagascar, located in the Indian Ocean, 400km from Mozambican, allow effectively increasing the rural electrification rate that currently represent, lower than 5% according to the statistical. This initiative aims to promote social and economic development of rural area that group 70% of the Malagasy population. Otherwise, it is also supposed that, because of this program, the population far from electrical network in the township hand modern energies well adapted. Then, a well define approach allow to reduce greenhouse gas emission and protect the Malagasy environment that witnesses more and more of an alarming situation.

After 8 years of sites study realization with financial backers and private operators and the strong experience in Madagascar, in collaboration with the rHYviere program and the GRET NGO in Madagascar, the Energy and Mining Ministry and private operators working in the energy sector, a socio – economic survey tools and a model of watershed protection study has been conceived. This tool is the basis of the financial analysis of the rural hydroelectric network realization. It aims to determine socio – economic and environmental aspects before the electrification of one community by the use of hydroelectric energy. Within the 9 rural communities in the island, the target population are 25 000.

Keywords: capacity to pay the hydroelectricity, willingness to pay, kilowatt-hour, basic lamp, monophase meter, triphase meter, invoicing

DAY 2 – Thursday 5 June – Room 2C - Level Garden – 10:30-12:30

[TH2-SE02-07] Community-Driven Innovation: Communicating Living Labs Essentials in the Developing World

Session Leader: Ms. Tunde Kallai, Prolog GmbH, Switzerland, European Network of Living Labs (ENoLL)

Co-Session Leader: Mr. Konte Papa Amadou, Dakar City Municipality, Senegal

The members of urban, rural and remote communities need sustainable development support in order to create jobs alleviate poverty, to improve the human skills, to use the technological innovations and communication platforms/systems and services if possible by the cheapest way. In order to do so they need an open multidisciplinary platform and system, thinking and supporting their living environment which can be facilitated by the Living Labs. The Living Lab approach provides its user group with an opportunity to develop a much deeper understanding of how the various components in their functional environment operate and interrelate. Living Lab leaders from various countries are invited to describe and explain by their experiences, which frameworks, incentives, catalysts and policies they developed or they are using. In summary: What are successful processes to develop and deploy essential technologies?

Dignity Corps, an Innovative Approach to Eradicate Poverty: The Tunisian Model

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Biography of presenting author: Dr. Lotfi Kaabi, 52, Tunisian and British bi-national, has obtained a BS in Geophysics, PhD in Remote Sensing (University of Toulouse, France), an MBA MS in Economics. He studied and worked in several countries including USA, France, Slovenia, Spain, Russia, Germany, UK. In the last 5 years, his focus turned to social innovation to fight poverty. Currently he is the advisor to the Tunisian president and creative producer of 'Dignity Corps', an innovative concept that aims to fight poverty

Abstract

Poverty and social exclusion are the main barrier to development in Tunisia and although they were in the center of the Tunisian revolution of dignity, the successive governments that came since the January 14, 2011 have failed to address those issues and to lay the foundations of a 'pro-revolution' social policy that tackles them successfully.

Over the last 2 years, the Presidency of the Tunisian Republic brought together policy makers, civil society and private stakeholders with the aim to devise an innovative and revolutionary approach to tackle poverty and exclusion and build participatory democracy. The product of this collaborative work is a project entitled 'life with dignity for all' that offers a three-dimensional approach that can help eradicating poverty and laying the foundations for sustainable local development. In this approach, poverty is addressed in its four dimensions - education, health, living conditions and Emancipation and at the micro regions level. Such intervention is performed in a dynamic and transformative way, migrating local communities from the state of poverty to the safe area of sustainable development.

The core principles underlying our approach are: (1) **People-centricity**: sustainable poverty eradication will be achieved only if external support focuses on what matters to people, understands the differences between groups of people and works with them in a way that is congruent with their current livelihood strategies, social environment and ability to adapt. (2) **Responsiveness and participation**: poor people themselves must be key actors in identifying and addressing livelihood priorities. Development agents need processes that enable them to listen and respond to the poor (3) **Multi-level**, ensuring that micro-level activity informs the development of policy and an effective enabling environment, and that macro-level structures and processes support people to build upon their own strengths. (4) **Partnership**: Our activities must be conducted in wide partnerships that include the public, civil society and the private sector. (5) **Sustainability**: there are four key dimensions to sustainability - economic, institutional, social and environmental sustainability. (6) **Dynamicity**: external support must recognize the dynamic nature of local development strategies, respond flexibly to changes in people's situation, and develop longer-term commitments.

In order to achieve our purpose, we have designed the project as a social franchise with Civil Society being the franchisor and Community Action Agencies as franchisees – those are local social enterprises' that comprise of 9 people with expertise in the various poverty indicators and who will carry the mission of helping their community to address the various faces of poverty and creating and coaching proximity social enterprises that are funded by a dedicated Social Innovation Fund. An initial investment of 12 MD was set up to conduct a the pilot project that covers 3 governorates and create 28 Community Action Agencies and 200 Proximity Social Enterprises in the fields of education, health, habitat, environment, agriculture, culture, information and communication

Keywords: multidimensional poverty, endogenous development, community action, social enterprise

Media Living Lab Concept for Sub-Saharan Africa

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Biography of presenting author: Adama Sow is a well know journalist and media analyst in Senegal. He managed the media office in the Ministry of Communication over a decade. He is also the man behind Youssou Ndour successful media project called Futures Medias which is the leading press group in Senegal. Mr. Sow ran the radio 7Fm and he teaches communication and social changes in several high academic institutes. He is a consultant for GNSS-EU-Africa project. He is a TV and radio anchor for many decades, one of Senegalese media well known journalist.

Abstract

The purpose of the paper is to discuss how media Living Lab can make a difference for their communities and to promote grass root social changes.
The media play a role in community development. In Africa, especially in Senegal, community radio stations play a very important social and economic role for the poor in rural and remote areas populations. It is here from experiments Def Leng and Manore Fm, two community media which caused an extraordinary change in Sereres a marginalized ethnic group in Senegal and women for Manore Fm. The presentation will also discuss the use of technology and innovation to help the media to develop the endogenous and tailored solutions. Ngoudiane a rural community became a model in the adoption of technological innovations to promote activities that led to women's groups and youth to earn a living and get out of poverty.
The approach of our Living Lab is based on the involvement of users and beneficiaries throughout the process of decision and management. The paper raises the problematic ownership of innovations by the Clients communities.
How media and technology can promote endogenous development and create wealth, it is the goal of our work.
Health, education, freedom of expression, participation and income-generating activities are the priority areas of the experiment carried out in these communities.

Keywords
Living Lab, media, innovation, social media, startups, social value, open community, user centric open innovation

The Co-Production of Aflateen Digital E-Learning Platform

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Brief biography of presenting author: Chandra Rinie Pudjiatie is currently E-learning Coordinator at Aflatoun, Child Savings International where she has led the development of Aflateen Digital. With a background in industrial design, Chandra was an Academic Researcher at Delft University of Technology and is a company mentor at Aflatoun where she supervises postgraduate master students.

Abstract

This paper presents a case study outlining the development and implementation of Aflateen Digital, an innovative, online e-learning platform helping young people explore social and financial education. The paper shares the experiences of a team of young people, teachers, designers and researchers working across continents in developing the platform. It goes onto explore the practical challenges around collaboration and co-production, the interaction between indigenous and exogenous knowledge, and how the results of such innovation can address wider challenges to education and development.
Aflateen Digital was envisaged as part of a wider global educational initiative to equip young people with the confidence and skills to develop social and financial enterprises in their community. The platform was co-designed with young people using an iterative, agile methodology. This process brought together young people with teachers, researchers and developers to explore how the platform would take shape, informing the design framework and the platform's functionality.
Aflateen Digital is now being rolled out with the support of partners across the globe, including parts of Africa, South America, and Asia. It presents new opportunities for promoting positive educational outcomes for young people in low and middle-income countries. It is also addressing some wider challenges to education and development, including barriers to access and program fidelity.
Aflateen Digital demonstrates the efficacy of co-production as a means of successfully and sustainably harnessing the potential of emergent technologies. It has allowed communities of young people to shape responses to the challenges they face, whilst creating space for the development of new forms of knowledge and expertise. Although challenging, co-production can effectively mediate the relationship between indigenous and exogenous knowledge, empowering

and enriching both. Aflateen Digital presents a useful case study to those wishing to develop complex technology projects with a global reach using a participatory methodology.

Keywords
e-Learning, co-production, digital innovation

Living-Labs as E-learning Cloud Environment: Reforming GCC Educational System

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Biography of presenting author: Fatmah BaOthman, gained her PHD in AI from the College of Engineering and Computing in the United Kingdom. She has worked in education for the past 20 years and held administrative and technology positions even outside the university (GM IT Security, Apple Center Manager, Director of E-learning), got involved in family business and provided consultations. She participated in establishing the CS Dept. for Women, forming the University IT Strategic Plan and the National Strategic IT Plan-KACST. She represented academics in the 55th political celebration (KSA and Austria), participated in Saudi Shura District Council, represented the region in the IEEE congress (Paris) and represented educated women. She was the Chairwomen (IEEE) Woman in Engineering-Western region, the president of the Women Committee Engineers at "Saudi Council of Engineering. She won funded researches, worked in translating and coined more than 500 Arabic technological terms.

Abstract
The purpose of the paper is to discuss ways of reforming education in GCC using Living Labs in E-learning cloud environment technology.

This paper will provide a new vision to reform education of research and e-learning in GCC countries via certified technology framework and clear standardization and policies process insuring high return on technology investment for all stakeholders via Living Labs methodology and cloud technology.

The Living Labs model will particularly support the different e-learning processes such as web-based learning (wb-learning), virtual learning (v-learning), digital collaboration learning (dc-learning), distance-learning (d-learning), blended-learning (b-learning), mobile-learning (m-learning), simulated-learning (s-learning) and interactive television learning (ITV-learning), video-conference learning (VC-learning). The Living Labs technology allows professional professors to deliver their courses via the intranet, internet and extranet to a world theatre classroom via Living Labs to any sectors. Students will have flexible system for second-life learning and real experiments; administrations will be aware of any activities to support high-level decision making in real time; and commercial and industrial sectors will gain enormous benefits as well. This Living Labs' model of international standards will create a unified working e-environments by applying living lab concepts and standardizations for human, robots or digital agents interacting with the system including leaders, administrators, professors, students, parents, investors and digital creatures. Within such a dynamic integrated intelligent environment (dii-environment), GCC Governments will be able to play significant role in practicing educational reform and in building expert capacity for future generations.

This paper develops a framework to enable educational reform in GCC using e-learning system via Living Labs. The purpose of this work is to map educational e-services to all activities within integrated e-environments based on quality living labs models' measures with unified standardization of industrial, business, financial, educational and governmental sectors that will certainly contribute in constructing better future for the world E-learning society.

Keywords
Living Lab, startups, cloud technology, essential infrastructure, models, innovation

Living-Labs for Community Development and Start-Up Businesses through the Experiences of Basaksehir Living Lab, Turkey

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Biography of presenting author: Ersin Pamuksüzer, is one of the founders of the Basaksehir Living-Lab. He is also the Founder of the Well-Being companies "The LifeCo" and "SAF" brands. Ersin Pamuksüzer started his career in Ericsson, Sweden in 1981 and was the General Manager of Ericsson Turkey. During the Ericsson Turkey period He initiated the formation of Turkey's first GSM Operator Turkcell in 1993 and has been a Board Member of Turkcell and Turkcell's International operations until 2006. He is an Enterprenuer as well as an initiator and driver of start-up companies. Recently he has become one of the founding members of "Startup-Bootcamp Istanbul" and "Startosphere" companies which have the main objective of proving the opportunities for innovators and entrepreneurs to start new businesses.

Abstract

The purpose of the paper is to discuss one of the ways of developing communities in cities or districts using Living Lab concepts and facilities.

Until recently Municipalities where providing basic services defined by laws and regulations while governments where taking a greater role in the well-being of the citizens. Governments also made the distribution of finance between municipalities, hindering competition between cities. In the new urban focused changing world, municipals of cities and districts are increasingly taking on the role of managing their communities and improving the well-being of their own citizens. Municipals are more and more involved in providing smart infrastructures and services to increase the quality of life of their community. When we talk about well-being, we mean the physical, mental, economic, educational and social life quality of the citizens. In order to be able to provide all these qualities, Municipals also need to create ways of providing these means. Improving well-being is also a way of building the brand of the city which in return attracts more people and investors to settle and invest in the city. Sustaining the attraction will require municipalities to provide the facilities and the services that will maintain the level of well-being in the area.

Living Labs can be a contributor for improving well-being of cities, because the concept of co-creation involves citizens in the decision making process of new product or service developments that will be consumed by the citizens. Especially if the Living Lab concept is complemented with a physical facility which provides the environment for incubation & development as well as user experience, the value add to entrepreneurs, companies, citizens, municipalities, universities and investors, will be much greater.

Living Labs can be a way of making the difference for municipalities if they can invest in the process of building and financing the facilities and the technological infrastructures. Some of the benefits that can be mentioned are;

- The municipalities will be able to address the direct interest areas of citizens by using the innovative capabilities of Living-Labs and finding solutions to the interest areas.
- The municipalities will be able to keep in touch with the public much more than ever, through Living-Lab environments and through technologies developed to interact with the public in real time.
- The municipalities will attract brains that need the environment to develop their ideas into commercial successful products and services, that in return can provide smart services for the citizens which in return will help build the brand image of the municipality as well as its governors.
- The universities will be able to find a bridge between theory, R&D and the real world, which in turn will improve the level and context of education in a way that it is beneficial for the society.
- The entrepreneurs will find the environment for being supported in the development of their ideas into prototype products and services. More importantly, the startups will be able to find investors, partners or funds for their new businesses.
- The investors will be able to find a market place for innovative products and services that have been or can be tested in real environments.
- As major corporations in the world are focusing on efficiency and downsizing which increases unemployment rates, local and national governments will be able to find a solution to macro-economic downturns via new employment opportunities enabled by the creation of new Small and Medium businesses.

This paper will provide an insight to the readers and listeners of a real value add experience of a Living Lab, from the perspective of a mayor, an entrepreneur, a startup business, an investor, a university and the citizens by Basaksehir Living Lab, as a first certified Living Lab in Turkey.

Keywords

Living Lab, startups, entrepreneurship, open community, urban development, user centric open innovation, user centric design

DAY 2 – Thursday 5 June – Room 3C – Level Garden – 10:30-12:30

[TH2-SE02-13-a] How Can We Co-design Technologies with (and not for) Vulnerable and Poor Communities?

Session Leader: Dr. Andrés Felipe Valderrama Pineda, Aalborg University, Denmark.

Co-Session Leader: Dr. María Catalina Ramírez, Universidad de los Andes, Colombia

The session focuses on the processes by which teams of students and professors from rich universities collaborate with communities. This is a focus on the dynamics of innovation, which place equal weight on the result (a technology to solve a specific problem) and the process by which that result is obtained (which knowledge is brought in and how, how does the involvement of the community guarantees their ownership over the solution and thus makes it sustainable). Additionally, we would like to encourage authors to think on the ways and dynamics by which a specific process in one community can produce knowledge for other communities. In this, we will privilege those cases in which we can see that the knowledge production process is guided or at least involves significantly the members of the community.

Lessons Learned from a North-South, International, Cross-Cultural, Inter-Institutional, and Interdisciplinary Research-Development Project Aimed to Benefit "Base of the Pyramid" Farmers with Hi-Tech Research

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Biography of presenting author: Natalie Ceperley recently completed her PhD at EPFL, in both Burkina Faso and Switzerland. She is interested in the role of vegetation in the hydrology of West Africa as mediated by local practices and perspectives. She holds a Master's degree in Environmental Science from Yale University and a Bachelor's of Arts from Grinnell College in Biology and Global Development. Previously, she served in the U.S. Peace Corps in Mauritania teaching environmental education and studied ethnobotany in Benin as a Fulbright scholar.

Abstract

Using an ethnographic methodology of participant – observation, this paper critically examines a project that includes two academic institutions on two continents (Europe and Africa), an entire commune of 8 villages, and another private organization so that future projects with similar aspirations and in similar contexts can learn from our experience. The project had the original goals to build an innovative planning support platform specifically adapted to rural development and to help people live more sustainably by increasing access to information regarding natural resources. An initial participatory mapping workshop directed research towards understanding the hydrologic consequences of conversion of savanna to agriculture and mitigating those consequences through education, information exchange, and reforestation in a specific village.

Although we made progress on the scientific questions, we have educated many audiences, and we planted some trees, we have failed to accomplish the initial goals that would empower the village. *Our failure is very justified because of the* conflict between the production of food and income and the production of knowledge. The tools for our research are not immediately useful for outreach and the time scale of knowledge conflicts with the scale of production. It has been hard to balance the abstract theoretical and scientific research objectives with the immediate needs of the village. However, since neither of the original goals, or the following more specific versions of those goals, necessitate any more technology than what we have on site, it is logical to focus on improving the social innovations necessary to these goals. This paper lays out some guidelines for how future projects can overcome these barriers and answer the question *"How do we do science, so others can benefit?"*

Keywords
hydrology, participation, agroforestry, micrometeorology, Burkina Faso

Development of a Bio-digester and Biogas Stove for Rural Women Entrepreneurs

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Biographies of presenting authors: Michael Faborode, an Agricultural Engineer, was Vice Chancellor, Obafemi Awolowo University (OAU), Nigeria, 2006-2011. He was Dean (2002-2006) and Head of Department (1996-2002). A Fellow, Nigerian Academy of Engineering, he received his B.Scs. and M.Sc. at the University of Ife, now OAU and his

Ph.D. at Newcastle University, UK. His research interests include biomaterial properties and bioprocess engineering; technology, gender and development, and higher education for development. He was a Resident Scholar at the Rockefeller Foundation Bellagio Centre, Italy, 2013. **Gbolabo Ogunwande** *is a Senior Lecturer in the Department of Agricultural and Environmental Engineering, Obafemi Awolowo University (OAU), Nigeria. He received Bachelor's, Master's and Doctorate degrees (Agricultural Engineering) from OAU and a Master's degree (Industrial and Production Engineering) from University of Ibadan, Nigeria. His research activities have been on solid waste management with focus on composting and anaerobic digestion from which he has published in reputable journals/conferences. He is a registered Engineer in Nigeria and members of various professional bodies.*

Abstract

The paper presents the outcome of a Development Partnership in Higher Education (DelPHE) project involving researchers from Nigeria and the University of Newcastle upon Tyne, UK on empowering rural women entrepreneurs in viable rural enterprises to enhance their livelihoods and environmental sustainability. Young academics were challenged with developing appropriate devices for handling household and farm wastes, to turn them into wealth generating products to unleash the innate entrepreneurial capability of rural women and sustain their attainment of realistic livelihood desires. This was in place of earlier plan to leverage on successful innovations at the Songhai farm in Benin Republic.

A systematic participatory approach was used to interact with the women to understudy their needs and natural environment, as well as motivate them to generate ideas that eventually led to the development of the biodigester to handle the wastes and turn them into biogas and organic fertilizer from the process residues. Harnesses for capturing and storing the gas were developed as well as burners for utilizing the gas. The women were then trained in understanding the proper use and care of the devices, while local artisans were trained in the fabrication of the devices, to assure constant supply to the women groups.

Up scaling the program for sustainability has seen the technology being adopted for massive rural biogas utilization initiative in a State in Nigeria. More rural communities are benefitting from the technology, whilst graduates are supported to set-up biogas and bio-fertilizer enterprises. Wider impact entailed mentoring younger academics and students to enhance the relevance of higher education to the real challenges of developing economies, including the lives of vulnerable and under-served rural poor farmers, particularly women. Success of this design engagement by a multi-disciplinary research team, in massive adoption and up-scaling of the technology by influencing public policy, is a lesson in deploying modern appropriate technologies to address some of the most fundamental millennium development challenges of under-developed/developing economies.

Keywords

bio-digester, biogas, entrepreneur, rural women, renewable energy

My Home Is a Lab. UPYA, Post-Disaster Housing Solution in Sincerín, Colombia

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Biography of presenting author: Ana Maria is a social catalyst working for different NGOs and acting as executive director and cofounder of FEM. Her experience is mainly with social innovation with vulnerable populations such as indigenous peoples, afrodescendants, and ageing communities.

Abstract

This paper describes the process of co-design and building of a prototype of UPYA[1], a project designed for and with post flood communities in Bolívar, Colombia in 2010. We document the implementation process with emphasis on the obstacles that made community participation essential for the prototype to be built and the project to survive. The project was designed to understand housing as an educational tool in itself by using the pretext of rebuilding the house as a way to research traditional construction methods and materials, by innovating through the use of clean technologies and recycling, and by creating a robust idea about the interdependence housing, health and general wellbeing have. It describes how its implementation has taught us resilience, creativity, community collaboration and flexibility. We explore how we came to believe that a sustainable future has to be adapative and creative if we are to survive as a species.

This paper aims to explain, in a first section, the sequence of events and the mechanics of community decision making that took place in order to have a housing project with the characteristics UPYA has. It describes the innovations, spinoffs, ideas and obstacles encountered in the process. It underlines the importance of designing methodologies, not

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[1]UPYA: Given name to the entire project of post-disaster housing to be developed by FEM in Sincerin.

from general knowledge of common situations, but from the point of view of very specific community dynamics, that need to be well understood. In the second section, we analyze the actual deployment of the technologies chosen for building, fundraising and community organization, and their results in order to create not only houses but also significant learning opportunities for the holistic development of the inhabitants of the area. We include the policy and community setbacks and reflect about the innovative forms of resolving conflicts that the project has come up with, and the issues is has not been able to solve. In the third section, we describe our vision of the project in the future, our new community alliances, sites, techniques and technologies to be used in upcoming challenges. We conclude by analyzing a core issue a of habitat co-creation: the marriage between technology/innovation and traditional knowledge. We believe that much richness was depleted as the development discourse became the mainstream approach. Now, that times have become more critical towards this concept, rethinking the way our ancestors built and used materials has become a very important area of interest that naturally empowers long excluded communities.

Keywords
community creativity, traditional building technology recovery, social innovation, sustainable building technology, holistic habitat approach

Learning Communities for Local Economic and Technological Development in Bogota

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Biography of presenting author: PhD studies in the Massachusetts Institute of Technology. Master Communications Strategies and Organizational Structure, University of Pennsylvania. Expert in organizational systems, organizational learning and intervention in technology organizations. Electrical Engineer, Universidad de los Andes (University of the Andes - Colombia). Professor at Department of Systems and Computer Engineering, University of the Andes and Founder of the Group for Research and Consulting Technology and Society

Abstract
This contribution presents a case study based on research with focus on Learning Communities that have been conducted by a neighborhood in Bogota, Colombia, local authorities and the Universidad de los Andes. The purpose of the project was addressing problems of poverty that affected the community, and the role of social technological appropriation in overcoming those issues.
In the Learning Communities perspective, the design is not only understood as the process to build technological artifacts, but structuring practices for building conscious world in which technological artifacts are designed participatory as part of a broader process.

Keywords
innovation processes, learning communities, university Social Technological System, vital vocations

Design with People – Locals as Co-Creators

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Biography of presenting author: Signe Pedersen is a PhD Fellow at Department of Development and Planning, Aalborg University Copenhagen, Denmark. She has been engaged in co-design activities of Improved Cooking Stoves in Nepal as well as product systems design in India. Her work has consisted of ethnographic research and co-design activities together with relevant stakeholders from the entire value chain. In addition, Ms. Pedersen is the co-founder of the NGO InnoAid that strives to co-design innovative solutions where aid is needed.

Abstract
For several decades the Western's answer to alleviate poverty in the Global South has been to implement technologies to meet the needs of the poor. However two crucial issues are at stake here; firstly how, and by who, are the needs of the poor identified and defined, and secondly how to ensure domestication of the developed technologies. The Western answer to both issues has been 'participation' and empowerment of the poor people. Despite a participatory approach, solutions are mostly predefined from the beginning as being technical solutions (Chambers, 1983; Cornwall & Scoones, 2011; Mikkelsen, 1995). In this article the authors question this argues that there is a need for approaching development in a more open and holistic sense, that involves co-design activities with actors from the entire network around the product, technology etc. to support the design and development process of appropriate technologies. Especially valuable is the involvement of end-users as co-creators who can contribute in making the technologies

intuitive; making them fit the local context and creating ownership and pride among the end-users, which ensures the conversion of the technologies.

The authors propose the concept of Design WITH People (DwP), as the first initial step to alleviate poverty by developing appropriate technologies. Design WITH People as a concept is a work-in progress, however it emphasizes the involvement of local actors as co-creators to develop technologies that are suited for the everyday practice of the poor and thus become domesticated (Lie & Sørensen, 1996). In a domestication analysis, empowerment is not the goal, but is considered to be a natural, positive side effect grounded in the domestication of technologies.

Empirically the authors draw on their own involvement in designing a sustainable energy solution especially improved cooking stoves for the rural population of Nepal but also on a student project conducted in India. Based on the authors experiences in Nepal, where actors involved in the network (manufacturers, end-users, professionals, local people, NGOs, Governments etc.) participated as co-creators through design games, interviews and by being observed during their everyday practice, the authors draw out the conceptual framework for Design WITH People. Further, they argue that in such processes it is important to manage how knowledge about different actors, with a special focus on the end-users, is gathered, packed and brought into the design process of new solutions and technologies.

Theoretically the article is based within STS, and finds its inspiration in ANT, domestication theory, political process theory (how knowledge is shared and communicated across knowledge boundaries – e.g. with boundary objects and intermediaries), co-creation and participatory design.

Keywords
co-design, ownership, domestication, DwP

Co-design is Co-Commitment to Sustainability: Marginal Farming Communities Experiences in Creating Rainwater Harvesting Technologies Jointly with Reliance Foundation

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Biographies of presenting authors: *Sudarshan Srinivas* *backed by philosophy and law major has a rich and diverse experience spanning over 25 years of working on development programs with marginal communities, organizing cooperatives, conceptualizing and operationalizing community aspiration driven development initiatives. The scope of work has ranged from Dairy development projects to natural resource management and also renewable energies.*
Sunil Shrivastava *a self-trained engineer has spent the best part of last 2 decades working at grassroots with communities in planning and executing soil conservation and water harvesting projects for achieving complete water security for marginal communities.*

Abstract
This paper establishes that considerations of communities will always override choice of best technologies creating seemingly sub optimal choices – but choices which will be sustainable in the long run. It explores the many dimensions which tend to drive the developing – or rather more importantly choosing / modifying an available technology for water harvesting structures. The larger objective is how to provide adequate water for drinking, domestic and irrigation purpose in water scarce areas where availability of water for whole year for drinking itself is in question in normal rain fall year. This could be severest in case of drought years.

For development initiatives, the processes are as important as the ends if not more. Thus the primary drivers and first principles for blending community aspirations and best technologies have been: i) Understanding the present context of community and existing technologies; ii) Identifying choices and options appropriate for the community and ecology and iii) Perspective and capacity building of community towards potential solutions.

This could result in confidence of community to innovate, replicate and sustain in tomes to come with ownership of community: i) Design and implementation of water harvesting structures are completed in short period of time with low cost; ii) Thinking and planning in more holistically started as revision of rules to use water for irrigation; iii) Maintenance system as contribution for maintenance fund started; iv) Water availability ensured for human and cattle drinking for whole of the year and v) Water budgeting and optimization of water use practices started like integrated crop management system, efficient system for irrigation, mix crops of different root zone depth started.

Our primary learning in the course of blending technology and communities aspirations is that solutions which nonexistent or improbable have been established successfully. This has happened only because of community partnership and technology being led by its felt need and not the other way around. USP is that the decision-making rests with the community. This is first step towards "Sustainable Development".

Keywords
water harvesting; sustainable; community

Methodologies Utilized in the Co-design of IVR Systems in Vulnerable and Poor Communities

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Biography of presenting author: Dr. T. Jama Ndwe is a postdoctoral research fellow at Rhodes University's department of computer science after having obtained a PhD in electrical engineering at the University of Cape Town. His research interests include ICT for developing regions and particularly focusing on Human Computer Interaction for Development (HCI4D) within the field of speech technology. He also holds a masters degree in computer science from Rhodes University which he obtained in 2002.

Abstract
After basic needs like food, shelter, and health care, access to information and communication is one of the most important needs in any population group. In Southern Africa and the developing world in general, it is difficult for most people to access information because the tools used such as computers and the internet are prohibitively expensive and require training prior to operating such tools. An alternative channel is through the use of technologies that are readily available in the envisaged deployment area of Southern Africa, and the telephone is such a technology as the majority of people in the region are accustomed to the telephone.

This research paper centres on the feasibility of using the telephone as a tool for information access in the oral communities of Southern Africa and makes use of two case studies whereby two IVR systems were developed, one targeted for users in Botswana, and another for users in South Africa. The present research presents two methods (i.e., participatory design and user-centred design) and advocates the importance of those methodologies in the co-design of the IVR systems mentioned above. The paper describes how the contributions and knowledge of the different intended users of the technologies were incorporated into the design and how this incorporation is maintained throughout the development lifecycle of the technologies. The research paper explains the benefits of engaging the intended users in the co-design of the proposed technologies and these benefits consequently reveal the essential processes that need to be looked at thoroughly in the development of essential technologies for poor communities.

Keywords
Participatory Design, User-centred Design, IVR systems, Developing regions

DAY 2 – Thursday 5 June – Room 5C – Level Garden – 10:30-12:30

[TH2-SE02-14] Technology in Global Health: Exploring New Paradigms

Session Leader: Dr. Leo Anthony Celi, Harvard Medical Institute, Massachusetts Institute of Technology, US

Co-Session Leader: Dr. Vipan Nikore, Department of Internal Medicine, Cleveland Clinic Foundation, United States

With increased participation in global health among clinicians, public health workers, engineers and computer scientists, the risk of fragmentation of purpose and redundancy of effort is increased. The lack of coordinated and tailored delivery onto an organized framework persists as a major obstacle to progress. Currently, healthcare initiatives are often developed by the donor country; subsequent isolated ad hoc implementations may result in insufficient consideration for the specific needs of the population and/or critical factors of social, cultural and political context. However, technological solutions such as mobile health or mHealth are appealing in theory, when applied indiscriminately to a weak healthcare infrastructure they often result in insignificant or short-lived impact.

Creating a Culture of Quality Health Care in Resource Limited Clinical and Community Settings: A Necessary Prerequisite to Technological Intervention

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Biography of presenting author: David Meyers is a Masters in Public Health candidate at Tufts University School of Medicine concentrating in Epidemiology and Biostatistics. He has conducted research internationally into mHealth interventions for population and clinical outcomes in resource-limited settings. He has worked in the past with organizations devoted to promoting global health equity, most recently with Nyaya Health in rural Nepal, and with Sana where he has assisted with the development of a course on health informatics systems in resource poor settings.

Abstract
Globally, health care delivery systems urgently need innovation in both access to and quality of care. New technologies have the potential to improve delivery systems, however, they are not sufficient to effect change if other factors such as organizational culture, systems design, and infrastructure are not addressed. If there is not a culture of quality and safety in place, technological interventions will not have lasting impact. The purpose of this paper is to describe and learn from experiences in developing this culture of quality improvement (QI) in resource-constrained environments.

This paper draws from the existing literature in addition to surveys of clinicians and public health practitioners with experience in patient safety and quality in developing countries. Semi-structured interviews were conducted and organized into a set of case studies that highlight the need for this culture at the onset of any technological innovation and the challenge it presents. The interview protocol was developed in cooperation with several experts in the field. Best practices have been identified and recommendations provided.

A literature review and focused interviews confirmed a culture of quality and safety is necessary for new technological interventions to succeed. Common challenges reported include technological barriers such as a lack of electricity or cellular phone service, a lack of interest by health care workers to improve services, and initiatives being lost in leadership transitions. Potential solutions make use of financial incentives, policy level interventions, and positive deviance theory.

A culture of quality and safety is a vital prerequisite for the success of technological innovations in global health. Institutions and organizations in the developing world stand to gain from embracing the success of the quality and patient safety movement both in the United States and that other international settings have already begun to adopt.

Keywords
quality improvement, positive deviance, mHealth, health informatics

Lessons from the Evaluation of a Clinical Decision Support Tool for Cardiovascular Disease Risk Management in Rural India

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Biography of presenting author: Brief Biography of Presenting Author: Arvind Raghu is currently pursuing a DPhil from the Institute of Biomedical Engineering, University of Oxford. Working alongside clinicians from Australia, India, and Oxford, Arvind's research is focused on the collaborative development of novel telemedicine systems for remote monitoring and clinical decision support in resource-constrained settings. He was a multiple recipient of the Indian Academy of Sciences research fellowship, and has worked in the areas of computational biology (at the Indian Institute of Science) and neuroscience (at the Indian National Centre for Biological Sciences). Arvind holds an MSc (with Distinction) in Biomedical Engineering from the University of Oxford.

Abstract

The rise of chronic disease and failure in the implementation of adequate prevention strategies places a heavy burden on the health systems of lower and middle-income countries. Despite vast interest in mobile health (mHealth) technologies, there is a lack of evidence for the clinical impact and scalability of tools for managing chronic diseases in a resource-poor setting. This paper presents the development and field evaluation of an mHealth solution which provides Clinical Decision Support (CDS) for healthcare providers within a primary care setup in rural India for the screening and management of cardiovascular disease risk. The CDS tool was designed prior to, and during an agile development phase that comprehensively engaged our end users, namely Primary Health Care (PHC) physicians and rural Non Physician Healthcare Workers (NPHWs). We present lessons from this pilot study that may help inform strategies for large-scale evaluation of mHealth technology in resource poor settings through a randomized control trial.

Keywords: mhealth, cardiovascular disease risk, clinical decision support tool, primary care, public health, LMIC, India

Building an Ecosystem to Provide Sustainable eHealth Technical Capability for the Philippines

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Biography of presenting author: Mr. Jose Eugenio Quesada is an Associate Professor at the Asia Pacific College in the Philippines. He is also Founder and President of Integrated Open Source Solutions. His current research focuses on customizing mobile technology for telemedicine and for improving healthcare delivery in the Philippines. His work has been published and presented at the Med-e-Tel conference in Luxembourg in 2012. He is heading the research and pilot implementation of eHealth projects with NGOs and government hospitals in Philippines.

Abstract

There have been several eHealth technology initiatives that have been developed and have matured in the past few years that are designed for implementation in developing countries. They are built using Open Source software, are server based, and accessible through a web browser or mobile phone interface.
In order for a developing country such as the Philippines to take advantage and apply these readily available tools, an ecosystem has to be built to provide training, implementation, and support for deployment of these technologies in local health organizations.
Together with that, there should be commercial viability for Information Technology companies to provide the implementation and maintenance support for the health organizations that implement Health Information systems.
This ecosystem has to be in line with the government's national eHealth development plan for the country, and should be created in collaboration with the government.
The challenge comes in bringing together, and aligning the initiatives of the health care sector, the government, the academe, and the information technology industry, in order to create the local capacity and capability in implementing and maintaining these readily available Health Information Systems.
This paper focuses on some initiatives that have been done in the past few years, to bring together and align the various components required to build this ecosystem. In particular, it describes the initiative to implement the Sana Mobile technology platform, and the GNU Health, Health and Hospital Information System here in the Philippines.
The paper will discuss the challenges and lessons learned from our experience with customizing Sana for a pilot project in collaboration with two Non-Government Organizations. It will also discuss the on-going projects of Health Information System implementations with government health organizations. These are the Philippine Air Force General Hospital, the Department of Otorhinolaryngology of Philippine General Hospital, and Maybunga Barangay Health Center in Pasig City, Metro Manila, the health clinic of a Local Government Unit.
It will compare the outcomes with measures of success using the framework defined in The Role of Science, Technology and Innovation Policies and Instruments for a Paradigm Shift Towards Sustainable Development. It will then outline the future direction in applying what we have learned to the National eHealth plan of the Philippine government.

Keywords

mobile health, open source software, capacity building, health information system, sustainability

Evaluating Open-source mHealth Solutions to Chronic Disease Management in Resource-Poor Settings

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Biography of presenting author: David Springer is a PhD researcher in the Institute of Biomedical Engineering at the University of Oxford on a Rhodes scholarship. He is studying the use of low-cost technology to deliver healthcare in developing areas of the world. He previously studied mechatronics engineering at the University of Cape Town before coming top of his class in the Master's degree in Biomedical Engineering at the University of Oxford.

Abstract

Hypertension (HT) has been identified as a leading risk factor for mortality and a major burden of disease worldwide, with about one billion people suffering from HT in low- and middle-income countries. Poor treatment adherence is an important and potentially modifiable contributor to uncontrolled HT, associated morbidity and early mortality. Although some SMS-text based interventions have been shown in clinical trials to improve health outcomes, the evidence from systematic reviews is mixed, with a particular lack of evidence on implementation at scale and integration in clinical practice. This has been identified by several organisations, including the UN Foundation's mHealth Alliance, as a key barrier to mHealth impact and sustainability.

The SMS-text Adherence Reminder (StAR) study is an on-going three-arm, parallel group, randomized control trial designed to test the efficacy of HT treatment adherence support delivered by SMS-text as compared to standard care. All 1372 recruited participants (making this one of the largest such trials to date) are adult patients on hypertension treatment, attending a peri-urban health clinic in Cape Town, South Africa (NCT 02019823). The intervention is a structured programme of clinic appointment and medication pick-up reminders, medication adherence support and HT-related education delivered via SMS-text.

All the SMS-texts are delivered automatically via an open-source web-based electronic medical record system (OpenMRS). All participant data, including patient demographics, contact information and blood pressure measurements, are captured in the clinic and uploaded to OpenMRS using Sana Mobile, an open-source Android platform.

This paper highlights and discusses the considerations and implications of using such open-source systems in the context of global health research. To our knowledge, we are the first research group to implement and customise open-source solutions to establish and maintain a fully functional trial management and intervention delivery system in a sustainable and scalable fashion in a low-resource setting.

Keywords
open-source, hypertension, chronic disease management, SMS-text, adherence

Mobile Technology as a Tool for Incentivizing Community Health Workers and to Improve Utilization of Maternal and Child Health Services in Low-Income Countries

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Biography of presenting author: Jane is a Masters student in Public Health at Kenyatta University and a Field Project Manager at Medic Mobile implementing mhealth projects at resource-constrained regions of Kenya and Africa. She holds a first degree in BSc. Nursing from University of Nairobi. She has 5 years' experience in implementing clinical and public health related interventions and programs.

Abstract

There are many factors contributing to the poor health outcomes in resource-constrained countries and these range from lack of the health services to underutilisation of the availed health services. Reassuringly, simple public health interventions such as reminders sent through mobile phone can improve utilisation of health services e.g. maternal child health in these resource limited areas.

Medic Mobile, a mobile technology NGO, collaborated with the Kilifi Ministry of Health (MOH) and *KilifiKids,* which is an NGO, to develop an *mhealth* program aimed at increasing uptake of antenatal and immunisation services in Kilifi. This initiative utilised the MOH's community owned human resource, whereby 459 community health workers (CHWs) were trained to send structured short message service (SMS) to register clients for antenatal care (ANC) and Immunisation consistent with the Kenyan health system guidelines. The CHWs were trained for four days for capacity building. The first two days had the clinical training component and was done by the MOH while the last two days, involved the mobile technical component that was done by Medic Mobile. CHWs were motivated through capacity building and ownership of a dependable communication tool.

459 CHWs have been empowered with an *mhealth* tool that has eased their work, and has motivated them to reach out to a total population of more than 50000 pregnant women and children, leading to improvement of maternal and child health through increased utilization of antenatal and immunization services in Kilifi county. Following the implementation of this initiative, the utilisation of maternal child health services in particular have increased by 50%. There are future plans to train additional 450 CHWs, an initiative which is expected to help improve the utilisation of health services even further.

We can conclusively say that community based mobile health technologies tailored to meet community felt health needs have great potential of creating lasting large health impacts in resource scarce communities. For this initiative to be successful, it needs the participation of both government stakeholders, community members and NGOs.

Keywords
Community health workers, mhealth. Ministry of Health, antenatal care, Kujua

Integrated Information Technology for Low-cost Community-based Pediatric Psychiatric Healthcare

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Biography of presenting author: *Dr. Bosl was originally trained as a computational physicist, then began research in neuroscience and biomedical informatics and joined the faculties of Harvard Medical School and Boston Children's Hospital. He developed methods for early detection of neurodevelopmental disorders from EEG measurements while pursuing additional graduate training in behavioral neuroscience at Boston University. He is currently Director of Health Informatics at the University of San Francisco where he focuses on creating low cost methods for neuropsychiatric healthcare in underserved populations.*

Abstract

Neuropsychiatric disorders impose the largest burden of disease of all chronic diseases in the world and are among the greatest threats to childhood health. Half of all mental and neurological disorders of adulthood may have antecedents in childhood and thus may be considered to have neurodevelopmental etiologies. Thus, the most leveraged opportunity for invention to prevent or reduce the severity of these diseases, in terms of both personal suffering and economic impact, is childhood. Highly trained clinical specialists are not accessible or available in many underserved regions. Thus, screening and intervention must be integrated into primary care, which is often given by community healthcare workers. Creation of affordable and easy to use neuropsychiatric screening and early detection tools is the key to significantly reducing the burden of neurodevelopmental disorders.

Existing neurotechnology, mobile devices and advanced analytics will be leveraged to create a cross-cultural neuropsychiatric research and community-based clinical support service. The system we envision integrates (1) mobile phone apps based on the Sana framework (www.sanamobile.org); (2) culture-specific psychiatric screening and assessment and monitoring tools developed within each region ; (3) a globally accessible database for storing uploaded EEG, assessment data and associated analytics; (4) portable EEG devices ; and (5) web-based backend reporting tools.

Preliminary evidence demonstrates that advanced EEG analysis may enable early detection of autism, epilepsy and post-malaria neurological impairments. An international research database and model for community-based mobile tele-psychiatry that will enable patient trends to be monitored, support autism, epilepsy and cerebral malaria research as well as epidemiological studies. It will enable resource-constrained regions to build capacity to support community-based mental healthcare delivery that frees them from the institutional model of care with the dehumanizing and stigmatizing asylum hospitals.

An international collaboration is described which will enable a distributed, e-infrastructure to support an advanced neuroscience research effort that ultimately enables a community based approach to mental healthcare.

Keywords
mental health, epilepsy, autism, cerebral malaria, EEG, health informatics

DAY 2 – Thursday 5 June – Room 4C – Level Garden – 10:30-12:30

[TH3-SE03-02] Tools and Techniques for Measuring Technology Impact: From Wireless Sensors to Experimental Field Trials

Session Leader: Prof. Ashok Gadgil, Lawrence Berkeley National Lab (LBNL), University of California Berkeley, US

Technological innovations can improve development outcomes, as evidenced by the market efficiencies and income growth achieved through rapid expansion of mobile telephony (Jensen, 2007). Yet designing for impact requires high quality information about consumer preferences and practices, as well as a keen understanding of the economic, social and environmental barriers to profitable technology adoption. It also requires rigorous evaluation of new technologies once deployed in the field—to reveal failures, understand successes, and identify opportunities for improvement.

Recent scientific advances are addressing this challenge. Greater access to information technology—from low-cost mobile devices and wireless sensors to improved networking protocols and remote sensing—have enabled researchers to generate high-quality measurements, in the field, of economic outcomes, environmental indicators, and even human behavior and decision-making processes. At the same time, advances in applied statistics, including the use of randomized trials and quasi-experiments in field settings, have made it possible to rigorously evaluate the social and economic impacts of technologies operating in the real world. In tandem, these two trends are yielding valuable information about consumers, and about the impacts of the technologies they use. This has potential to revolutionize the way pro-poor technologies are designed.

The aim of this session is to discuss recent research advances that are applying novel methods to measure both consumer preferences and the impacts of pro-poor technologies.

Balancing Depth and Breadth while Experimentally Validating Medical Technologies for Developing and Emerging Markets

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Biography of presenting author: *Amos Winter an Assistant Professor of Mechanical Engineering at MIT. His research focuses on the marriage of mechanical design theory and user-centered product design to create simple, elegant technological solutions for highly constrained environments. His work includes design for developing/emerging markets, agricultural equipment, water systems for purification and irrigation, and assistive devices. He was the recipient of the 2012 ASME/Pi Tau Sigma Gold Medal and was named one of the MIT Technology Review's 35 Innovators Under 35 (TR35) for 2013.*

Abstract

This paper reports on successful tools and techniques that have been used by our team to measure the impact and efficacy of medical technologies under development by the Global Engineering and Research (GEAR) Lab at MIT. Designers of technology for developing and emerging markets must balance the iterative nature of design with the necessity to validate technologies in context. Large-scale trials are often inappropriate and too expensive for prototypes that will be improved as a design evolves. This work discusses how depth and breadth of field experiments can be tuned to match the maturity of a technology, and how substantive data can also be gathered through stakeholder engagement, background research, and technical analysis.

Case studies about three GEAR Lab medical technologies provide the basis of this paper and demonstrate effective validation techniques for early, mid, and late-stage concepts. The All-Terrain Knee (ATKnee), a low-cost prosthetic knee, is used to show the power of blending engineering analysis with user feedback to form a full set of design constraints and requirements. The second project presented – redesigning the Jaipur Foot prosthetic foot – shows how obtaining early-stage feedback on a design, even in small numbers, can drastically improve the design of later, refined prototypes that will be field tested on a larger scale. The case study presented on the Leveraged Freedom Chair all terrain wheelchair shows how successive field trials, each building in number of participants and depth of engagement, can refine a design towards a viable solution.

The methodology presented in this paper may be useful for academics, designers, and practitioners working in medical as well as other areas of developing/emerging market technology. In each case, we were able to obtain meaningful data from field trials with relatively few participants by leveraging background research, preliminary surveys, stakeholder engagement, design iteration, and rigorous analysis.

Keywords: field trial, design, mechanical engineering, assistive device

Data Collection for Literacy Tablet Reading Project in Rural Ethiopia

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*Biographies of presenting authors: **Angela Chang** researches how multisensory interactivity improves literacy. Her postdoctoral research was to develop custom literacy applications for children. **Lidet Tilahun** directs One Laptop per Child's International Outreach. She advocates for innovative learning to influence large-scale change at the country level and on the global development agenda. Lidet, managed the "Learning to Read" project in two remote villages in Ethiopia testing whether children can teach themselves how to read using only tablets filled with applications designed for self-learning.*

Abstract

This paper describes the data collection solution employed in the deployment of `literacy tablets" to children in two remote rural villages in Ethiopia. To conduct this research, touchscreen tablets preloaded with educational application were used as educational delivery mechanisms for literacy.
This work aims to investigate how children form collaborative "learning cells" using technology designed especially for learning. This project fosters interactions between children by establishing a supportive environment where literacy learning can flourish and providing a learning platform. Those two conditions are most lacking in remote rural areas.
We detail the data collection software used in a year-long field test. Our modified Android operating system and the data collection framework allowed us to configure data collection probes for privacy and secure backups. The tablet software records usage data that is used to assess and iteratively adapt the reading platform to a child's developing educational trajectory.
We report the educational interests and usability issues encountered. We correlated our findings with primary observations from field reports to the site. We discuss the difficulty of assessing long-term learning trajectories based solely on data, and discuss our reliance on observations on the socio-cultural use of the tablets. Finally, we reflect on how these lessons will influence future deployments, by focusing on potential opportunities for remote data collection in rural terrain. We also discuss the implications for unsupervised teaching through such technology regarding developing digital learning tools for these remote populations.

Keywords
literacy, big data, tablets, rural, education

Essentials in a Technology for Development: From Field Experiences on Arsenic Mitigation Technology Deployment Strategy in India

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Biography of presenting author: Dr. Abhijit Das is an Assistant Professor in Economics at Kandi Raj College in India. Dr. Das has been researching extensively over past one decade in rural West Bengal to understand the social, economic and political issues that drive lack of access to safe drinking water. His understanding of the problem is based on rigorous field based research and extensive interaction with rural communities, government, non-government and private water service providers. His field research has been primarily funded by University Grants Commission (India).

Abstract

A major developmental challenge of West Bengal is to provide arsenic safe water to rural population in at least 79 blocks in 8 districts of the state. The total population at risk of mass poisoning in the state is approximately 28.7 million, i.e. 36% of its population. Consumption of arsenic laced water beyond WHO permissible limit has very serious health implications. The only long term solution to protect health of the people at risk is to induce them to switch to arsenic safe water. Initial approach for managing this developmental issue in poorly developed areas was through scientific detection led technology deployment strategy through Public Health Engineering Department of the Government of West Bengal, (PHED, GoWB). Our field experience from one district shows 95% of deployed equipment failed to provide the service targeted for within one year of installation. Field level bottom up information confirms that top down deployment strategy failed to consider the full innovation chain needed for social placement of technology. It lacked thus longer-term vision and system wide approach from the very planning stage. The multilateral funding agencies also supported the partially conceived deployment strategy without taking any rigorous social science expert view. Failed social experiment has resulted into a complicated social situation and challenges are more today given the increasing plight of arsenic led health impact. Based on the bottom up observations the message

we want to communicate through this article is, past failure in no way can be taken as negative incentive for future intervention but must be taken as a learning for realigning of our thinking and actions for finding a well-designed solution rather than another experimentation.

Keywords
arsenic, health effects, West Bengal, mitigation efforts, ASWAS framework and sustainability

Comparing Cookstove Usage Measured with Sensors versus Cell Phone-Based Surveys in Darfur, Sudan

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Biography of presenting author: Daniel Wilson is a former aerospace engineer, current National Science Foundation Fellow, Fulbright Fellow, and Ph.D. student of mechanical engineering at the University of California, Berkeley. Daniel's research focuses on measuring metrics of cookstove impact including measuring both emissions and adoption of cookstoves. Daniel's work has centered on the Berkeley-Darfur Stove, distributed in Darfur, Sudan. In 2014, Daniel will be a Fulbright Fellow at the Indian Institute of Technology in Delhi where he will work on next-generation cookstoves and monitoring technologies for the Indian market.

Abstract

Three billion people rely on combustion of biomass to cook their food, and the resulting air pollution kills four million people annually. Replacing inefficient traditional stoves with "improved cookstoves" may help reduce the dangers of cooking. Therefore, analysts, policy makers, and practitioners are eager to quantify adoption of improved cookstoves. In this study, we use 170 instrumented cookstoves as well as cellphone-based surveys to measure the adoption of free-of-charge Berkeley-Darfur Stoves in Darfur, Sudan where roughly 34,000 Berkeley-Darfur Stoves have been disseminated. We estimate that at least 73% of participants use the stove more than 10% of days that the sensor was installed on the cookstove. Compared to sensor-measured data, surveyed participants overestimate adoption both in terms of daily hours of cooking and daily cooking events ($p<0.05$). Average participants over-report daily cooking hours by 1.2 hours and daily cooking events by 1.3 events. These overestimations are roughly double sensor-measured values. Data reported by participants may be erroneous due to difficulty in recollection, courtesy bias, or the desire to keep personal information obscure. A significant portion of sensors were lost during this study, presumably due to thermal damage from the unexpected commonality of charcoal fires in the Berkeley-Darfur Stove, thus pointing to a potential need to redesign the stove to accommodate users' desire to cook using multiple fuel types. The cooking event detection algorithm seems to perform well in terms of face validity, but absent a database of cooking logs or witnessed accounts of cooking, the algorithm should be trained against expert-labeled data for the local cooking context to further refine its performance.

Keywords
cookstove, sensor, survey, adoption, monitoring

Use of Electronic Sensors to Improve the Effectiveness of Environmental Health Interventions in Developing Countries

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Biography of presenting author: Evan A. Thomas, Ph.D., P.E., is an Assistant Professor and Director of the Sweet (Sustainable Water, Energy and Environmental Technologies) Laboratory, and a Faculty Fellow in the Institute for Sustainable Solutions at Portland State University. Evan has professional experience working in government, industry, non-profits and academia. Evan holds a Ph.D. in Aerospace Engineering Sciences from the University of Colorado at Boulder and is a registered Professional Engineer (P.E.) in Environmental Engineering in the State of Texas.

Abstract

Efforts to assess the impact of community and household-based environmental interventions such as water pumps, filters and cookstoves often rely on data collected through person-to-person surveys or subjective observations. However, this conventional approach has two major shortcomings. First, surveys often overestimate adoption rates due to courtesy bias (where the participant is attempting to please the surveyor) or recall bias (tendency to forget

details in more distant past). Second, the presence or repeated visits of observers or enumerators can cause reactivity—influencing the behavior, they are measuring.

Cellar reporting sensors may provide feedback on the sustainability of interventions in developing communities, improving on survey data and infrequent spot checks to assess performance. This presentation will profile several example applications of remotely reporting sensors to assess the proper operation and use of environmental health interventions.

In the context of a five-month randomized controlled trial of household water filters and improved cookstoves in rural Rwanda, we collected data from intervention households on product compliance using (i) monthly surveys and direct observations by community health workers and environmental health officers, and (ii) sensor-equipped filters and cookstoves deployed for about two weeks in each household. The adoption rate interpreted by the sensors varied from the household reporting.

A second example is an operational scale implementation of sensors on rural hand pumps in Rwanda. The CellPump Project is designed for 200 water pumps, targeting a 50% reduction in water pump failure. The sensors add roughly 10% in cost, while potentially increasing cost effectiveness by nearly 27%. The sensors may be able to reduce the per person cost of water from over $150 to less than $70 over six years. The sensor data is directly integrated via an online dashboard with smartphone based operation and maintenance surveys completed by technicians, thereby allowing entirely paperless and near-time performance monitoring of water provisioning in developing communities.

Keywords
impact, Sensors, monitoring, health

DAY 2 – THURSDAY 5 JUNE 2014 – AFTERNOON

TH1-SE01-02 (Lavaux Vineyards) 14:30-16:30 – Thursday 5 June 2014	**What Technologies are Essential for Megacities of the Future to be Sustainable?**			
	Session Leader: Dr. Justin Bishop, Department of Engineering, University of Cambridge, United Kingdom			
	Gómez-Galvarriato Freer, Margarita	MX	Université Catholique de Louvain (Belgium)	Essential Sustainable Water-use Technology: Learning from Mexico City's Urban Poor
	Meikle, Amber	UK	Practical Action (United Kingdom)	Technology Justice in Urban Service Provision
	Patil, Abhay	IN	Yeshwantrao Chavan College of Engineering (India)	Critical Study of Utilization of Silico Manganese Slag – A Non-Biodegradable Waste Material as Coarse and Fine Aggregates in Plain and Reinforced Cement Concrete
	Nwaichi, Eucharia Oluchi	NG	University of Port Harcourt (Nigeria)	Enhanced Phytoremediation of Crude Oil-Polluted Soil by Four Common Native Plants: Effect of Inorganic and Organic Fertilizer Amendments

TH2-SE02-02 (Lavaux Vineyards) 14:30-16:30 – Thursday 5 June 2014	**Politics, Society, and Technology Integration: How Does Policy Making Affect Governmental and Local Use of ICTs for Disaster Risk Reduction?**			
	Session Leader: Dr. Paula Lytle, The World Bank, United States			
	Co-Session Leader: Mr. Charles Martin-Shields, Ministry of Communications and Information Technology, Independent Samoa			
	Vasilescu, Veronica	IT	Politecnico di Torino (Italy)	Share for Care. Communication Technologies and Social Inclusion for Empowerment in Guayaquil, Ecuador
	Relhan, Gaurav	IT	The World Bank (United States)	Municipal Information and Communications Technologies Capacity and its Impact on the Climate-Change Affected Urban Poor: The Case of Mozambique
	Fernández Polcuch, Ernesto	AR	UNESCO Regional Office for Science in Latin America and the Caribbean (Uruguay)	Mainstreaming Indigenous Knowledge Systems to Science, Technology and Innovation Policies as a Strategy to Reach the Essential
	Garrity, David	US	GVA Research LLC (United States)	Mobile Financial Services in Disaster Relief: Modeling Sustainability

DAY 2 – THURSDAY 5 JUNE 2014 – AFTERNOON

TH2-SE02-03 (Lavaux Vineyards) 14:30-16:30 – Thursday 5 June 2014

Up-Scaling and Mainstreaming Renewable Energy Technologies for Energy Security, Climate Change and Economic Development

Session Leader: Dr. Pankaj Agarwal, Panitek AG, Liechtenstein

Co-Session Leader: Dr. Kinsuk Mitra, InsPIRE Network for Environment, India

Bharadwaj, Ritu	IN	Institute for Industrial Productivity (India)	Green Mini Grids: Evidence From India Experience Providing Learnings for Scale Up In Low Income Countries
Walwyn, David R.	ZA	University of Pretoria (South Africa)	Local Government Impedes the Implementation of Renewable Technologies
Sinha, Shirish	IN	Swiss Agency for Development and Cooperation (India)	Large Scale Diffusion of Thermal Gasifier in India's Micro, Small and Medium Enterprises: Experience and Opportunities
Singhal, Sudhir	IN	Indian Institute of Petroleum (India)	A Case Study of Sustainable Village Energy Security Project in India

TH2-SE02-15 (Lavaux Vineyards) 14:30-16:30 – Thursday 5 June 2014

Facilitating and Stimulating Inclusive Design and Innovation

Session Leader: Prof. Prabhu Kandachar, Faculty of Industrial Design Engineering, Delft University of Technology, The Netherlands

Dotz, Dara	US	3DPforHealth (Haiti)	A Pilot of 3D Printing of Medical Devices In Haiti
Syson, Michael	PH	Ateneo de Manila University (Philippines)	Electronic Health: Using ICT to Enhance the Directly Observed Treatment Short-course Compliance Assessment Tool of the Philippine Plan to Control TB
Kubicki, Andrea	US	Michigan Technological University (US)	Bringing Healthcare to Rural Ghana
Chavarriaga, Ricardo	CO	Ecole Polytechnique Fédérale de Lausanne (Switzerland)	Designing Suitable Assistive Technology for the Population with Motor Disabilities in Colombia

TH3-SE03-04 (Lavaux Vineyards) 14:30-16:30 – Thursday 5 June 2014

Sustainable Deployment of Technology Solutions in Emerging Countries: Case Studies

Session Leader: Ms. Jennifer Brant, Innovation Insights, Switzerland

Mages, Allison	US	General Electric (United States)	GE Healthcare's End-to-End Approach to Building Biomanufacturing Capacity through KUBio
Needham, Paul	IN	Simpa Networks (India)	Financing New Business Models to Expand Energy Access in Emerging Markets: A Case Study and Recommendations for Development Finance
Parthasarathy, Balaji	IN	International Institute of Information Technology (India)	Innovating for the Bottom of the Pyramid: Case Studies in Healthcare from India
Tronchon, Stephane	FR	Qualcomm (United States)	How Technical Innovation Can Improve Healthcare Access and Delivery: Cases from South Africa and China

DAY 2 – Thursday 5 June – Afternoon

Lavaux Vineyards – 14:30-16:30

[TH1-SE01-02] What Technologies are Essential for Megacities of the Future to be Sustainable?

Session Leader: Dr. Justin Bishop, Department of Engineering, University of Cambridge, United Kingdom

Over half the global population lives in an urban environment. There are significant socio-economic promises which stimulate migration to the city. However, the urban impoverished suffer from poor housing, infrastructure and job prospects. What technologies exist or are necessary for cities of the future to deliver social equity and economic prosperity to its poorest residents?

The objective of the oral presentation is to discuss scalability of the intervention and real-world deployment of the technology/behavior at scale; limitations and unintended consequences; and speculate on the impacts of widespread use of such technologies/behaviors.

Essential Sustainable Water-use Technology: Learning from Mexico City's Urban Poor

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Biography of presenting author: With a background in Architecture from Universidad Iberoamericana, Mexico City and in Architecture and Sustainable Development from EPFL, and UCL (Catholic University of Louvain), I have developed architectural design projects aiming to the creation of humane and sustainable spaces. I am currently working on a PHD research project on Sustainable Water Use in Informal Settlements in the Ajusco region of Mexico City at UCL. Part of this project is done through "Isla Urbana", a local non-profit organization that has developed and installed Rainwater-Harvesting Systems in the region.

Abstract
Human population continues growing and concentrating in urban areas where even drinking a glass of water becomes a highly technological act. Many of the new urban dwellers of the world cannot access the technologies needed to fulfill basic needs or the *essential technologies*.

In Mexico City "informal settlements" are sixty percent of its total households. These settlements have developed beyond the limits of urban planning and regulations, and often on unsuitable areas with no access to basic urban services. They face acute water scarcity problems but are rich in inventive low-cost solutions to cope with it.

Rational water use is an everyday reality for the people living in these "informal settlements". Water-saving practices and alternative water resources are currently used when water becomes scarce. This study aims to assess water saving practices currently used in a case study area with the purpose of detecting opportunities to develop low-cost technologies with interesting potentials that can make the practices desirable and practical even when acute scarcity is no longer an issue.

Keywords
water-saving practices, informal settlements, essential low-cost technology, sustainable water use, water reuse

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Technology Justice in Urban Service Provision

Amber Meikle[1] Dr. Lucy Stevens [1]
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Biography of presenting author: Amber Meikle is Senior Policy and Practice Adviser – Technology Justice for Practical Action

Abstract
In Practical Action's vision for cities and urban areas, all people enjoy technology justice. This means they can access the technologies they need to provide at least a basic level of services, as part of their human right, and the foundation on which they can improve their well-being and live a life they value. It also means that they have a voice in the governance of, and are equipped to make informed choices about these technologies.

Water, Sanitation, Hygiene (WASH) and waste management are among the key services that the urban poor need, demand and have a right to. People's lives are severely affected without them: their health is at risk, they use considerable amounts of time, and they often pay more for services than their richer neighbors.

Practical Action's urban services work has shown that it these technology inequalities – or injustices - are not generally due to availability of technology to provide services, but a problem of access in ways which are affordable and

appropriate to people's needs. These inequalities will persist in cities in the future unless the barriers to delivery of services to poor urban people are understood and overcome today.

Using Practical Action's participatory approach, solutions to problems such as unimproved sanitation are led primarily by the communities who would normally be marginalized in this process. In doing so they are empowered to shape, and be resilient to, the complex urban systems that affect their lives as they are able to make choices about the technologies they need and have a right to. This paper introduces learning from two case studies of this approach in South Asia and East Africa, and makes recommendations on how to ensure technology overcomes rather than deepens social equality in cities today and in the future.

Keywords
technology justice, urban, WASH, waste management, participation

Critical Study of Utilization of Silico Manganese Slag – A Non-biodegradable Waste Material as Coarse and Fine Aggregates in Plain and Reinforced Cement Concrete

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Biography of presenting author: Born on June 3, 1965, Abhay Patil graduated in Civil Engineering from Visveswaraya National Institute of Technology, Nagpur (1986) and obtained post-graduation in Structural Engineering from IIT, Roorkee (1989). Working as faculty of Civil Engineering at Yeshwantrao Chavan College of Engineering, Nagpur, he is actively involved in R&D and was associated with research projects on Low Cost Housing & Ferrocement. He has published 35 technical papers and attended number of National and International conferences in India, China and Thailand.

Abstract
Enormous amount of naturally available materials like metal and sand are exhausted in infrastructure development, especially in concretes used for buildings and pavements. The availability of these natural resources is depleting and today stage has set that the administration and judiciary has to regulate its mining in order to maintain ecological balance. On the other hand large amount of non-biodegradable waste like silico manganese (SiMn) slag are generated and discarded from the SiMn smelting furnaces. In India estimated 2 Million Tons SiMn slag is generated annually, the disposal of which is usually carried out in landfill leading to ground and water pollution. The demand for utilization of industrial by-products and wastes in construction is increasing, aptly supported by government policies and public awareness. Our national commitment to shelter for all is a gigantic task and requires huge quantity of building materials contrary to a big gap between demand and supply of building materials in India.

The principal objective of investigations presented in this research paper was to assess the utilization of SiMn slag in plain concrete and Reinforced Cement Concrete (RCC). The concrete of M20, M25 and M30 grades were considered for the replacements of coarse aggregate with slag manufactured aggregate. In plain cement concrete improvement in compressive strength, split tensile and flexure strength over control mixes were observed. In reinforced cement concrete, the results were comparable with the concrete manufactured using conventional aggregates. The studies undertaken provided altogether new knowledge about the potential applications of SiMn slag as manufactured aggregate in concrete and the research demonstrated that the SiMn slag has immense potential of use in concrete for buildings and pavements. It is concluded that the use of SiMn slag can be regarded as truly sustainable material in terms of built environment and innate environment. On the basis of overall observations, suitability of SiMn slag is recommended for utilization as aggregates in plain and reinforced cement concrete applications.

Keywords
Silico Manganese Slag, aggregate, sustainable, sand, concrete

Enhanced Phytoremediation of Crude Oil- Polluted Soil by Four Common Native Plants: Effect of Inorganic and Organic Fertilizer Amendments

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Biography of presenting author: Dr Eucharia Oluchi Nwaichi was born to the family of late Sir Donatus Nwaichi of Abia State Nigeria. She holds B.Sc, M.Sc and Ph.D in Biochemistry (Environmental and Toxicology option) and is a lecturer in University of Port Harcourt Nigeria. Eucharia bagged several awards including international UNESCO L'OREAL Fellowship For Women in Science 2013 and is an Environmental consultant. She enjoys many affiliations, has presented many papers at important international conferences, and has several scholarly articles in renowned journals.

Abstract

Crude oil pollution has become a serious problem in the Niger Delta, Nigeria and requires an environmentally – friendly approach as a clean - technology. A 90d field experiment to investigate performance of native species - *Vigna subterranean, Hevea brassilensis, Cymbogonium citratus and Fimbristylis litoralis* at major contaminants removal and /or uptake at a freshly crude oil spill site, was performed during the 2013 wet season. Soil functional diversity and soil - enzyme interactions were also investigated. A total of 16 Polycyclic aromatic hydrocarbons were identified of which 6 were carcinogenic and up to 42.4 mg kg^{-1} total PAHs duing initial field characterization. At 90d, up to 92% and 90% PAHs and Cd removal respectively was achieved using *F. Litoralis*. The diagnostic ratios and the correlation analysis identified mixed petrogenic and pyrogenic sources as the main contributors of PAHs on the study site. Organic amendment rendered most studied contaminants unavailable for uptake in preference to inorganic fertilizer. Among all plant species studied, organic amendment accounted for over over 70% of the increased dehydogenase, phosphomonoesterase, proteolytic enzymes activity. Generally, phytoremediation improved significantly the microbial community activity and thus will promote ecosystem restoration.

Keywords

environmental contamination and clean-up, phytoremediation, heavy metals, oil spill, hydrocarbon contaminants

DAY 2 – Thursday 5 June – Lavaux Vineyards – 14:30-16:30

[TH2-SE02-02] Politics, Society, and Technology Integration: How Does Policy Making Affect Governmental and Local use of ICTs for Disaster Risk Reduction?

Session Leader: Dr. Paula Lytle, The World Bank, United States

Co-Session Leader: Mr. Charles Martin-Shields, Ministry of Communications and Information Technology, Independent Samoa

Rapid increases in technology development and access have made mobile phones and computing increasingly ubiquitous in the developing world. This session aims to answer three related questions about DRR: 1) Which technologies are allowing governments to be more transparent and connected to local populations? 2) What technologies are helping local actors share information with their governments and among each other? 3) What policies are being put into place to encourage local-to-national information sharing for DRR?

Share for Care. Communication Technologies and Social Inclusion for Empowerment in Guayaquil, Ecuador

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Biography of presenting author: Veronica Vasilescu is a post-graduate student from Politecnico di Torino and Milano, with a Master Degree in Architecture for Sustainability. During her last two years of university, she has joined the excellence program of Alta Scuola Politecnica (ASP). In this context, she developed a multidisciplinary project, focused on international cooperation, innovation and communication technologies. She is deeply committed to humanitarian activities, and interested in projects and studies concerning architecture and technology as means for sustainable development.

Abstract

The paper presents the main characteristics and expected results of IMPARAR (*Improving Access to Resources at Reduced Risk for Urban Areas with Strong Informal Settlements*), a project belonging to the realm of social innovation and development that aims at promoting social development and inclusion in deprived neighbourhoods of the city of Guayaquil (Ecuador) by increasing resources and services accessibility. Living conditions in informal settlements present several challenges, such as lack of management strategies, in particular regarding access to services, risk prevention and other sensible issues. One of the reasons behind these challenges is the considerable lack of communication between local communities and public administrations and the difficulty of territorial data collection in informal contests. In order to improve the relations between public institutions and population, in turn providing better management strategies and consequent enhancement of the quality of life, a *two-way communication-intervention* system, named "*SHARE FOR CARE*", was designed. It is a composed solution characterized by a Digital Tool System and a Community Based Organization.

The project, developed through a participatory design approach, defines an organization system that should support the communitarian and collaborative work of the population, by using diffuse Information and Communication Technologies (ICTs) with an innovative approach. In particular, the expected result of the application is to involve citizens, in order to make them able to interact with each other and with the local institutions, through the use of ICTs and, more in particular, through tools spread among the population and used in every-day life. An actual implementation of a system that combines the innovative use of technologies with policies of inclusion and social mobilization, would led to considerable benefits for both the public administration and the community, on the one hand allowing for the improvement of relations between Municipality and unprivileged population and, on the other hand, for the implementation of sustainable development strategies.

Keywords

information and communication technologies, social inclusion, empowerment, sustainable development, innovation

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Municipal Information and Communications Technologies Capacity and its Impact on the Climate-Change Affected Urban Poor: The Case of Mozambique

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Abstract

Mozambique has since long embraced policies aimed at leveraging ICT as a poverty alleviation tool for better service delivery capabilities and transparency in public-sector institutions. Under the lens of such policy framework, Mozambique is upgrading its local governments' capabilities using various ICT tools. While progress has been made towards applying ICT in this direction, the impact on poverty reduction has been unknown.

This Poverty & Social Impact Analysis (PSIA) paper conducts a spatial analysis of Mozambique's ICT policy framework to assess the impact of local government–level ICT on the poor. The objective is to uncover the pattern of municipal ICT impact that may exist in other low-capacity countries with analogous political economy structures in relation to leveraging ICT in public sectors. Given the economic importance of Mozambique's coastal cities and their susceptibility to regular climate hazards, the country's ICT policy framework is evaluated by analyzing the efficacy of ICT tools along a dimension that disproportionately affects the poor more, namely vulnerability to flooding -- a reality worsening each year due to the effects of climate change. The spatial analysis approach involves comparing key coastal cities with each other to discern differences in respective ICT capabilities and effectiveness that derive from policy as well as scale.

Findings from this study suggest that within the framework of leveraging ICT for public-sector reform in Mozambique, differences in municipal resources and governance structures have led to a ICT capabilities being better developed in cities that are of greatest economic significance, and least developed in cities where economic output is smallest. Paradoxically, the digital divide in ICT's impact appears to be widest in the better equipped, wealthiest cities, and narrowest in the lower capacity smaller ones.

The paper recommends that dimensions of the country's ICT policy framework be sufficiently broadened to increase citizen participation and social accountability. A framework is provided for enabling local governments to uptake cost-effective Demand-Side ICT methodologies.

Keywords
ICT, Climate Change, Cities, Poverty Reduction, Social Accountability

Mainstreaming Indigenous Knowledge Systems to Science, Technology and Innovation Policies as a Strategy to Reach the Essential

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Abstract

Indigenous knowledge, sustainable development, and science and technology policies are very closely linked. To face the challenges of sustainable development, including vulnerabilities to climate change and disaster risk prevention, Latin America and the Caribbean countries have recognized the importance of indigenous knowledge. Furthermore, the outcome document of the *United Nations Conference on Sustainable Development* (Rio +20), entitled *The future we want*, recognizes the importance of the participation of indigenous peoples in achieving sustainable development. It is increasingly recognized that sustainable development solutions need an integral and holistic approach.

Incorporating indigenous knowledge systems (IKS) into evidence-based policy making requires proper mainstreaming of IKS into science, technology and innovation (STI) policies. There have been different approaches to linking IKS and STI policies, depending on factors such as the country's overall framework in relation to indigenous people -such as the "plurinational" conception of the state in Bolivia and Ecuador-, as well as specific targeted policies in each area. This becomes particularly important in STI policy. Mainstreaming IKS into STI policies presents many challenges, depending on endogenous needs of each country and its relations with Indigenous Peoples' issues.

Latin America is particularly rich in such bodies of knowledge and indigenous people are now recognized as essential partners in environmental management.

This paper presents the findings of a survey and two regional workshops held in Latin America, in 2013. Furthermore, the paper presents an initial analysis and categorization aimed to identify the different approaches that Latin American countries are using regarding the incorporation of IKS in STI policies.

Keywords

indigenous knowledge; science policy; Latin America and Caribbean; sustainable development; science, technology and innovation system

Mobile Financial Services in Disaster Relief: Modeling Sustainability

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Biography of presenting author: *David M. Garrity, CFA is the founder of GVA Research, LLC. He has advised and led technology companies, as Chief Financial Officer (CFO) of Aspen Group, Inc. (on-line education), and as Director & CFO of Interclick, Inc. (behaviorally targeted internet advertising, sold to Yahoo! Inc. in 2011). Prior, as Global Research Coordinator at Dresdner Kleinwort, Mr. Garrity expanded research into eCommerce enterprise software and subsequently co-founded American Technology Research. He holds an MBA from Northwestern University's Kellogg School.*

Abstract

Mobile Financial Services (MFS) have provided marginal populations with access to basic financial services, including savings programs and insurance policies. Disaster relief response has been characterized by the use of MFS as a vehicle for charitable donations, both directly from diaspora populations as well as campaigns organized by traditional relief organizations. The paper will develop a financial model and analysis of how scaling MFS can be commercially viable and sustainable. The analysis will assess the extent to which the deployment of MFS as a disaster risk mitigation measure may be enhanced by the provision of information on available risk profiles.

The paper will assess the enabling environment for successful deployment of MFS as a mechanism for managing financial shocks in disaster relief and for mitigating individual risk. Statistical models have been developed using mobile network operator (MNO) call detail records (CDRs) to assess which subscribers may present better credit risks as well as how to best structure premium levels and payment methods to best fit subscribers' abilities and needs. Based on such models and on the pricing structures of MFS, the paper will extrapolate from instances where farmers have secured insurance against weather-related crop failures and where MFS have been developed. The model will analyze available data on use of MFS as a risk-sharing mechanism, identifying the periods in which measurable increases occur in volume and amount of transfers. MFS adoption in developing countries follows a model in which remittances lead to the adoption of other MFS.

The data overview indicates that the existence of established reciprocity and social networks drives volume and that establishment of trusted networks is critical to MFS achieving scale. Building on these findings, the analysis will identify enabling regulatory factors and will provide recommendations for various stakeholders. In conclusion, the analysis will examine how patterns of use of MFS provide an informational basis on which disaster risk reduction can implemented in different form factors.

Keywords

mobile financial services, mobile micro-insurance, index insurance, financial inclusion

DAY 2 – Thursday 5 June – Lavaux Vineyards – 14:30-16:30

[TH2-SE02-03] Up-Scaling and Mainstreaming Renewable Energy Technologies for Energy Security, Climate Change and Economic Development

Session Leader: Dr. Pankaj Agarwal, Panitek AG, Liechtenstein
Co-Session Leader: Dr. Kinsuk Mitra, InsPIRE Network for Environment, India

How can we Facilitate Deployment and Access to Renewable Energy through Technology and Infrastructure Development? The session will cover the following key thematic areas: Power Technology and Infrastructure; Heating and Cooling Technologies; Buildings and Transport.

Green Mini Grids: Evidence from India Experience Providing Learnings for Scale up In Low Income Countries

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Biography of presenting author: *Ritu Bharadwaj has 14 years of extensive experience in the field of energy, environment and climate change. In the past, she has worked with the Government of India for nine years leading a large portfolio of programs. She has led some big action research projects in the area of renewable energy commercialisation and climate change. As an Advisor with DFID, she championed a diverse portfolio of programs with LICs in Africa and Asia. She is currently with the Institute for Industrial Productivity.*

Abstract

The International Energy Agency has estimated that, in order to achieve universal electricity access, mini-grids will have to provide around 40% of new capacity needed by 2030. While use of diesel mini-grid systems is expanding, green mini-grid options exist but have struggled to expand beyond pilot projects and will not make a meaningful contribution to Sustainable Energy for All targets at current deployment rates. Key barriers include lack of access to affordable longer term finance, weak effective consumer demand, local capacity issues and policy uncertainty. This paper presents the experience and learnings of policy initiatives in India to promote village electrification based on renewable energy powered mini grids that has high potential for scale up world-wide especially in Africa. An analysis of the scale up potential of the renewable energy based mini grids implemented in India has been undertaken under the five pillars of sustainability viz (1) Planning, (2) Technical, (3) Financial, (4) Institutional, and (5) Social. In addition, the assessment also covers environmental sustainability to ensure that the chosen options are not only climate friendly, but also do not lead to local environmental problems. This assessment has been used to suggest a strategy for scale up in Low Income Countries particularly in Africa, which includes a cluster based approach to mini grid that can help in providing the scale of operation to cover the issues around the management, operation, cost recovery, social & institutional issues and diversification of energy use. A decision making tool for ranking various renewable energy based mini grid options has also been presented, which includes a scoring matrix based on the capital cost, generation cost, environmental impact, local manageability and ease of operation and the potential for enhancing the livelihood opportunities.

Keywords
Mini grids, scale-up, cluster approach, technology decision framework

Local Government Impedes the Implementation of Renewable Technologies

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Biography of presenting author: *David Walwyn is a professor in the Graduate School of Technology Management, University of Pretoria, and runs a small company, Reseva, the latter providing consultancy services in science policy, feasibility studies and research management. He has previously worked as the Research Manager at the CSIR, as the CEO of Arvir Technologies, and in a number of other research and development (R&D) positions. His research interests cover science policy, research management, performance management within R&D organizations, renewable technologies and public health.*

Abstract

Based on a learning curve methodology, the levelised cost of electricity (LCOE) from photovoltaic (PV) systems is predicted to fall below the equivalent cost from new coal-based power stations in South Africa by the end of 2016. The emergence of PV as a dominant energy source will put considerable pressure on the national regulator and local

authorities to allow the re-design of energy generation systems. Nevertheless these entities have been slow to develop the appropriate systems and regulations supporting the implementation of widespread roof-top solar, despite its obvious advantages. Two reasons for this recalcitrance are cited, namely that energy independence will excise from local authorities a portion of their revenue, thereby restricting their role in providing services to the poor; and secondly the implementation of PV will result in the loss of jobs from the coal industry. The purpose of this research has been to proportion the scale of the revenue loss, its potential impact on service provision, and the predicted effect of PV on employment. Using municipal budgets from the previous five years, it has been shown that such authorities will not be significantly affected by roof-top solar, at least in the medium term. Furthermore the net impact on employment will be positive. It is recommended that policy adjustments should be implemented to facilitate roof-top solar, thereby realising the double dividend of higher levels of employment and lower carbon emissions. Local authorities will also be well-advised to take proactive steps to safeguard their pro-poor initiatives given that wide-scale PV could reduce earnings from electricity sales by 5 to 10%.

Keywords: policy conflict, local government, renewable technology, redistribution

Large Scale Diffusion of Thermal Gasifier in India's Micro, Small and Medium Enterprises: Experience and Opportunities

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Biography of presenting author: *Dr. Sinha is a Senior Thematic Advisor, Climate Change with the Swiss Agency for Development Cooperation (SDC) in the India program. He specializes in the field of energy and development, especially focusing on rural energy. He has 18+ years of experience in research, policy and development cooperation. In 2012, he published his book In Pursuit of a Light Bulb and Smokeless Kitchen, which provides longitudinal analysis of role of energy policies to alleviate rural energy poverty in India.*

Abstract

The micro, small and medium enterprises (MSMEs) in India forms the backbone of the economy through their 7% GDP contribution and employment to 60 million people. However, MSMEs are going through a turbulent phase due to overall sluggishness in the economy and also due to rising input energy costs. In recent years, the prices of all forms of energy, especially fossil fuels used by MSMEs have registered a steep increase.

In the current energy supply scenario, biomass fuels have emerged as a potential option for replacing fossil fuels in MSMEs. This paper, presents an insight and analysis on experience of promoting diffusion of biomass thermal gasifiers in MSMEs across India as clean energy technology solution. As demand for thermal gasifiers increases, there are still critical barriers for accelerated diffusion in MSMEs.

In 1992, the Energy and Resources Institute (TERI) started developing biomass thermal gasifier systems in collaboration and support from the Swiss Agency for Development and Cooperation (SDC) in MSMEs sector. The efforts have resulted in improvement in understanding, uptake and diffusion of the gasifier in MSMEs and in identification of key barriers and opportunities with respect to accelerated dissemination.

The SDC-TERI experience for promoting gasifiers, which involves over 650 gasifiers installation in MSME clusters in the country with cumulative capacity of about 65 MWth. It has also resulted in CO_2 reduction of around 175,000 tons per annum. However, the current number of installation is just a small fraction of the potential and opportunity that exists. The recent energy pricing and implementation of pollution norms for MSMEs have created a favorable environment for rapid acceptance of the technology. For example, in case of thermal applications like water heating, hot air generation, drying, cooking and steam generation, cost per unit of useful energy through the gasification route is 60% cheaper than furnace oil/diesel option, and 80% cheaper than electricity option, at the current prices of diesel, electricity and biomass fuels. Another, key reason is enforcement of stringent environmental and pollution norms in the MSMEs, forcing them to shift towards clean technologies.

The experience of the SDC-TERI project has clearly demonstrated that the biomass gasifier thermal option is economically viable is likely to remain so for years to come. However, for accelerated diffusion to take place there are still some critical barriers that needs to be addressed. These include:

- ***Instrumentation and control system*** for gasifier thermal applications. In order to ensure large scale adoption in MSMEs, gasifiers need to become more user-friendly through automated systems for controlling various processes,
- A ***comprehensive biomass supply chain*** analysis needs to be done, since lack of a sustainable biomass supply often poses problems in continuous operation of these systems.
- ***Market development*** must be facilitated to evolve models that will ensure wide and sustained uptake of gasifier based technologies among MSMEs.

Keywords: biomass gasifier, micro, small and medium enterprises, thermal energy

A Case Study of Sustainable Village Energy Security Project in India

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Abstract

The paper describes in brief the work done to provide clean renewable energy through the use of biofuels to people in a remote village in India. Vegetable oil (SVO) operated diesel engine gensets, which were optimized particularly for this application, provided electric power which was utilized for home and street lighting, for running pump sets for irrigation, for thrashing of paddy and for other applications. The success of the project lies entirely in the interactions that took place with the villagers both before and after the installation of these gensets, as a result of which these gensets could subsequently be managed entirely by the Village Energy Committee (VEC) and have now operated, every day, for over 40 months, without a single breakdown. This sustainable technology project is easily replicable and can mobilize communities through their participatory approach.

Keywords

Energy Security, Social Impact, Remote Village Electrification, Biofuels, Sustainable Technology

DAY 2 – Thursday 5 June – Lavaux Vineyards – 14:30-16:30

[TH2-SE02-15] Facilitating and Stimulating Inclusive Design and Innovation

Session Leader: Prof. Prabhu Kandachar: Faculty of Industrial Design Engineering, Delft University of Technology

This session is set at the intersection of healthcare and technology, focusing on medical devices. The session is built around the following interdependent themes: 1) Design and innovations which are socially responsible; 2) Less is More: Design for sustainability - ecological economic and social implications; 3) The role of private sector in creating sustainable and inclusive designs and innovations; 4) The role of social entrepreneurs, NGO's, local organizations and academic institutions in supporting inclusive design and innovations; 5) Predicting the health trajectories and appropriate policy interventions; 6) Evaluation of interventions.

A Pilot of 3D Printing of Medical Devices in Haiti

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Biography of presenting author: *Dara Dotz combines design, strategy, and technology to empower people overcoming low socio-economic environments. Dara holds a Bachelor of Science in Industrial Design with a minor in International Business from Metropolitan State College of Denver. Dara's portfolio includes: job development, Sovereign Nation Ute Mountain tribe, USA; founding team, Recrear, Germany; program designer, Social Entrepreneurship Program, Nepal; human factors lead, Made in Space, Inc., USA; founder, iLab Haiti, an innovation lab using 3D printers to build replacement parts for clinics, Haiti.*

Abstract
3D Printers are small-scale manufacturing facilities in a box. With minimal resources, they enable rapid on-demand production. Cost-effective complex products are made when needed with decreased transportation, storage and customs costs. The immediate access to medical devices created by 3D printing reduces uncertainty and delivery delays.
This presentation introduces a pilot project to collaborate with local clinicians and design medical devices with a 3D printer in Haiti. The pilot aimed to empirically ascertain whether locally engaged staff could implement 3D printing of medical devices. This process may be replicated globally and brought to other areas of need.
On multiple occasions, we visited three health care delivery sites in Haiti. By observing and interviewing medical staff, we identified high-demand supplies with the potential for 3D printed fabrication. We also identified equipment not used due to broken parts that could be easily fabricated. In collaboration with local clinicians, we developed a list of 16 3D printable objects to meet the localized demand in real-time.
3DPforHealth launched a 3D printing lab in Haiti and trained local people in design using the Makerbot Rep 1 printers. To demonstrate 3D printing medical application, we collaboratively designed an umbilical cord clamp prototype. Variants of the clamp design were iteratively tested to assure durability and efficacy of grip on multiple materials.
The process identified initial concerns of printing medical devices including: sanitation, product longevity, reuse of retired materials for new product development, and parameters for responsible human trials.
Initial trials demonstrate proof of concept for identification and 3D printed production of much-needed medical devices by collaborating with local clinicians. Further, we were able to train local people 3D printing design. We envision 3DPforHealth as a replicable model for countries struggling with similar challenges. 3DPforHealth will be a program to design solutions shared with other resource-constrained environments, bypassing infrastructure and distribution limitations globally.

Keywords: medical devices, capacity building, 3D printing, design, innovation, capacity building

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Electronic Health: Using Information and Communication Technologies (ICT) to enhance the Directly Observed Treatment Short-course (DOTS) Compliance Assessment Tool (DCAT) of the Philippine Plan to Control Tuberculosis

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Biography of presenting author: Michael Syson, or Mike, is a student, teacher, and social entrepreneur. He teaches basic Japanese Language and Culture at the Ateneo de Manila University, and works on the Usbong project--which, in partnership with government, industry, and academe, is an open-source platform that allows non-technical people to create their own Android applications for use in data collection, assessment, training, and digital story telling. He is currently finishing his doctorate degree in Computer Science at the Ateneo de Manila University.

Abstract

Information and Communication Technologies (ICT) are more effective when perceived not as a means to substitute people, but as an amplifier of human intent and capacity for human development (Toyama 2010). This ongoing study puts this theory into practice by providing an alternative tool in assessment compliance in the area of public health. Specifically, ICT was used to enhance the DOTS (Directly Observed Treatment, Short-course) Compliance Assessment Tool (DCAT) by transforming the Microsoft Excel-based scorecard that runs on PCs to Usbong DCAT, a more portable mobile-based form that runs on Android devices. National Tuberculosis Program (NTP) medical and nurse coordinators are being trained on the use of DCAT, which uses weighted scores to measure DOTS compliance of Local Government Units (LGUs) implementing the Tuberculosis (TB) DOTS program in the Philippines. LGUs who comply with DOTS are then given incentives in the form of performance-based grants, which they can use to finance interventions that are aligned with their Provincial-wide Investment Plan for Health (PIPH) and the Annual Operations Plan (AOP). Findings from the development of Usbong DCAT show that the technical product has to find its value and location in various social processes involved in decision and policy-making. This entails providing presentations and getting clearance from the NTP, as well as collaboration agreements with the Center for Health and Development (CHD)-Regional Health Office, and subsequently the LGUs, so that they would have the intention to use Usbong DCAT. Furthermore, the mobile tool is expected to amplify human capacity in performing the DCAT by addressing issues that were found after the initial testing of the original Excel version in more than 40 provinces in the Philippines. Usbong DCAT will be pilot-tested soon after it is further revised based on the recommendations of the Department of Health (DOH) NTP in the last quarter of 2013 to harmonize it with the updated Philippine Plan of Action to Control TB (PhilPACT) indicators and NTP protocols.

Keywords
ICTD, eHealth, DOTS, TB, Public Health

Bringing Healthcare to Rural Ghana

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Biography of presenting author: As a pre-health student at Michigan Technological University, I traveled to Ghana this summer through the Pavlis Institute for Global Technological Leadership. Before traveling, I worked with a team from the IBV (Biomedical Products for Global Markets) and an engineering senior design team to create a mobile health clinic. While in Ghana, my team introduced the mobile health clinic and went into the field to collect data on the use of the vehicle and ideas for improvement in the future.

Abstract

At Michigan Technological University, a mobile health clinic was designed and built through a unique collaboration among the Pavlis Institute for Global Technological Leadership (Pavlis Institute), the IBV (Biomedical Products for Global Markets) Enterprise, and a mechanical engineering technology senior design team. The three entities created a mobile clinic for people in the remote villages of Ghana who often lack the means to visit healthcare centers in their region. A 12-passenger vehicle was retrofitted with a water supply system, auxiliary power system, lighting system, two jump seats, refrigeration, microscopes, EKG machine, centrifuge, generator, awning, portable ultrasound, and etc. The vehicle was then shipped to Ghana and a team of undergraduate students from the Pavlis Institute traveled to Ghana to facilitate the deployment of the mobile clinic and to collect data on clinic usage and effectiveness. Affordable mobile healthcare brought directly to the people allowed medical teams to administer preventive care and treatment and, if expanded, mobile healthcare could greatly reduce the number of preventable deaths in the future. There is a great need and potential for mobile health clinics in Ghana. In the development of the mobile health clinic, the major expenses were the 12-passenger vehicle and the shipping. Thus, the team is currently looking at developing a flexible modular medical equipment package outfitted with donated equipment and could be inserted into used vans that are readily available in Ghana. These modular packages would have everything needed for diagnostics and treatment; several could be fitted into shipping containers, which would reduce the cost per mobile health clinic. In the future, vehicles in Ghana and similar countries could be outfitted with these modular packages, providing affordable healthcare to millions of those in need. While the concept of mobile clinics is not new, the planning and development

of a systematic and affordable method for delivering future healthcare to Ghana could be innovative and become a model for pervasive healthcare in developing countries.

Keywords
mobile health clinic, Ghana, low-resource settings

Designing Suitable Assistive Technology for the Population with Motor Disabilities in Colombia

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Biography of presenting author: Ricardo Chavarriaga is a senior researcher at École Polytechnique Fédérale de Lausanne (EPFL), Switzerland. He has a degree in Electronics Engineering from the Pontificia Universidad Javeriana in Cali, Colombia and received a PhD in computational neuroscience from the EPFL. His research focuses on robust brain-machine interfaces and the study of cortical potentials that convey information about the user's cognitive processes and the use of such signals for neuroprosthetics and rehabilitation.

Abstract
Motor disabilities, due to traumatic or pathologic origins, have significant consequences at a personal and social level. Assistive technology has the potential of supporting people in this situation, so as to improve their autonomy and their opportunities to actively participate in society. For this reason the development of these technologies is an active research topic worldwide. However, this process is rarely addressed from a perspective that takes into account the socio-cultural aspects of the potential users in developing countries who have different conditions than in developed countries. To overcome this, we established a research line on the development of technology-based assistive solutions using an Expanded Model of Axiomatic Design. It is based on a multidisciplinary approach -combining engineers, physical therapist, researchers and end-users- that puts the user at the center of the design process so as to effectively identify the user´s needs in a particular context.

This approach has many advantages for each participant and his respective discipline and organization. Additionally, this approach goes beyond to the market vision centered in interest and affinities of the enterprise.

Indeed, contrasting with developed countries, the causes of most cases of motor disabilities in Colombia are linked to violence (42%) and mainly affect the young population. The disabled population has physical barriers in the public infrastructure, has low income and perceives discrimination from the rest of the society among others problems, which limit their social inclusion.

Based upon this characterization, we designed two products: one wheelchair for mobility and a rehabilitation station facility for supporting therapy. The wheelchair is based on a mechanical impulsion system by levers and allows a semi standing position to reach objects. The facility has characteristics that will be an aid to perform evaluation studies of technology-assisted neurorehabilitation between engineers and therapists.

This collaborative research between Swiss and Colombian institutions, as well as a rehabilitation center and a start-up company in Colombia, allows us to develop and apply state-of-the-art technology tailored for the specific needs of the community. At the same time, it also allows strengthening the research capabilities of local institutions and a valuable test bed for transnational research on this field. In this sense, we did some neuro-rehabilitation practices using the expertise of EPFL-CNBI, elaborate and applied two surveys based on ICF and offered two courses for interdisciplinary groups focused in rehabilitation and product design of assistive products based on our experience.

Keywords
assistive technology, interdisciplinary design, motor disabilities, social inclusion, neurorehabilitation

DAY 2 – Thursday 5 June – Lavaux Vineyards – 14:30-16:30

[TH3-SE03-04] Sustainable Deployment of Technology Solutions in Emerging Countries: Case Studies

Session Leader: Ms. Jennifer Brant, Innovation Insights, Switzerland

This session will feature representatives of technology providers, from different sectors, discussing their companies' experiences deploying specific technology solutions in developing countries. Participants will identify those factors that supported the sustainable deployment of the technologies in question, as well as the diffusion of related know-how. Particular attention will be paid to factors that could be readily replicated in other markets.

GE Healthcare's End-to-End Approach to Building Biomanufacturing Capacity through KUBio

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Abstract

Biopharmaceuticals are in high demand and few countries have the capability to produce them. In light of potential export challenges, many countries may find it desirable to establish local production. Biomanufacturing requires specialized knowledge that may not exist today in the countries who desire to establish such capabilities. To overcome this challenge GE Healthcare introduced KUBio, a modular biomanufacturing facility levering a single-use bioprocess production train. The facility can be assembled, qualified, and ready-to-run within 14 to 18 months and provides a cost-effective alternative to traditional plants. In addition to the facility itself, GE Healthcare assists in all stages of biomanufacturing, from facility design to production and through continuing education. This allows countries without existing capacity to access expertise in bioprocess development and hands-on training for facility personnel. As a result, developing countries have the opportunity to efficient develop local capacity in biomanufacturing.

Financing New Business Models to Expand Energy Access in Emerging Markets: A Case Study and Recommendations for Development Finance

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Abstract

Over 1.5 billion people worldwide lack access to electricity. Perhaps a billion more have unreliable connections, only receiving between 4 to 12 hours of power per day. The energy-poor often spend 20% or more of their incomes just to meet their essential needs for lighting. Globally, they spend over $50b per year on very poor solutions, such as kerosene fuel for small lanterns, which are dangerous, dirty, and dim.

The good news is that effective decentralized energy solutions already exist. Small-scale solar home lighting systems, for example, can meet the essential energy requirements of a household or small business. Small solar PV systems can provide multi-room lighting, mobile-phone charging, and power for small DC appliances such as electric fans for cooling and mosquito control.

The problem is that because these clean energy technologies involve significant up-front costs, they are not immediately affordable to the energy-poor. Studies show that consumers are willing to pay for regular energy delivery, but few can afford the high up-front costs associated with the installation of electricity infrastructure. In several markets around the world, new companies and new business models are emerging to tackle the development challenge of expanding access to clean, reliable electricity. These companies are pioneering for-profit business models that promise to advance the development objective of improving energy access.

A key barrier to the expansion of these innovative models is the lack of availability of appropriate working capital.

This paper presents a case study about the work of one such company that is selling solar-as-a-service to energy poor households and small businesses in rural India. Simpa Networks is developing a for-profit business model that aims to attract private capital in order to to scale up into a commercially sustainable model. The paper identifies a critical opportunity for development finance and philanthropic capital to help energy access companies in their early years to prove the viability of their models at a smaller scale, in order to ultimately mobilize mainstream commercial capital to achieve massive scale.

Innovating for the Bottom of the Pyramid: Case Studies in Healthcare from India

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Biography of presenting author: Balaji Parthasarathy is on the faculty of the International Institute of Information Technology, Bangalore. His interests are in the relationship between technological change and social transformation, in domains such as governance, health and education, in underprivileged contexts. His research draws on empirical work undertaken in South Asia and in Latin America, with support from many international agencies and foundations. Balaji earned a bachelor's degree from the Indian Institute of Technology, Kharagpur, and a PhD from the University of California, Berkeley.

Abstract

The much vaunted fortune at the bottom of the pyramid (BoP) has proven hard to reach. This is because realizing the opportunities provided by the BoP market faces several challenges, ranging from affordability to a lack of human and physical infrastructure. This paper argues that overcoming these challenges to achieve "frugal innovation", requires design strategies which deploy new technologies and organizational approaches. To substantiate its argument, this paper presents case studies of four firms, and their innovations, in the health care domain. All the cases are from India, which has emerged an ideal location for developing products and services for the BoP market. India not only has the skills to propose new technological solutions but, because the market is present in all its diversity, it also demands various organizational approaches. Two cases focus on diagnostic devices and products: one is a portable ophthalmic imaging device, to reduce preventable blindness, while the other is a baby warmer to lower infant mortality by preventing hypothermia. The other two cases focus on health care delivery: one relies on telemedicine while the other relies on mobile telephony to reach populations that would otherwise not have access to care. All four cases describe the circumstances surrounding the design, development and deployment of the product and services, to highlight how balancing new technologies and organizational changes was crucial. But, even as the firms have successfully designed for the BoP context, the paper will point to the challenges they face. For diagnostic devices, the challenge of positioning a new offering in the diagnostic devices ecosystem, especially in terms of quality and cost figures prominently. For service delivery, the challenge is to negotiate and manage the balance between the technological and human elements in servicing those needing care. Each case provides insight into the factors responsible for the sustainable deployment of these innovations, thus enabling a degree of extrapolation of lessons.

Keywords
frugal innovation, technological change, organizational approaches, diagnostic devices, healthcare delivery

How Technical Innovation Can Improve Healthcare Access and Delivery: Cases from South Africa and China

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Abstract
Today, many resource scarce countries labor to provide adequate healthcare to their citizens. The demands of an aging population and the global epidemic of chronic illnesses compound the problem. This paper provides current, real-world examples of health interventions using mobile broadband technology and the positive impact that these mobile health (mHealth) solutions are having on the health and welfare of people in underserved parts of the world. This paper also discusses how the current global system of invention and intellectual property protection make possible the rapid diffusion of mobile technologies and inspire mHealth solutions that are leading to healthier people and nations worldwide.

DAY 3 – FRIDAY 6 JUNE 2014 – MORNING

Identifying Opportunities and Constraints for Women in the Renewable Energy Sector

Session Leader: Dr. Bipasha Baruah, Department of Women's Studies and Feminist Research, University of Western Ontario, Canada

Co-Session Leader: Dr. Mini Govindan, Social Transformation Division, The Energy and Resource Institute (TERI), India

TH1-SE01-03 – Room 2C – Level Garden – Friday 6 June 2014 10:30-12:30

Terrapon-Pfaff, Julia	DE	Wuppertal Institute for Climate, Environment and Energy (Germany)	Analyzing the Role of Women along the Project Cycle of Small-Scale Sustainable Energy Projects in Developing Countries
Fernández-Baldor, Alvaro	ES	Universitat Politècnica de València (Spain)	Gender, Energy and Inequalities: a Capability Approach Analysis of Renewable Electrification Projects in Cajamarca, Peru
Sesan, Temilade	NG	University of Ibadan (Nigeria)	Deconstructing 'Discriminatory' Technologies: Insights into Inclusive Development from Improved Cookstove Projects in Nigeria
Abdelnour, Samer	CA	London School of Economics and Political Science (United Kingdom)	Technologizing Humanitarian Space: Darfur Advocacy and the Rape-Stove Panacea
Mahajan, Siddha	IN	The Energy and Resources Institute (India)	Decentralized Energy Solutions for Women Empowerment: A Case Study of SELCO-SEWA Bank Model in Gujarat

Implementing Living Labs Concepts to Strengthen the Innovation Ecosystem for Social Innovation in Rural Areas and Cities

Session Leader: Dr. Hans Schaffers, Centre of Knowledge and Innovation Research (CKIR), Aalto University, Finland

TH2-SE02-08 – Room 3C – Level Garden – Friday 6 June 2014 10:30-12:30

Hongisto, Patrizia	FI	Middle East University (Lebanon)	Open Innovation for Development
van Rensburg, Johann (Rensie)	ZA	CSIR - Council for Scientific and Industrial Research (South Africa)	Beyond 'Technology for Development' and 'Sustainability' towards Systemic and Holistic Rural Innovation: Success Factors from the Southern African Experience over 20 Years
Cunningham, Paul	UK	International Information Management Corporation (Ireland)	Living Labs in a Developing Country Context
Martin, Benjamin	US	Ecole Polytechnique Fédérale de Lausanne (Switzerland)	Participatory Language Technologies as Core Systems for Sustainable Development Activities
De Filippi, Francesca	IT	Politecnico di Torino (Italy)	The Use of ICT for Social Inclusion and Participative Planning. A Case Study of "South-North" Technology Transfer
Musa, Michael W.	NG	Ahmadu Bello University (Nigeria)	Creating Linkages, Meeting Innovation Needs for Sustainability of Post-harvest Systems: Insights from Nigeria
Riggs, Conor	US	iDE-Bangladesh (Bangladesh)	Facilitating Adoption of an Open Innovation Approach to Rural Sanitation in Bangladesh by the Private Sector through Enhanced Market Linkages within a "Living Lab Business Model"

DAY 3 – FRIDAY 6 JUNE 2014 – MORNING

TH2-SE02-10 – Room 5C – Garden Level — 10:30-12:30 – Friday 6 June 2014

Low-Cost, High-Tech and Crowd-Sourced Solutions for Better Water Management – Opportunities and Challenges

Session Leader: Dr. Tobias Siegfried, hydrosolutions Ltd., Switzerland

Co-Session Leader: Mr. François Münger, Corporate Domain Global Cooperation, Swiss Agency for Development and Cooperation (SDC), Switzerland

Lüthi, Beat	CH	Photrack AG (Switzerland)	Furrow Runoff Measurement App for Smartphones
Bouleau, Clémence	FR	Ecole Polytechnique Fédérale de Lausanne (Switzerland)	Low-Cost Wireless Sensor Networks for Dry Land Irrigation Agriculture in Burkina Faso
Bolay, Matthieu	CH	Haute Ecole ARC (Switzerland)	Designing Technology with Users: Potential and Challenges of the Anthropotechnology Approach in a Tanzanian Case
Soutter, Marc	CH	Ecole Polytechnique Fédérale de Lausanne (Switzerland)	An e-Atlas to Support Integrated Water Resources Management in the Orontes River Basin
Eamen, Leila	IR	K.N. Toosi University of Technology (Iran)	Agricultural Development Role in Urmia Lake Crisis, Iran

TH2-SE02-13-b – Room 1C – Garden Level — 10:30-12:30 – Friday 6 June 2014

How Can We Co-design Technologies with (and not for) Vulnerable and Poor Communities?

Session Leader: Dr. Andrés Felipe Valderrama Pineda, Aalborg University, Denmark

Co-Session Leader: Dr. María Catalina Ramírez, Universidad de los Andes, Colombia

Gupta Aggarwal, Anima	NL	eSHIFT Partner Network Association (Switzerland)	Resolving Project Conflict between Donor and Local Community Beneficiary in Implementing IT Projects in Southern or Developing Countries by Leveraging the Project Choice-Making Matrix (PCMP)
Hajibi, Soumia	MA	University Hassan 1st (Morocco)	Territorial Strategy: Towards a Territorial Information System in Moroccan Medium-Sized Cities – Case of the Cities of Settat and Kenitra
Kabutey, Robert Okine	GH	Kwame Nkrumah University of Science and Technology (Ghana)	Utilizing the Mobile Phone for Input and Output Payment: The Case of Smallholder Cocoa Farmers in Ghana
Lucena, Juan	US	Colorado School of Mines (United States)	Partnering with/Designing for Vulnerable Communities through NGOs: Criteria, Relationship Building, and Pedagogy
Mattarolo, Lorenzo	IT	Engineering Without Borders – Milano, Politecnico di Milano (Italy)	Solar Water Heating System Co-design and Do-It-Yourself Approach for Appropriate Technology Diffusion: The Médina Training Centre Case Study
Taoka, Yuki	JP	Tokyo Institute of Technology (Japan)	Evaluation of the Impact of Co-Design Approach in East Timor on Acceptability
Usen, Bridget	NG	Centre for Community Health and Development International (Nigeria)	Affirmative Action for Scaling-Up of Technology Innovations in Healthcare Delivery in Rural Communities in Nigeria

DAY 3 – FRIDAY 6 JUNE 2014 – MORNING

TH2-SE02-16 – Room 4C – Garden Level 10:30-12:30 – Friday 6 June 2014	**Strategies for the Successful Implementation of Mobile Health (mHealth) in Low-Resource Settings** *Session Leader: Dr. Walter Karlen, Stellenbosch University, South Africa & University of British Columbia, Canada*			
	Stroux, Lisa	DE	University of Oxford (United Kingdom)	The Importance of Biomedical Signal Quality Classification for Successful mHealth Implementation
	Godara, Balwant	IN	Foundation for Innovative New Diagnostics (Switzerland)	mHealth to Strengthen Diagnostics of Infectious Diseases in Resource-Limited Settings: Landscape Analysis using a Technology-Centred Approach Approach
	Medhanyie, Araya	ET	Mekelle University (Ethiopia)	Meeting Community Health Worker Needs for Maternal Health Care Service Delivery Using Appropriate Mobile Technologies
	Ettinger, Kate	US	University of California, San Francisco (United States)	Ethical Considerations and Relation - Centered Design for Mobile Health Applications
	Beratarrechea, Andrea	AR	Institute for Clinical Effectiveness and Health Policy (Argentina)	Challenges of Implementing mHealth Interventions for Lifestyle Modification in Prehypertensive Subjects in Guatemala, Peru and Argentina

DAY 3 – Friday 6 June – Morning

Room 2C - Level Garden – 10:30-12:30

[TH1-SE01-03] Identifying Opportunities and Constraints for Women in the Renewable Energy Sector

Session Leader: Dr. Bipasha Baruah, Department of Women's Studies and Feminist Research, University of Western Ontario, Canada

Co-Session Leader: Dr. Mini Govindan, Social Transformation Division, The Energy and Resource Institute, India

The overarching theme of the session will be "Identifying the opportunities and constraints women face in accessing technologies and finding quality employment in the renewable energy sector in developing countries and emerging economies". Within this theme there will be three sub-topics: 1) Access to technology and resultant employment opportunities; 2) Advancing the leadership of women in the renewable energy sector and 3) Gender dimensions of renewable energy policies and programs.

Analyzing the Role of Women along the Project Cycle of Small-Scale Sustainable Energy Projects in Developing Countries

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Biography of presenting author: Julia Terrapon-Pfaff is a research fellow and PhD candidate at the Research Group "Future Energy and Mobility Structures" of Wuppertal Institute for Climate, Environment and Energy. She graduated from the University of Trier in 2008, where she studied geography, strategic management and public law. Julia's primary research areas are renewable energy solutions for developing countries and the development of strategies for transforming energy systems towards sustainability.

Abstract

The access to sustainable and affordable energy services is a crucial factor to reduce poverty in developing countries. Especially community-based renewable energy projects are recognized as an important form of development assistance to reach the energy poor. These types of projects that provide access to sustainable energy technologies on a local level can have significant gender related benefits for girls and women. But whereas these potential benefits of energy access for women and girls are widely recognized, less attention has been given to the gender dimension in energy project designs. More information on the perception of gender in energy planning is required to explain the growing number of publications and the prevalent uptake of gender mainstreaming rhetoric by the international development community on the one hand and the persisting inequality at every level of the energy sector on the other hand.

To better understand the role allocated to gender in small-scale energy projects, the analysis presented in this paper starts at the beginning of the project cycle by analyzing and evaluating the gender dimension in proposals for small-scale sustainable energy projects, which have been submitted to the project supporting scheme of WISIONS initiative (SEPS) scheme between 2010- 2012. This analysis is the first part of a more comprehensive research effort to advance the knowledge on how to better unlock the potential of sustainable energy interventions to empower women. The results of this first analysis show that even in concepts for small-scale sustainable energy projects that should be particularly sensitive to gender concerns the subject is still not on the forefront of the agenda.

Keywords

gender, women, small-scale energy projects, sustainability, project concepts

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Gender, Energy and Inequalities: a Capability Approach Analysis of Renewable Electrification Projects in Cajamarca, Peru

Álvaro Fernández-Baldor[1]**,** Alejandra Boni[1], Pau Lillo[1], Andrés Hueso[1].

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Biography of presenting author: Álvaro Fernández-Baldor (PhD) works at the Centre for Development Cooperation at the Universitat Politècnica de València (Spain), where he is also researcher in the Group of Studies on Development. He focuses his research on technology-oriented development projects, human development and the capability approach. He is lecturer in different Master courses, in areas related to technology and human development. He has field experience as practitioner in Guatemala, Brazil and Peru. In 2007 he was awarded in the IV Technology for Human Development Contest.

Abstract

Technology, despite being very important, is not the only factor that ensures the success of an intervention. There are many different elements to take into account when planning projects, especially in complex environments such as the least-developed areas of the world. However, development aid interventions have generally been focused on supplying a technological good or service instead of focusing on people, missing thus the project potential for social transformation.

This article presents the main results drawn from a research conducted in Peru with Practical Action, a technological NGO whose headquarters are based in UK and with several branches in Africa, Asia and Latin America. This research examines four renewable energy based electrification projects in the rural area of Cajamarca in north Peru implemented by Practical Action. The four cases are off-grid projects with a communal management model and can be considered successful projects in energy terms (efficiency, effectiveness, percentage of electrified households, etc.). But, despite this, are those electrification projects reducing inequalities and improving people's wellbeing? And, until what extent are the benefits of those projects equitably distributed among men and women? These are the two main question addressed in this article.

Using qualitative methodologies, the research examines the impact of the projects on the things people value. It confirms that projects provide different benefits to the communities (reducing air pollution caused by candles and kerosene, improving the access to communication through television and radio, providing the possibility of night study under appropriate light, etc.) but also detects an expansion of the capabilities in other areas not considered by the NGO related to religion, leisure or community participation. However, the expansion of capabilities is different between men and women. The study reveals the limitations of interventions that don't take into account certain elements which can make the use of technology contribute unequally to the expansion of people's capabilities. The paper concludes that electrification projects can generate inequalities and some recommendations are presented in order to address these issues when planning the interventions.

Keywords: off-grid electrification, capabilities, gender, project evaluation, Peru

Deconstructing 'Discriminatory' Technologies: Insights into Inclusive Development from Improved Cookstove Projects in Nigeria

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Biography of presenting author: Dr Temilade Sesan is a development sociologist with expertise in the fields of energy and the environment. Her doctoral thesis investigated socio-cultural barriers to the uptake of improved cookstoves in sub-Saharan Africa. Temilade's research to date has brought together a range of development themes, including appropriate technology development, women's empowerment, and livelihoods improvement. She is currently an Associate Lecturer at the University of Ibadan, where she teaches a postgraduate course exploring the economic and policy dimensions of renewable energy technologies.

Abstract

Nearly half of the world's population lacks access to modern fuels and cooks with solid biomass, mostly over open fires and inefficient stoves. Efforts to develop and disseminate improved cookstoves among biomass-reliant populations have been launched by both Northern and Southern development actors, with the interactions between North and South constantly shaping notions of appropriate technology within local contexts. This paper examines elements of the interaction between the Centre for Household Energy and the Environment (CEHEEN), a local non-governmental organization that set out independently to promote the uptake of improved cookstoves in Nigeria, and Project Gaia, a US-based international NGO that arrived later on the scene with similar objectives but a different approach. The paper explores the changing narratives of need and responsiveness precipitated by Project Gaia's entry and recognizes the resultant shift in CEHEEN's priorities as limiting the inclusion of the poorest energy users.

Using data from interviews and project documents, the paper shows how the principles that informed CEHEEN's Improved Egaga project – participatory development, indigenous technology, and local production – have given way to the seemingly progressive technology transfer principles underpinning Project Gaia's CleanCook project. Contrary to CEHEEN's assumption that the ethanol-fuelled CleanCook stove would be less 'discriminatory' than the wood-burning improved Egaga stove, the findings show that higher-income households that already have access to comparable alternatives such as kerosene and LPG stoves are likely to be incorporated in the CleanCook solution to a greater degree than the low-income biomass-reliant households that were originally targeted by the Improved Egaga project. The paper highlights the pitfalls inherent in homogenizing the energy needs and capabilities of Southern populations, and concludes that a differentiated approach to collaborative energy projects which recognizes the opportunities and limitations of households at various socio-economic levels is likely to produce more inclusive, if incremental outcomes.

Keywords: appropriate technology, improved cookstoves, inclusive development, North-South interactions, technology transfer

Technologizing Humanitarian Space: Darfur Advocacy and the Rape-Stove Panacea

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Biography of presenting author: Samer Abdelnour is a PhD Candidate at the London School of Economics. His research crosses a number of broad fields including social enterprise, organizational theory, globalization and political sociology. His doctoral work examines the global-local institutional dynamics of humanitarian interventions to address sexual violence in Darfur, and post-war reintegration initiatives targeting ex-combatants in the Blue Nile, Sudan. He has taught courses at the LSE summer school in London, the LSE-PKU summer school in Beijing, and the Rotterdam School of Management.

Abstract

This paper examines how an unassuming domestic technology—the fuel-efficient stove—came to be construed as an effective tool for reducing sexual violence globally. Highlighting the process of *problematization*, the linking of problems with actionable solutions, we show how US-based humanitarian advocacy organizations drew upon longstanding spatial, gender, perpetrator, racial, and interventionist constructions to advance the notion that 'stoves reduce rape' in Darfur. Though their effectiveness in Darfur remains questionable, efficient stoves were consequently adopted as a universal technical panacea for sexual violence in any conflict or refugee camp context. By examining the emergence and diffusion of a global rape-stove problematization, our study documents an important example of the technologizing of humanitarian space. We postulate fuel-efficient stoves to be a *technology of Othering* able to simplify, combine, decontextualize, and transform problematizations from their originating contexts elsewhere. Moreover, when humanitarian advocates construe immensely complex crises as 'manageable problems', the promotion of simple technical panaceas may inadvertently increase the burden of poverty for user-beneficiaries and silence the voices of those they claim to champion and serve.

Keywords: humanitarian advocacy, technology; problematization, sexual violence, fuel-efficient stoves

Decentralized Energy Solutions for Women Empowerment: A Case Study of SELCO-SEWA Bank Model in Gujarat

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Biography of presenting author: Siddha holds a post graduate degree (M.Sc.) in Natural Resources Management from TERI University and Bachelor of Science (Honours) in Botany from University of Delhi. Having an experience of more 4 years in the field of renewable energy, she has developed a working knowledge of policy and regulations, mostly dealing with solar energy for both off-grid and grid connected applications. Currently she holds dual posts of research associate in TERI and Assistant Programme manager in REEEP South Asia Secretariat.

Abstract

Decentralised Clean Energy (DCE) systems are positioned to play key role in meeting global targets of 100% energy access and have also supported several livelihood linked applications. Selection of right business model that suits end users as well as the players involved in its implementation is important. This is otherwise paid less attention when success of any technology is discussed. Furthermore, clean energy access has proven to have more visible and positive impact on women's health and prosperity, especially in developing countries, where majority of them reside indoors and take care of household tasks. Based on these two evidences, SEWA Bank, an all women run bank, in association with SELCO Solar Pvt. Ltd., the technology provider for solar solutions, have been delivering clean energy services through solar home lighting systems by implementing regionally appropriate business model, in the state of Gujarat, India. This business model mainly has women stakeholders at different levels. Other than providing energy access, it has resulted in women employment opportunities and boosting existing businesses. The paper attempts to analyze how this model has been able to provide energy access solutions along with empowering women throughout the value chain of service delivery, discussing their pros and cons. While strengths and opportunities in this model are many, technology cost and certain risks involved in the value chain are also important to be deliberated upon, which may pose threats on long-term sustainability of model. Lessons from this model would be vital for replication, up-scaling and development of similar projects in other energy poor regions in other parts of the developing world. This study was a part of research conducted on "Decentralized off-grid electricity generation in South Asia" supported by Engineering and Physical Sciences Research Council (EPSRC), U.K. and Department for International Development, U.K.

Keywords: energy access, SELCO, SEWA Bank, women employment

DAY 3 – Friday 6 June – Room 3C – Level Garden – 10:30-12:30

[TH2-SE02-08] Implementing Living Labs Concepts to Strengthen the Innovation Ecosystem for Social Innovation in Rural Areas and Cities

Session Leader: Dr. Hans Schaffers, Centre of Knowledge and Innovation Research (CKIR), Aalto University, Finland

The focus of this session is on making the concept of "living lab" effective for accelerating sustainable urban and rural development in developing countries. Related questions are: What are the limits and opportunities and practical implementation approaches of the concept. How will the concept be useful for development and exploitation of new technologies for sustainable development, and how can entrepreneurship and development be boosted along social innovation and empowerment. How can the newer platform technologies and mobile applications be applied to accelerate sustainable development.

Open Innovation for Development

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Biography of presenting author: My background is regional development. As senior researcher at Aalto University School of Economics, Finland, I conducted EU-funded research on ICT-enabled services and systemic innovation in Europe and South Africa. Currently, I am stationed at Middle East University, Beirut, Lebanon. My research focuses on societal change, how networked co-creation and open innovation facilitate interaction between public and private actors, and citizens. I study processes conducted in LLs as an innovation arena that combines user-centric and open innovation approaches.

Abstract

This paper reflects on the significance of an open innovation approach from a development perspective. Shared understanding of open innovation relies on the observation that firms rarely innovate alone; that innovation is result of interactive relationships between firms and users; that cooperation extends to public, or societal, institutions, and citizens in every day settings. A relevant question is if open innovation is applicable in developing countries. Based on interviews of key actors in a network of institutions around LLs (LL) in rural South-Africa and deriving from conversations with the active population in those LLs, a conceptual typology of open innovation as networked co-creation is presented. This allows distinguishing between different methods of emergent co-creation that may be viable in the specific setting of development. By distinguishing between economic exchange relations and social exchange relations within a LL setting the paper contributes with reflections on plausibly joining open innovation to a close-to-user, close-to-citizen, and close-to-market facilities as catalyst for sustainable development. The paper shows that the main objective of open innovation in development is to use interactive information for experimentation with solutions that mingle applications, technologies, and local processes. It is important to arrive at societal solutions proving innovative, but also relevant, sustainable, and viable. The challenges are how key elements of open innovation may enhance pertinent development for either rural, or urban, users. How can interactive information and practice be used to increase the "fit to market" components of new offerings? Can emergent co-creation provide opportunity for citizens and small businesses to innovate together, and tie firms and public service providers? Conclusions provide insights on how to structure the open innovation approach within a development practice. Suggestions are given for further research on dedicated facilities and on promoter roles, such as LLs, able to support open innovation and strongly contribute to successful implementations of innovation for development.

Keywords
open innovation, societal innovation, LLs, interaction capability

Beyond 'Technology for Development' and 'Sustainability' towards Systemic and Holistic Rural Innovation: Success Factors from the Southern African Experience over 20 years

Johann (Rensie) van Rensburg[1], Uys du Buisson[2], Braam Cronje[3], Mario Marais[4] and Emmanuel Haruperi[5]
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Biography of presenting author: Johann (Rensie) van Rensburg is Programme Manager for the Rural Enterprise and Economic Development Initiative of CSIR Meraka Institute and has been active in the ICT for Development arena (ICT4D) for 20 years. Van Rensburg has extensive practical knowledge and experience in working with rural communities and micro enterprises, government, science councils and industry in the implementation of sustainability models and technical solutions for the advancement of rural communities in South Africa and the SADC region.

Abstract

This paper describes essential, real-world activities and processes needed to develop and deploy people-centred networks enabled with innovative technologies that in turn produce "essential knowledge economy functions in service of systemic and holistic rural innovation" based on some of the authors' own and multiple other documented difficulties encountered in Information and Communication Technologies for Development (ICT4D) and broader "technology for development" implementations in the developing world - especially in the light of the challenge of directly linking ICT4D application (and adoption) to scalable socio-economic development in a number of Southern African initiatives. The authors subscribe to a view of development as a participatory process, improving the individual and communal asset-base and embedding it in bottom-up visioning. Their rural enterprise and economic development (REED) involves a shift away from an ICT4D-driven orientation to an approach now focusing on people-centred network development that consists of: identifying the key visions (and dreams) as well as innovative systemic dependencies in the targeted context and services delivery channel; developing a programmatic behavioural change process; utilising ICTs as enablers of human-centric community networks that render knowledge economy services into the local delivery channel – called Infopreneurs[®]; surfacing and understanding the individual and collective resource base in support of the engagement; surfacing existing mind-sets and managing behavioural change as well as relationship building. Infopreneur[®] networks engage directly with the community and deliver a range of knowledge economy services to enhance, build and grow the five main community assets /resource bases: human, physical, financial, natural and social. They act as the extended local delivery channel ("extending extension") to support new scalable and sustainable micro-enterprises within the local contexts. The results of the emerging approach involve five key aspects including: local ownership, a systemic and holistic approach, knowledge economy services, ongoing monitoring, evaluation, reflection and learning as well as the application of systems thinking and network theories.

Keywords

Living Labs in a Developing Country Context

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Biography of presenting author: Paul Cunningham is President and CEO of IIMC, a technology, consulting and research organization headquartered in Ireland and Founder and Coordinator of IST-Africa, a strategic partnership between IIMC and Ministries and National Councils responsible for Information Society, ICT and Innovation adoption, policy and research in 18 African Countries, supported by the EC and AUC, founded in 2002 and co-funded under the EU Framework Programme since 2005. Paul works as an expert for European Commission, European Science Foundation, National Research Foundation, South Africa, and World Bank. A graduate of Trinity College Dublin and Smurfit Graduate School of Business, UCD, Paul has studied at postgraduate level in Hungary and USA. Paul is a member of the Institute of Directors and EU – AUC Living Labs Taskforce for Africa, Chair of IEEE SSIT UK and Ireland Chapter, and former International Board Director of MPI (2008 – 2011).

Abstract

This paper presents contextual differences between Living Labs in Developed and Developing Countries and an overview of Living Labs related activities in Africa. Based on analysis and participatory workshops carried out in IST-Africa Partner Countries (www.IST-Africa.org since 2010, the objective is to raise international awareness of existing Living Labs related activity in Africa, provide a better perspective into African requirements for Collaborative Open Innovation, and identify potential opportunities for international collaboration with local Innovation Stakeholders to accelerate African socio-economic development, with an emphasis on the promotion of ICT adoption, public service delivery, community empowerment and entrepreneurship through Living Labs and Innovation Spaces.

Keywords

Participatory Language Technologies as Core Systems for Sustainable Development Activities

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Biography of presenting author: *Martin Benjamin is the founder and executive director of the Kamusi Project, an international effort to produce learning and lexical resources for languages worldwide. He is a senior scientist in the Distributed Information Systems Laboratory at EPFL. Trained as an anthropologist, his doctoral research (Yale 2000) examined the relations between development programs and the communities they intend to serve. He has conducted extensive field research in Tanzania, and leads language and technology cooperation projects with partners in Africa and beyond.*

Abstract

Language is the medium by which people interact with all aspects of their worlds, whether economics, health, the environment, or technology. In both development programs and technology, however, language is usually given secondary consideration, if any at all. As a result, people who do not speak a major language are excluded from full participation in development programs and from technologies such as ICTs that could enhance their economic and social circumstances. In Africa, for example, where only a small minority speaks English or French, few development programs have the resources to devote to the most basic of language considerations, such as translating health information into local languages. Language technology can be a fast and cost-effective way of overcoming knowledge and communication gaps that underlie many other aspects of the development agenda.

The most efficient way to address language development is through public tools and vocabularies that can be reused, revised, and repurposed for multiple domains. We discuss a universal multilingual dictionary that is designed to build a parallel vocabulary of core concepts across languages, with a special focus on languages with few existing resources. The lexicons are built in close cooperation with local partners. Much attention is paid to a data structure that will enable downstream technologies. Further, a system develops domain-specific terminologies through a participatory process, so that complicated concepts can be communicated clearly and consistently. Data is made available to the public for free, with strong efforts to develop systems for access via least-cost technologies with the widest reach along the bottom of the pyramid.

When successful, a focus on core language development can improve the outcomes of many other projects. In health, for example, translation is often too expensive and too difficult, because basic resources such as dictionaries do not exist and technical terms do not have adequate local-language equivalents. For the one-time cost and effort of building the lexicons and terminologies, in conjunction with the free tools being created to access those vocabularies, the infrastructure opens for cheap and rapid translation of health material. Similarly, students are able to use the lexicons to access knowledge that has previously been blocked behind linguistic barriers, reducing future language-based inequalities. Participatory data collection methods mean that vocabularies continue to grow in response to the expressed needs of particular linguistic and development communities. The perpetual accessibility of the public resource means that development programs can make sustainable use of the data in multiple languages, for multiple purposes, with no further investment.

Language is a hidden aspect of the development equation; language technology in itself does not cure a disease or put food on a table. However, whether communicating agricultural techniques, delivering government services, or performing numerous other activities that fall under the rubric of development, attention to developing language technologies for underserved language populations can be the difference between working together and talking past each other – the difference between failing to communicate and succeeding in expressing the path toward accomplishing common goals.

Keywords
language, ICT, access to knowledge, infrastructure, services

The Use of ICT for Social Inclusion and Participative Planning. A Case Study of "South-North" Technology Transfer

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Biography of presenting author: *Architect and Phd, Director of the Research and Documentation Centre in Technology, Architecture and City in Developing Countries at the Politecnico di Torino (Italy), where, since 2007, she is in charge of coordinating the development cooperation activities. She is project supervisor in several international cooperation*

projects in the field of urban regeneration, housing and sustainable architecture in Developing and Emerging Countries. She is part of the Scientific Board and lectures in the Postgraduate School in Habitat, Technology and Development at Politecnico di Torino.

Abstract

The proposed paper aims to address the use of ICT for social inclusion. In peculiar this research study and experimentation examine both the application of participative methods and techniques, which support the community to identify problems and resources, and the possibility to integrate data and tools with the ones used by public stakeholders, as a starting point for future interventions. Participative planning is then intended as a way to think over the public action, either in the relationship with citizens or in the public space management. The proposed subject takes cue from the "Crowd mapping Mirafiori Sud" project outcomes. The project has been granted with 5x1000 funds from Politecnico di Torino for student projects and is now in the final phase. The aim of the project is to conduct a pilot experience in a participative and inclusive way in order to identify and categorize – returning information on a geographic map – the nature, the location and consistency of the obstacles/barriers which prevent vulnerable categories to access and use the public spaces of their neighborhood. For this aim it is going to be used Ushahidi, an open source platform which allows an easy crowdsourcing of data and the total transparency of their diffusion. One of the key aspect of using Ushahidi is the possibility to use mobile phones as a mean to send reports and receive updates, not needing an internet connection, which is often not available. Outcomes of data collection are then available and given to local and public actors, establishing a direct connection with the instrument used and the possibility to continue the project autonomously. This crowd mapping, and the transparency of the process, are useful not only to sensitize the population and to define the state of the art, but they mostly allow to interpret the results, analyzing the problem from the point of view of the community, the public actors and the scientists, hypothesizing active and participative solutions.

Keywords

social innovation, ICT for development, crowd mapping, urban regeneration, social inclusion

Creating Linkages, Meeting Innovation Needs for Sustainability of Post-harvest Systems: Insights from Nigeria

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Biography of presenting author: Dr. Michael W. Musa is an agricultural sociologist at the Ahmadu Bello University (ABU), Nigeria. Responsibilities include lecturing, research, administration and consultancy. Areas of expertise comprise indigenous knowledge systems, agricultural extension, participatory approaches, poverty reduction and sustainable rural development. Currently coordinator of ABU-Sasakawa Fund for Extension Education (SAFE) programme. In the past, has undertaken several consultancy services under joint collaboration between the Federal Government and the British Council/DFID, World Bank, Save the Children Programme and the European Union in Nigeria.

Abstract

Experience from Nigeria shows that, many earlier innovations in management of post-harvest systems were not based on sufficient understanding of the social needs and agro-ecological peculiarities under which smallholder farmer's produce. The evidence of bad conditions of post-harvest systems indicates *that* linkage problems exist between smallholder farmers and technology development agencies. Linkage problems weaken information flows, limits impacts and coordination of agricultural innovations. Agricultural innovations are not just about transfer and adopting new social innovations, but normatively laden and driven by different social needs. Questions are: What are the social needs defined by smallholder farmers? Under what platform of social needs should post-harvest innovations be developed for smallholder farmers in Nigeria? Should they be based on solicited, demonstrated, ascertained or generated social needs, or through an assessment process involving a mix-and-match of these social needs? This paper seeks to share lessons drawn from social innovative practices in cowpea post-harvest management developed through joint experimentation between researchers, inventors and cowpea growing smallholder farmers in Zekun Community of Adamawa State, northern Nigeria. The study focused on the promotion, dissemination and management of (non chemical) hermetic storage technology for poverty reduction and food security, using the Purdue Improved Cowpea Storage (PICS) triple bag technology in conjunction with the use of plastic water tank, 'rhumbu'(indigenous silo) and large earthen pot storage systems. Data were generated using participatory methods and conventional survey techniques. Findings reveal that 71.42% of the smallholder farmers preferred the PICS technology in minimizing cowpea pest attacks because it proved easy to use, simple to understand, is cost-effective and contributed to increased income compared to the other storage innovations. The alarming occurrence of post-harvest losses in Nigeria offers investment opportunities for north-south involvement in providing solutions to the losses. In the face of

better crop varieties and increasing yield, strengthening effective linkages and a clear understanding of the innovation needs of smallholder farmers are crucial for innovation design and sustainable post-harvest systems.

Keywords
post-harvest systems, social needs, linkages, social innovation, Nigeria

Facilitating Adoption of an Open Innovation Approach to Rural Sanitation in Bangladesh by the Private Sector through Enhanced Market Linkages within a "Living Lab Business Model"

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Biography of presenting author: F. Conor Riggs has over eight years experience in value chains and market systems development across a wide variety of farm- and nonfarm sectors, and has lead the WASH and product innovation teams at iDE Bangladesh since January 2012. Mr. Riggs holds a bachelor's degree in Business Management from The George Washington University and a master's degree in International Economics and International Relations from The Paul H. Nitze School of Advanced International Studies (SAIS) at Johns Hopkins University.

Abstract
In rural Bangladesh, the need for wider distribution of accessible, customer-oriented improved sanitation facilities for low-income communities has never been greater. Yet the market for affordable sanitation products in rural Bangladesh is fundamentally characterized by a lack of formal commercial linkages between sanitation entrepreneurs (SE) and commercial lead firms (LF) with scalable, sustainable and dynamic products and business models. Encouraging LFs to adopt an open innovation approach by developing business models that generate a "living lab" environment represents a promising direction to increase the capacity of SEs to provide improved products and services to low-income consumers in a sustainable manner. Utilizing a Human Centered Design (HCD) methodology, the SanMark Pilot (SMP) project (2012-2014) aimed to develop a living lab outcome for LFs and SEs in Rajshahi District, Bangladesh that was underpinned by business model that would encourage LFs to actively engage with SEs in Bangladesh for the design and development of context-appropriate sanitation products and services. By its conclusion, the project supported the development of an upgradeable latrine product that reached over 17,000 people in 6 months. This product was channeled through a fully commercial business model that formally links SEs to the large-scale marketing and distribution infrastructure of the LF as dealers within the latter's supply chain, enabling the provision of supporting services such as above the line marketing and skills training. The positive feedback loop created through this "living lab business model" encouraged the LF to innovate through the development of a mass-producible version of the latrine product in 2014, grounded in continual interaction with formerly disconnected SEs and local government institutions.

Keywords
rural sanitation, open innovation ecosystem, human centered design, multi-stakeholder partnership, lead firm linkage, business model

DAY 3 – Friday 6 June – Room 5C – Level Garden – 10:30-12:30

[TH2-SE02-10] Low-Cost, High-Tech and Crowd-Sourced Solutions for Better Water Management – Opportunities and Challenges

Session Leader: Dr. Tobias Siegfried, hydrosolutions Ltd., Switzerland

Co-Session Leader: Mr. François Münger, Corporate Domain Global Cooperation, Swiss Agency for Development and Cooperation (SDC), Switzerland

The focus of the session is on low-cost, high-tech technologies, including on using crowd-sensing and data from remote sensing, for better, more sustainable and effective water outcomes. The aim is to organize a session that is broad in the sense that it provides insights into recent development around these topics while inviting are wide range of contributions from all fields and across disciplines, including from natural and social sciences and humanities.

Furrow Runoff Measurement App for Smartphones

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Biography of presenting author: Dr. Beat Lüthi studied Mechanical Engineering at ETH Zürich and graduated at ETH as PhD in 2002 in the field of fluid turbulence. Until 2012, Beat Lüthi was active in research in the fields of image based particle tracking velocimetry and turbulence small scale dynamics. In 2012 Beat Lüthi founded the ETH spin off company photrack Ltd, a company that develops image based methods for flow measurements, in particular an image based river runoff measurement method.

Abstract

We present a method to measure irrigation furrow runoff with smartphone apps, aiming at furrows like they exist e.g. around the Themi river close to Arusha, Tanzania. With the presented tool runoff data can be obtained reliably by a crowd of smartphone holders for very low initial costs and even smaller running costs. The app is developed for an Android smartphone and its technology is derived from an already implemented and tested similar webcam application. In a joint project of photrack and BAFU (Swiss Federal Office for the Environment) during summer 2013, rigidly mounted webcams continuously measured the runoff of the river Schächen, Uri, Switzerland. In contrast to the continuous webcam application, the smartphone app analyses a few seconds of a movie sequence that have been recorded by a hand held smartphone. The runoff is estimated from measured water level, from measured surface velocity and from priori knowledge on the river or furrow bed form. The measurement principle to obtain the water level is the determination of the separation line of image segments with and without optical flow. Via calibration of the camera position this separation line is mapped to a water level. To obtain the surface velocity a modified method of the standard Particle Image Velocimetry method (PIV) is implemented. Among the key characteristics of the method is the fact that no tracer particles are necessary. The results of the Swiss pilot project for the webcam application show that the method is capable to produce continuous and reliable data for water level, surface velocity and runoff. The accuracy is within 5% of data obtained from a commercial radar sensor. The existing preliminary results for the smartphone application indicate similar accuracy.

Keywords

runoff, measurement, smartphone, irrigation, high-tech, low-cost

Low-Cost Wireless Sensor Networks for Dry Land Irrigation Agriculture in Burkina Faso

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Biography of presenting author: Clémence Bouleau holds a Master's Degree in geology and environmental sciences from the ENSG, Ecole Nationale Supérieure de Géologie in France. She specialized in hydrogeology and has worked in various contexts in West African countries: Mauritania, Senegal, and Burkina Faso. She is currently project manager at the Cooperation & Development Center at Ecole Polytechnique Fédérale de Lausanne (CODEV EPFL) in Switzerland. She is in charge of the Info4Dourou 2.0 research project in the "ICTs applied to the environment and development" thematic.

Abstract

Essential environmental data in developing countries is scarce and mostly collected manually with obsolete equipment. Current automatic weather stations are very onerous and local resources for station repair and maintenance are limited. Collecting relevant and reliable hydrometeorological data is especially crucial in the context of dryland irrigation agriculture in the semi-arid and arid regions, as well as for a better understanding of climate change in the Sahel regions.

Research project Info4Dourou 2.0's main goal is to improve environmental data collection in developing countries using low-cost local-made meteorological stations. These completely automatic stations, developed by EPFL and the start-up Sensorscope, have been designed specifically for the harsh environmental conditions and limited local resources, simple to install and requiring little maintenance. A local engineer is in charge of installation and maintenance in the perspective for the stations to be produced, assembled, maintained and commercialized locally.

Low-cost local-made meteorological stations have a strong potential to improve agricultural production. By combining these stations with soil water plants atmosphere models, we have designed an irrigation management system that makes information available in a very simple form for the local community through two interfaces: when the soil matrix potential drops below a defined threshold in the roots area, either a light on the station turns red, or a text message (sms) is sent to the producer on his cell phone, providing the right information at the right moment, indicating that an irrigation is needed. The data is also openly available on the web for the needs of remote users.

A preliminary experiment in the field showed that stations allow for significant water savings while increasing production and therefore, food security. More experiments are planned to consolidate the results towards a wider use of this irrigation management system in semi-arid and arid countries to improve food security and contribute to a sustainable management of groundwater resources, a decisive issue for developing countries.

Keywords

Burkina Faso, low-cost Wireless Sensor Networks, drip irrigation, groundwater management

Designing Technology with Users: Potential and Challenges of the Anthropotechnology Approach in a Tanzanian Case

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***Biography of presenting author: Matthieu Bolay** is coordinator of iMoMo (innovative monitoring and modeling of water) at He-Arc, Neuchâtel, in the laboratory for Anthropotechnology (EDANA) and Phd Student in the Laboratory for transnational studies (MAPS) at University of Neuchâtel. His main interests for research include the circulation of people and technology in low formalized environments, Anthropotechnology and political ecology approaches in the field water and natural resources extraction. **Philippe Geslin** is professor at He-Arc: www.philippegeslin.com*

Abstract

History of development in the South is marked by years of failures largely documented by postcolonial and development studies. Despite a trend towards "participatory approaches", cooperation programs still privilege transfers of ready-made technologies. Low sustainability degree of those programs is often due to the lack of consideration of specific socio-cultural settings of people they are intended to, in particular in early stages of programs' conception. Anthropotechnology proposes a user-based methodological framework embedded in socio-cultural context for technology development and transfer. The approach is not specifically oriented towards the field of "development" but can fruitfully be applied to it. This paper aims at presenting the Anthropotechnology approach and the opportunities it offers in the field of technology conception and/or transfer by using material from a project concerned by low-cost high-tech water information systems in Tanzania (iMoMo).

The paper first presents the methodological framework of Anthropotechnology. The specificity of the approach mainly relies on its four complementary dimensions stemming from environment studies, anthropology, ergonomics and cognitive anthropology. Special focus is placed on demand formulation and co-design in early stages of technology development. In short, the approach is shaped by users in the field, in particular by embracing a co-design perspective with all considered stakeholders. Second, the approach is illustrated through examples of low-cost high-tech water information systems in Tanzania (iMoMo). The project well illustrates the transition from a technology-based approach to a user-based approach. Co-design iterations with users highlight the pertinence of the considered four dimensions in the conception of the technology. For instance, environmental local knowledge shapes uses of water and agricultural decision-making; gendered uses of cell phones appeal to specific types of information feedbacks; traditional ways of measuring water flows conduct to design locally identifiable measurement tools; interpretation of bio-indicators lead to integrate qualitative data in the information system.   Third, global problematics such as water management require local answers. Anthropotechnology approach can contribute to elaborate scalable solutions by widening the scope of referential situations, whose outcomes can be activated in and adapted to different contexts. In

the frame of iMoMo, transition of the approach from Tanzania to Central Asia suggests challenges in reformulating the developed concepts in a totally different context. Therefore, iMoMo aims at fostering collaboration with Fablabs throughout the world – Central Asia in this case – which provide great entry-points to get technology reinterpreted an readapted in its local context of appropriation.

Keywords
Anthropotechnology, Technology co-design, Tanzania, Central Asia, Water management

An e-Atlas to Support Integrated Water Resources Management in the Orontes River Basin

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Biography of presenting author: With a background in environmental engineering – MSc in 1988 and PhD in 1996 – Marc was since 2000 a lecturer and research associate at the Hydrology lab of EPFL, with a focus on GIS and integrated water resources management. He joined the GIS lab of EPFL in 2011, with current research interests focusing on the development of knowledge sharing platforms, including GIS components, to support multi-stakeholder scenario planning approaches. Research outcomes are further developed and applied by the Ipogee SME he is running since 2007.

Abstract
Integrated resource planning and management rely much on stakeholder involvement and need improved communication facilities. The development of these IT support systems comes up with some interesting challenges regarding information management and knowledge sharing: (i) the need to cope with a large variety of stakeholders with very diverse backgrounds and interests, which poses the question of accessibility, both in terms of cost and of complexity, (ii) the need to handle the time dimension in addition to the space dimension, to provide adequate support to strategic planning, action plans and further monitoring, (iii) the need to handle various scenarios for a given point in time to address the strategic planning issues, and (iv) the need to host and integrate also non-spatial information to be able to share the logics of processes (e.g. feedback loops, flow charts, dashboards, etc.) and/or address other relevant aspects such as the legal framework, project management, etc.
The online electronic atlas presented in this paper is being currently developed to address these various issues within the framework of a water resources management project on the Orontes river basin, shared by Lebanon, Syria and Turkey. It provides a platform to host the contributions and support the collaborative work of a group of stakeholders with diverse geographic, cultural and scientific backgrounds and interests (agronomists, economist, hydrologists, hydrogeologists, geographers, archeologists, etc.), as well as a knowledge repository that might be used to address the various water management issues in this transboundary watershed.
Although the above mentioned challenges have so far only be partially addressed, since the scope and frame of the e-atlas is yet rather limited, it is expected that other aspects of data management (time and scenario) and viewing tools (dashboards, albums, etc. and composite workspaces) will be emphasized in the upcoming second stage of the project. It nevertheless remains that in its current state the atlas already provides an invaluable, effective and dynamic platform that fosters knowledge sharing among the parties involved in this project.

Keywords
GIS, knowledge sharing, e-atlas, Orontes

Agricultural Development Role in Urmia Lake Crisis, Iran

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Biography of presenting author: The presenting author, Leila Eamen, is MSc student in civil department of K.N. Toosi University of Technology. She is studying impacts of Water Resources Management scenarios of the basin on Urmia Lake under climate change as the MS.c. Thesis.

Abstract
Urmia Lake, northwest of Iran, is currently in danger of complete drying up. Agricultural development, over extracting from groundwater resources, wide reservoir constructions and simultaneous increasing temperature and decreasing precipitation due to the climate change, and severe drought started from a decade ago have caused dramatic shrinkage of Urmia Lake area in the last decade. Several studies have been implemented with the aim of discovering

roots of the Lake crisis. One of the major issues mentioned by most experts is the lack of integrated approach in water resources studies and development in the area. In order to establish an integrated water resources management system, proper estimation of water resources and demands of the basin is an essential step. Although evaluating the amounts of water resources and demands needs continuous surveys and measurements, in most of developing countries, like Iran, monitored databases may not be available and estimating methods are implemented instead. This paper, while reviewing some of these studies attempts to assess the role of agricultural development in Urmia Lake crisis and to recommend solutions for the current situation. In this regard, agricultural water consumption of the basin was estimated and together with other calculated components of water system of the basin used in simulation of water resources and demands of the basin with the help of the Water Evaluating and Planning system [WEAP]. The role of agricultural water consumption and reservoirs on the Lake level fluctuations were studied then in the base and future scenarios. Achievements of this study showed that without any withdrawal from water resources of the basin for agriculture, the lake level would have risen up to about 5 meters in the base year of the study (2006). In the future period, the most effective scenarios on raising the Lake water level are those that deal with reductions in the agricultural water consumptions. Therefore, the most efficient solution in the long-term for the current situation would be reducing water withdrawals for agricultural uses.

Keywords
Integrated Water Resources Management, Urmia Lake Basin, Agricultural water consumption, Lake Level Fluctuation, Lake Management

DAY 3 – Friday 6 June – Room 1C – Level Garden – 10:30-12:30

[TH2-SE02-13-b] How Can We Co-design Technologies with (and not for) Vulnerable and Poor Communities?

Session Leader: Dr. Andrés Felipe Valderrama Pineda, Aalborg University, Denmark.

Co-Session Leader: Dr. María Catalina Ramírez, Universidad de los Andes, Colombia

The session focuses on the processes by which teams of students and professors from rich universities collaborate with communities. This is a focus on the dynamics of innovation, which place equal weight on the result (a technology to solve a specific problem) and the process by which that result is obtained (which knowledge is brought in and how, how does the involvement of the community guarantees their ownership over the solution and thus makes it sustainable). Additionally, we would like to encourage authors to think on the ways and dynamics by which a specific process in one community can produce knowledge for other communities. In this, we will privilege those cases in which we can see that the knowledge production process is guided or at least involves significantly the members of the community.

Resolving Project Conflict between Donor and Local Community Beneficiary in Implementing IT Projects in Southern or Developing Countries by Leveraging the Project Choice-Making Matrix (PCMP)

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Biography of presenting author: Anima Gupta Aggarwal is an experienced project manager and business analyst. Developed these skills in the public and private sectors in varied international environments across Asia and Europe enabling her to first hand understand challenges of low- income countries. Holding an MSc in Software Engineering from Oxford University (UK) and an MSc in Management Sciences and Operational Research from Warwick University (UK). Worked on numerous information technology projects at UN agencies including WHO and UNAIDS. Demonstrated professional strengths are finding creative and innovative solutions to complex problems.

Abstract

There is prevalence in the international development market for donor-steered collaborations where donors are driving and managing IT projects in southern countries. These projects are regularly haunted by the risk of failure, in part due to the complexities and uncertainties in these environments, and in part due to the donor's lack of understanding of the local context. As multiple key stakeholders are involved in these projects, there are frequently conflicts in project expectations and priorities. Project priority refers to the prioritization of cost, schedule, scope and quality for the overall project. As these project conflicts, caused by differences in expectations and priorities are not clearly identified and resolved, it leads to ineffective use of scarce project resources, culminating into the overall failure of the project.

This paper introduces a process to identify key stakeholder project priorities and analyze the associated risks to find the best outcome for the project from the perspective of the northern donor and southern beneficiary. The Project Choice-Making Process (PCMP) is a three-step process to enable early identification of conflict and develop alignment of project expectations between key stakeholders. The first step of the PCMP defines the project priorities for each stakeholder using the Expectation Management Matrix (EMM), to establish the high-level project conflicts. Step 2 of the PCMP analyses the project priorities in the context of the risks associated with the project, using the Risk Analysis Matrix (RAM). Finally Step 3 uses the information from Step 1 & 2 to enable positive dialogue and communication between the stakeholders to work towards resolving the identified project conflict.

Keywords

Project Risk Management, Project Choice-Making Matrix, Expectation Management Matrix, Developing Countries, Project Conflict

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Territorial Strategy: Towards a Territorial Information System in Moroccan Medium-sized Cities - Case of the Cities of Settat and Kenitra

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Biography of presenting author: Soumia Hajbi is a doctoral student in Territorial Strategy at the Hassan 1st University (Settat, Morocco). She holds an Engineering diploma in Computing Science at the National Institute of Statistics and Applied Economics (Rabat, Morocco) in 2009. After graduation, she has worked at the Moroccan Ministry of Agriculture and Fishing. Her research includes territorial dynamics, with specific interests in Territory Information System and ICT for territorial development.

Abstract

The regionalization Project in Morocco aims to establish a new territorial approach which will improve the contribution of the local actors in coherence with the national policies. The main objectives of this project could not be achieved without the implementation of a territorial strategy which is illustrated usually by an integrated territorial information system supplied by local sources.

The project of advanced regionalization process is trying to implement a new means of public management by sharing the decision making process with various local actors. Indeed, it will need an implementation of a new approach of territorial intelligence by extending the information system to allow a proactive control of the strategic information, to increase the competitiveness and the security of territory and to promote the national economy and companies.

As a social and educational actor, the university must contribute to this national initiative. In fact, the university is an important actor who is involved in this projects category because it is considered as a direct link between science and practice.

As Researchers in Hassan 1st University, and to contribute to enhance the right condition to the Regionalization project, we aim, by submitting this paper, which is based on a comparative methodology, to achieve the flowing objectives:

– Describe the evolution of collective perception of the concept of territorial intelligence with the local actors, within the framework of the search-action applied to the cities of Settat and Kenitra, led during the annual seminaries on the ICTs and Competitiveness of territories organized by Hassan 1st University introduced since 2009.

– Make a Proposal of solution of technical, organizational and legislative of cooperation in the area of territorial information exchange. This proposal must introduce primary steps of the implementation of a territorial information system at the cities of Settat and Kenitra.

Keywords: university, Local actors, regionalization, territorial intelligence.

Utilizing the Mobile Phone for Input and Output Payment: The Case of Smallholder Cocoa Farmers in Ghana

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Biography of presenting author: I provide senior leadership for the strategic use of IT resources in support of the mission and goals of the Kwame Nkrumah University of Science and Technology (KNUST), and eight other institutions in Ghana. As head of web and mobile development at KNUST, I supervise the planning, development, implementation and management of web applications. I am also a co-founder and Research Lead at mFriday, a mobile web hub where members are trained as ICT developers and future socially responsible entrepreneurs.

Abstract

Smallholder farmer access to agricultural finance has been a major constraint to agricultural commercialization in many developing countries including Ghana. The ICT revolution in Africa has however brought an opportunity to ease this constraint. Mobile phone-based banking services that started in the urban areas of Ghana have started to spread to the rural areas. Using these m-banking services, farmers can ultimately receive payment for their crops and use their phones for other transactions. In a study under the input supply component in Ghana, smallholder producers were required to pay a 1/3 initial deposit prior to receiving chemical inputs, which were distributed according to a calendar period. Producers were then given one year to pay the remaining 2/3. To collect the outstanding debt, credit officers conducted frequent visits, during which most farmers were unable to fully repay the balances. Unable to properly track timely repayments and account for the actual outstanding amount in circulation within the credit union, the credit union run the risk of not meeting its payment and loan obligations. Students and faculty of mFriday innovation lab at the Kwame Nkrumah University of Science and Technology undertook this study. The methodology used in this feasibility study involved review of literature as well as qualitative research methods. The combination of questionnaires and structured interviews were used to acquire information about the feasibility of mobile banking among the cocoa farmers in the study districts. The qualitative research method results were used to determine the Mobile Network Operators (MNOs) provision for mobile banking for the study districts. The study looks at the factors that affect the implementation of mobile banking, such as access to the technology, infrastructure, access to financial institutions, the technology adoption model, the gender effect and roles of stakeholders. The study proposed a

tripartite approach involving the MNOs, Financial institutions and farmer co-operative unions in the implementation of such technology.

Keywords: M-banking, Agric-finance, Cocoa

Partnering with/Designing for Vulnerable Communities through NGOs: Criteria, Relationship Building, and Pedagogy

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Abstract

This paper presents a conceptual and curricular model for engineering students to work with communities through Non-Governmental Organizations (NGOs). We have found that successful development projects require a level of embeddedness in community, community engagement and logistical maturity that universities are ill equipped to provide alone. Moving beyond the dangers and perils of "help the poor" trips, we are developing a new form of interaction with well-established and socially responsible NGOs to ensure that the voices, concerns and desires of communities are present in engineering design when students work outside their own community.

First, we select NGOs in international development who meet the following criteria: 1) have a well-established philosophy of how to work with communities by empowering them; 2) have a long-term relationship with communities and a significant level of embeddedness in specific localities; 3) often employ community members in their staff or work directly with community development committees; 4) have technical staff who work as liaisons between communities and students; and 5) are willing to spend time teaching and learning with our students.

Second, we build a relationship with these NGOs through a number of strategies, including inviting them as 1) guest instructors to our engineering classes, 2) partners who provide design criteria and review design progress, and, when feasible and appropriate, and 3) co-developers and co-teachers of design-related classes. Pursuing these strategies creates the strong working relationship needed for successful collaboration that hopefully will translate into community empowerment.

Third, we have developed a three-course sequence of design classes titled *Engineering By Doing (EbD)* where students learn human-centered problem definition and explore design challenges with NGO partners. The EbD sequence challenges students to focus on human needs and concerns instead of technology development (EbD I), rapidly construct and test concepts to foster a strong feedback loop between the students and their partners (EbD II), and develop design solutions that, hopefully, can be implemented by NGOs in the communities where they work (Sr. Design). A key element of the EbD sequence is the inclusion of geographically close NGOs as partners which allows for regular iteration/feedback and time necessary to properly understand and address challenges.

Leveraging the resources of established NGOs, fostering long-term relationships, and creating a strong curricular scaffold for the student-NGO relationship to mature, are key to successful engagement with communities. The principles presented in this paper are currently being piloted and are based on lessons learned during the 10-year history of the Humanitarian Engineering Program at Colorado School of Mines and our ongoing collaborations with NGOs at the Posner Center for International Development.

Keywords: design, NGOs, partnership, communities, humanitarian engineering

Solar Water Heating System Co-design and Do-It-Yourself Approach for Appropriate Technology Diffusion: The Médina Training Centre Case Study

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Lecturer of the course of Fundamentals of Energetics at Politecnico di Milano. Lecturer for the Training Course on "Renewable energies for decentralized systems: supporting tools and best practices for green energy and sustainable development", organized by the ICS-UNIDO in 2012. **Lorenzo Mattarolo** *graduated in mechanical engineering at Università degli Studi di Padova. He worked for 5 years in the private sector addressing energy efficiency, distributed generation technologies and electricity market. Since 2012 he has been working at the Department of Energy of Politecnico di Milano as program manager of the UNESCO Chair in Energy for Sustainable Development, dealing with projects related to access to energy and sustainable development. Currently he is focusing on M&E models for energy cooperation projects.*

Abstract

Energy topic and more specifically energy access are strongly linked and interconnected to environmental, economic and social sustainability issue at both global and local levels. Both National and International Institutions and Governmental Organizations have focused and keep focusing their efforts on the production of electric and thermal energy via renewable energies in Developing Countries. Among the energy needs, hot water supply is not considered a basic need in many developing countries but despite that, hot water is increasingly seen as fundamental aspect of modern hygienic and healthy life in contemporary societies and, in some cases, has a key role in artisanal productive processes, incentivizing the demand growth. Furthermore, SWH actually represents an economic competitive alternative in countries with high-energy costs and sufficient irradiation, contributing to open up possibilities for sustainable socio-economic development.

In order to develop an effective technology transfer, as in the SWH case, the technical aspect (appropriate technology) and the planning aspects (stakeholders participation, training and skills transfer..) are both fundamental. Technology transfer must always take into consideration many aspects beyond the purely technical so that it can prove beneficial social, economic and environmental impacts on the local context.

In the paper, a multistakeholders participative approach focused on the SWH technology diffusion and application, and the integration of multistakeholder roles in the local context has been proposed and applied to the 'CdF Médina' project in Médina, Dakar. The introduction of a co-design method involving engineers, engineering students, local stakeholders and migrants coupled with an appropriate technique (DIY) has been tested and recently locally implemented permitting the start-up of the phase of diffusion and local repeatability among trained artisans. Furthermore, with the involvement of local partners and stakeholders, and Senegalese migrants the idea of creating a local, artisanal, enterprise of SWH panels has been developed and a detailed feasibility analysis has been created and it will be ready to be implemented in the next future.

Keywords

renewable energies, appropriate technologies, solar water heating, Do-It-Yourself, Dakar

Evaluation of the Impact of Co-design Approach in East Timor on Acceptability

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Biography of presenting author: Yuki Taoka is a research assistant and graduate student at Tokyo Institute of Technology, Japan. With a background in mechanical design engineering, his current research deals with the design and development of technological solutions for and with people in developing countries. He has organized several academic events in Japan to promote a North-South co-design approach ("Design for Extreme Affordability" and "Participatory Workshop for Co-design Approach" Symposia, 2013). His work in East Timor has been covered in the national media (NHK).

Abstract

Design is a powerful tool for improving the life of people, especially people at the Base of the Pyramid (BoP). In this paper, we report a design project with people in the Democratic Republic of Timor-Leste (East Timor). Our research question is the following: "How to increase the acceptability of technological solutions by people at the BoP?". We show that a co-design approach based on participatory workshops with local people allows to design successful technological solutions, in terms of acceptance, usability and thus, sustainability."

Our project consisted in two phases, with two field trips to East Timor. In 2012, a "traditional" design approach was followed and several design solutions were created. However, target users were reluctant to use our products because the latter did not fit the local lifestyle. The design solutions were rejected because the designers did not have a clear understanding of the needs and context, thus the level of acceptability was low. In 2013, in order to overcome the acceptability issue, a "co-design" approach was introduced. It consists in designing "with" the target users, rather than "for" them and it enables to design products based on real needs of people. To reach a high level of mutual understanding, we organized participatory design workshops with groups of East Timor people.

This design collaboration between Japan and East Timor has two main outcomes (1) Development of technological solutions that are fully accepted by East Timor people. (2) Evaluation of the impact of a co-design approach on the acceptability of technological solutions by East Timor people. More specifically, the introduction of participatory workshops in a co-design process could be assessed and some factors for a successful co-design approach in North-South projects were identified.

Keywords: co-design, participatory workshop, collective creativity, acceptability, East Timor

Affirmative Action for Scaling-Up of Technology Innovations in Healthcare Delivery in Rural Communities in Nigeria

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Biography of presenting author: Bridget Usen is 23 years old, young graduate of Biochemistry from University of Nigeria, Nsukka. She is currently Volunteering with Centre for Community Health and Development International (CHAD), Nigeria. She is a Project officer on Global fund Round 9, Phase 2 on Orphan and Vulnerable Children Project with Centre for community Health and Development International, a sub- sub recipient of Global fund project on Orphan and Vulnerable Children and Community System Strengthening. She has experience on monitoring and evaluation.

Abstract
Most people in rural areas especially in developing countries are denied access to affordable and efficient healthcare services. This therefore increases mortality rate especially maternal and infant mortality. The growing population rate further poses serious challenge to health care delivery in rural setting. Africa's population has rapidly increased, from 221 million people in 1950 to more than 1 billion today. Nigeria population rapidly increased from 45.2 million in 1960 to 166.2 million in 2012. Though Nigeria allocated 15% of her total budget to the health sector, only 5.6% was spent in 2013 making the situation bad. This is worsened as 70% of this budget is spent on health care delivery in urban areas leaving only 30% to the rural areas where poverty, malnutrition and poor health affect a large proportion of the people in rural areas. The poor infrastructural facilities in the rural areas makes it near impossible for operation and utilization of advance diagnostic medical supplies and equipment to function effectively in meeting the health needs of the people. This briefing is about looking at barriers or challenges that may prevent rural communities from benefiting from scale up innovation in health care technology, Drawing from empirical evidence from 6 primary health care facilities (PHC), 1 secondary facilities and 1 tertiary facility, it is apparent that most Primary Health Care facilities need to be re-positioned to benefit from scale up innovation in health care technology. This is based on the evidence provided by major key stakeholders like local authorities, clinicians (doctors, community health care providers, and nurses), engineers, public health experts, business entrepreneurs, and social scientists at both local and state/Federal levels, corporate organizations investing in health care technologies as well as end beneficiaries. The author and the consortium of these stakeholders had in-depth look at barriers to sustainable technology in health care services in selected geographical areas to draw up strategies that will pragmatically bridge the existing gaps in health care delivery in rural areas especially in developing countries. This consortium are selected because they are directly involved in providing healthcare services at this setting. Data was generated through in-depth questionnaire, focus group discussions and desk review of previous studies on this issue. This briefing adopts a bottom top approach contrary to previous work to understand issues around this and to draw the attention of relevant stakeholders especially policy makers to address identified issues. The strategies identified will ensure that health technology designers takes cognizance of identified barriers and factor them in as they design medical supplies and equipment suitable for rural communities. It concludes by recommending that government at all levels in Nigeria, corporate organizations investing in health care technology should be able to take affirmative action that must address barriers or challenges that hampers health care delivery in rural areas.

Keywords
primary health care, infrastructure, people living with HIV/AIDS

DAY 3 – Friday 6 June – Room 4C – Level Garden – 10:30-12:30

[TH2-SE02-16] Strategies for the Successful Implementation of Mobile Health (mHealth) in Low-Resource Settings

Session Leader: Dr. Walter Karlen, Stellenbosch University, South Africa & University of British Colombia, Canada

In this session, participants will discuss the challenges in scaling up mHealth. We will identify essential methods required for successful development and deployment of mHealth. For this we will bring together engineers, mHealth developers, social entrepreneurs, policy makers, and researchers from social, business and basic sciences to present and discuss their research and experience with mHealth and its implementation. This interdisciplinary dialog is very important; the earlier scale-up and implementation questions are considered in the design process, the easier the implementation can become. At the end of this session, we will have gathered a portfolio of essential features that people can take home and include in their design and decision process.

The Importance of Biomedical Signal Quality Classification for Successful mHealth Implementation

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Biography of presenting author: *Lisa Stroux is currently pursuing her PhD at the Institute of Biomedical Engineering, University of Oxford, UK, with a focus on perinatal health monitoring in low-resource settings. Lisa is a design engineer by background with several years of experience in the area of medical device development, having worked with research institutions such as the Helen Hamlyn Centre in London, UK, and international organisations including the World Health Organization. Her particular passion is the development of human-centred, affordable healthcare solutions.*

Abstract

The disparity in health outcomes between high-income and low- and middle-income countries (LMICs) can be attributed to a chronic lack of trained healthcare professionals, cost and poor infrastructure. In comparison, the so-called 'digital divide' is shrinking. Mobile-phone penetration has reached 89% in LMICs with handsets becoming progressively sophisticated yet affordable. This motivates the use of mobile devices to address some of the healthcare challenges (mHealth).

A key consideration for successful mHealth implementation should be the unusual circumstances that arise when previously out-of-reach technologies are made available to users with limited experience in handling them. Ensuring the quality of data is a primary concern and best controlled at the point of data collection. It is critical to provide the healthcare worker with guidance on the usability of the signals recorded to allow the recapture of data if needed.

The approach is illustrated with the example of an on-going mHealth project addressing the high prevalence of perinatal mortality in LMICs. The prototype combines a low-cost ultrasound sensor with a smartphone for foetal heart rhythm assessment. A signal quality algorithm is presented which distinguishes between clinically useful and non-useful signals. Foetal cardiac activity and device movement were recorded from pregnant women referred to a UK hospital. Three independent annotators assessed the quality of each ultrasound recording. Quality indices were derived from the sample entropy and wavelet coefficients for the ultrasound recording and the phone's accelerometer data. Using the annotator-assigned quality labels and computed quality indices a logistic regression (LR) and support vector machine (SVM) classifier were trained and tested on separate labelled segments. The LR and SVM classifiers were able to distinguish good quality from poorer signals with a 91.5% and 93.6% accuracy on out-of-sample data respectively. The introduction of the novel accelerometer indices further improved the accuracy to 92.9% and 94%. Results provided positive evidence for the viability of a mHealth foetal monitor to which adequate risk assessment capability could be added.

Keywords
signal quality algorithm, mHealth, foetal monitoring, biomedical signal processing

mHealth to Strengthen Diagnostics of Infectious Diseases in Resource-Limited Settings: Landscape Analysis using a Technology-Centred Approach

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Biography of presenting author: Present: Consultant for World Health Organization's (WHO) country office for India, and visiting faculty at International Institute of Information Technology, Bangalore, India. 2013: Consultant in mobile health for Foundation for Innovative New Diagnostics (FIND), Geneva, Switzerland. 2007 – 2012: Assistant professor at Institut Supérieur d'Electronique de Paris, France. Over 60 publications in international journals and conferences. Holds Bachelor of Technology in Electrical Engineering (Indian Institute of Technology, Delhi, India, 2002), and PhD in Microelectronics (University of Bordeaux, France, 2006).

Abstract

Infrastructural inefficiencies cause infectious diseases to remain endemic in many settings. mHealth has great promise here, and has been used from disease surveillance to treatment compliance, but has found very limited adoption for diagnostics. Nonetheless, we see increasing initiatives that incorporate ICT at different stages of the diagnostics process. No existing literature expressly considers this, even if such studies could help conceptualise mHealth. We hope to make up for this lack. We analysed interventions that are integrated into diagnostics (Pre-Analytical, Analytical, Post-Analytical stages). We then studied the architectures and identified common blocks: this model can extend beyond the three diseases we studied (TB, malaria, HIV). Our ultimate aim is to aid key stakeholders (diagnostics manufacturers, laboratories, point-of-care) choose, design and dimension adapted solutions for the use of mHealth in the diagnosis of infectious diseases.

We were able to confirm the increasing presence of mobile technologies for diagnostics of infectious diseases, including three scaled-up solutions as well as efforts by diagnostics manufacturers. Our analysis shows that mHealth can be broken down into three elements: front-end, back-end, controller. The *front-end* involves a user device (mobiles, tablets, …). The *back-end* consists of the ICT infrastructure and links the mHealth to the health programme. In between the two is the *controller*, most often a dedicated server. Many programmes use common-denominator services like SMS but use of dedicated 'apps' is increasing.

However, this field still suffers from a lack of impact assessment. Diagnostics (and any one disease) cannot be considered in isolation if we are to arrive at high-impact solutions that 'are not just another pilot'. The future use of mHealth for diagnostics should also combine non-diagnostics parts like surveillance and supply chain management to arrive at holistic solutions. To ensure easier interoperability with the existing landscape, we must conform to the widespread frontend-controller-backend model. We must consider incorporation of emerging technologies insofar as feasible and relevant.

Keywords

diagnostics, eHealth, infectious diseases, information and communication technologies, mHealth.

Meeting Community Health Worker Needs for Maternal Health Care Service Delivery Using Appropriate Mobile Technologies

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Biography of presenting author: Mr. Araya Medhanyie is a young lecturer and researcher. He works for the department of public health of Mekelle University in Ethiopia. His research areas and interests are primary health care and health care innovation in developing countries. As part of his PhD study, in the past three years, he has been doing a research on the use and implementation of mobile health application and technologies for maternal health care service delivery at primary health care settings in Ethiopia.

Abstract

Mobile health applications are complex interventions that essentially require changes to the behavior of health care professionals who will use them and changes to systems or processes in delivery of care. Our aim has been to explore and meet the technical needs, develop, and test appropriate mobile health application for maternal health care use by the Ethiopian Health Extension Workers (HEWs) and midwives.

We have developed and evaluated a set of appropriate smartphone health applications using open source components, including a local language adapted data collection tool, health worker and manager user friendly dashboard analytics and standardized maternal and newborn protocols. This is a twenty month follow up of an ongoing observational study in the northern of Ethiopia involving two districts and twenty HEWs, twelve midwives and five supervisors.

Most health workers very rapidly learned how to use and became comfortable with the touch screen devices and the android operating system so only limited technical support was needed. Unrestricted use of smartphones generated a

strong sense of ownership and empowerment among the health workers. Ownership of the phones was a strong motivator for the health workers, who recognized the value and usefulness of the devices, so took care to look after them. A low level of smartphones breakage 3(8.1 %) and loss 1 (2.7%) were reported. Standardized antenatal and postnatal care protocols required an average of 20 minutes to complete, a significantly increase over normal practice. Each health worker made an average of 160 minutes of voice calls and downloaded 27Mb of data per month; however, we found very low usage of short text messaging. Approximately 6% of all protocol forms entered had an issue regarding patient identification.

Achieving a strong sense of ownership and empowerment among health workers is a prerequisite for a successful introduction of any mobile health program.

Keywords
community health workers, mHealth, mobile technologies, health extension program, maternal health,

Ethical Considerations and Relation-Centered Design for Mobile Health Applications

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Biography of presenting author: Kate Michi Ettinger, JD, Senior Fellow, Center for Health Professions, UCSF, brings over 15 years of cross sector experience to her work at the intersection of health care, bioethics and product design. Kate currently focuses on how to harness new technologies, such as sensors, wireless, mobile – to make it easy, effective and affordable to openly monitor data on quality, reliability and safety for medical devices deployed anywhere in the world.

Abstract
Increasingly, mobile health applications (mhealth apps) facilitate clinical decisions and assist clinical interactions. In clinical settings, ethical dilemmas for clinicians and their patients often arise around decision making due to the imbalance of power inherent in clinical relationships. Designers of mhealth apps may not sufficiently consider the ethical implications of the products they develop.

User-centered design attends to the needs, wants and limitation of users at every stage of design. Yet most clinical ethics issues arise after deployment not from the user's unique experience but as a result of the dynamic interaction between clinician-patient. Relations-centered design is a process for clinical mhealth app developers to consider how their technology impacts the clinical relationship at every stage of development; relation-centered design prompts developers to strengthen the clinical relationship, attend to its inherent imbalances of power and enhance the collaborative nature of decision making. This paper presents a framework developed to systematically review ethical considersations and relation-centered design implications of mhealth apps.

The framework was piloted with an mhealth app developer from the outset of the design of a mhealth app for community health workers (CHW) to diagnose pneumonia in children in rural South Africa. In staged consultations, relation-centered design and ethical considerations were introduced.

Applying relation-centered design throughout the mhealth app development process informed decisions about the specifications and requirements. The mhealth app developer found the framework useful, relevant and informative from the outset of the product's development.

As technology increasingly embeds decision making within mhealth app design, relation-centered design and ethical sensitivity for mHealth designers becomes paramount.

Keywords
decision-making, clinical relationship, mHealth, bioethics, relation-centered design

Challenges of Implementing mHealth Interventions for Lifestyle Modification in Prehypertensive Subjects in Guatemala, Peru and Argentina

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Brief Biography of Presenting Author: *Andrea Beratarrechea is a researcher at Institute of Clinical Effectiveness and Health Policy and consultant for the Directorate of Health Promotion and Control of NCDs, Ministry of Health, Argentina. Her main research areas are the design and implementation of programs to prevent and control NCDs. She is the coordinator for Argentina of two trials that include mHealth interventions "A Comprehensive Program for Prevention and Control of Hypertension in Argentina" and "Mobile health to prevent progression of prehypertension in Latin American urban settings".*

Abstract

mHealth have shown to improve patient outcomes in chronic diseases in developed countries. In fact, mHealth is considered attractive to improve health care delivery and access in developing countries. Randomized controlled trials (RCT) are the gold standard for evaluating interventions but require standarized interventions to be implemented uniformly to a target population. As these conditions are difficult to be met in health promotion, recommendations have included gathering contextual and process data in RCT. The present study describes the processes related with the implementation of mHealth interventions for lifestyle modification in a RCT conducted in prehypertensive subjects in Guatemala, Perú and Argentina from low-resource settings.

In the intervention group participants received during a year a monthly call to a mobile phone from a trained caller for counseling and one weekly tailored SMS to promote the adoption of healthy behaviors. We evaluated reach (proportion of the target population who received the intervention), fidelity (degree to which the intervention was conducted as planned) , dose and atrittion (percentage who dropped out of the intervention) to assess how the intervention was implemented.

637 prehypertensives were included , 53% women with a mean age 43.4 ± 8.4 years. 98.7 % of the intended target population (312 participants) received the intervention. The mean number of calls to contact a prehypertensive subject were 3.29± 1.55 (2.58 ± 0.96 Guatemala, 4.12 ± 1.65 Perú and 3.15 ± 1.54 Argentina). The overall median number of of motivational interviews were 6 (IQR 4-8) with no differences observed across the countries. With regard to SMS , 56.3 % of the messages sent were received (82% Guatemala, 46.2% Perú and 50 % Argentina). Atrition rate was 12.6% (10.5% Guatemala, 4.7% Perú and 24% in Argentina).

The delivery of the intervention was challenging in the three countries with differences among them. Process evaluation methods and metrics are useful to assess whether the intervention program was delivered as planned.

Keywords
mobile phone, telemedicine, prehypertension, lifestyle

DAY 3 – FRIDAY 6 JUNE 2014 – AFTERNOON

Catalyzing Innovation through Targeted Scientific Training and Capacity Building

Session Leader: Prof. Federico Rosei, UNESCO Chair in Materials and Technologies for Energy Conversion, Saving and Storage, Institut National de la Recherche Scientifique (INRS), University of Quebec, Canada

Stellacci, Francesco	CH	Ecole Polytechnique Fédérale de Lausanne (Switzerland)	Rectification and Amplification, A New Approach to Energy Conversion
Korter, Grace	NG	University of Ibadan (Nigeria)	The Significance of Information and Communication Technology for Attaining Educational Development in Developing Countries
Kruckenberg, Lena J.	DE	University of Leeds (United Kingdom)	Empowering Partnerships? Renewable Energy Partnerships in Development Cooperation
Pasche, Natacha	CH	Ecole Polytechique Fédérale de Lausanne (Switzerland)	Building Local Capacities to Monitor Methane Extraction in Lake Kivu
Reckerzügl, Thorsten	CH	Caritas (Switzerland)	Bali, Indonesia: Combating Climate Change and Poverty – Recycling Used Cooking Oil by Transforming it into Biodiesel

TH2-SE02-04 – Room 1C – Level Garden — 13:30-15:15 – Friday 6 June 2014

Low Cost Data Communications for Sustainable and Environment Sound Development

Session Leader: Prof. Ermanno Pietrosemoli, Abdus Salam International Centre for Theoretical Physics, Italy and Fundacíon "EsLaRed", Venezuela

Freitag, Felix	DE	Universitat Politècnica de Catalunya (Spain)	Community Clouds for Supporting Data Services in Underserved Areas
Oliveira, Renato	PT	Fraunhofer Portugal AICOS (Portugal)	Framework for Offline Mobile Data Communications
Beech, Craig	ZA	Peace Parks Foundation (South Africa)	Toward a Spatial Monitoring and Evaluation System, Collecting Indicators to Map and Measure
Mlatho, Justice	MW	University of Malawi (Malawi)	Successful Process for Deploying TV White Spaces Technology in a Developing Country

TH2-SE02-08 – Room 3C – Level Garden — 13:30-15:00 – Friday 6 June 2014

Medical Devices for the Base of the Pyramid: Where are they?

Session Leader: Mr. Zach Friedman, LIGTT: Institute for Globally Transformative Technologies, Lawrence Berkeley National Lab (LBNL), University of California Berkeley, United States

Diage, Tiffini	US	Raechelon LLC (United States)	Development and Manufacture of a Bag-Valve-Mask Device in Ethiopia
Leeds, Nicole	US	Medtronic (United States)	Ecosystem Solution to Screen, Diagnose, Refer and Treat Patients with Chronic Ear Infections and Hearing Loss in Developing Countries
Oppenheimer Karen Pak	US	World Health Partners (United States)	Lessons from a Rural Social Franchise for Large Scale and Sustainable Use of Low Cost Medical Technologies

TH2-SE02-18 – Room 5C — 13:30-15:00 – Friday 6 June 2014

DAY 3 – Friday 6 June – Afternoon

Room 1C – Level Garden – 13:30-15:15

[TH2-SE02-04] Catalyzing Innovation through Targeted Scientific Training and Capacity Building

Session Leader: Prof. Federico Rosei, UNESCO Chair in Materials and Technologies for Energy Conversion, Saving and Storage, Institut Nationale de la Recherche Scientifique (INRS), University of Quebec, Canada

Leading question: How can capacity building in scientists and students from low and medium income countries be leveraged to accelerate the development and deployment of technologies within these countries? Underlying concept: Training a new generation of scientists and engineers who focus on adaptable technologies that can be transferred to developing regions has the potential to make an impact in bridging the knowledge and technology gap between north and south.

Rectification and Amplification, A New Approach to Energy Conversion

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Biography of presenting author: Francesco Stellacci is a Materials Science professor working in the Institute of Materials at EPFL. His interests are in surface science and nanotechnology.

Abstract

Photodetectors are based on the light-induced generation of charge carriers across a semiconductor band gap; these carriers are always in competition with the thermally induced ones whose number is inversely proportional to the band gap. Photodetector design is a trade-off between sensitivity at long wavelengths and thermal noise, hence the need for cooling in infrared detectors. By taking inspiration from the old 'crystal radio' design, we propose a photodetector where such a trade-off is removed because light induces a current decrease. The new photodetector is based on a semiconducting nanowire transistor and a metal nanoparticles/nanorods over-layer. Light is mostly absorbed by the metal nanomaterials, making the photodetector tunable from the visible to the infrared range. Upon illumination, charge transfer between the metal and the nanowire occurs, leading to a Fermi-energy shift for the nanowire device that in turn determines a current decrease for the transistor. Based on this mechanism, we demonstrate a photodetector with femtoWatt sensitivity, and tunability from the visible to the mid infrared, with no requirement for cooling.

Keywords
energy, rectennas, infrastructure

The Significance of Information and Communication Technology for Attaining Educational Development in Developing Countries

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Biography of presenting author: Korter, Grace is a research student and lecturer at the Departments of Statistics, University of Ibadan, Oyo State, Nigeria and Mathematics/Statistics, Federal Polytechnic, Offa, Kwara State, Nigeria. Her research interests are designing, organizing, conducting and analyzing survey data; writing and presenting survey reports and building econometric and spatial econometric models for policy analysis and forecast. She is proficient in the use of Microsoft Office (Word, Excel, etc), Eviews, SPSS, STATA and ArcGIS.

Abstract

Education is the bane for development, while sustainable development leads to poverty reduction. To engage students, improve learning and become a cutting edge educator, it becomes necessary to combine traditional classroom instruction with online or mobile learning activities through the technology world which moves so fast and changes so rapidly. Using the power of the internet, students can now learn different things whenever and wherever they want. The objective is to examine the frameworks needed to foster innovations and to mobilize innovation towards co - creating computers in the context of developing countries' challenge of unreliable energy supply, in order to enhance performance of information and communication technology (ICT) as teaching aids for educational

attainment. The basic underlying assumption is that computers are the simplest interactive instructional devices and that energy is a fundamental requirement for its functionality.

Without focussing on improving energy supply, a sample survey was conducted to ascertain the existing energy and ICT situation and needs amongst students. 213 questionnaires were administered to students of the University of Ibadan, and the Polytechnic, Ibadan, Oyo state of Nigeria. SPSS was used for statistical analysis. Summary measures were obtained using descriptive statistics, while the Chi- square test statistic was used for significance tests.

Investigation on technologies that can make the computer more relevant to users and adaptable to the environment revealed 51.4% suggesting longer battery life, 21.8% - double battery pack, 8.5% - both longer battery life and double battery pack and 7% - a reduction in the energy consumption of component parts of the computer. Other suggested features include ready and fast internet access accessories, educative software\learning kits, textbooks, faster processor, larger ram /hard drive space and free access to online journals and libraries. At 5% level of significance and p - value equal 0.001. There exist a strong association between educational development and ICT. Also, analysis showed there is a significant impact of poor energy supply on the use of computer as teaching aid in developing countries. Next, technological innovation has a significant effect on the number of hours the computer can be put to use. Lastly, there exists a strong dependency between computer use and energy supply. At 5% level of significance and p- value equal 0.085. There is no significant impact of poor energy supply to ICT in developing countries. This suggests the existence of other inhibiting factors in the environment.

The results support existing literature on the possibilty of adapting technology to suit local needs, improve energy efficiency and to acheive economic goals without necessarily improving energy supply. Apparently, there is need to maximize the full potentials of the computer to enhance educational development and to expose students across the globe to equal platforms and opportunities for learning. This study should enable the orientation of technological policies targeted towards manufacturing computers to suit the unreliable energy supply challenge in developing countries. Thus, allowing students from developing countries to compete favourably with students in developed countries.

Keywords
education, development, computers, energy

Empowering Partnerships? Renewable Energy Partnerships in Development Cooperation

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Biography of presenting author: Lena Kruckenberg is a third year PhD student at the University of Leeds (UK). Her interdisciplinary research focuses on the role of inter-organizational networks in processes of technology transfer/ technology adoption in development contexts. Lena holds master's degrees in International Relations from Keele University (UK) and in Sociology from the University of Bielefeld (Germany).

Abstract
Recent decades have witnessed a surge in international programs set up to assist the transfer of renewable energy technologies (RETs) to low and lower-middle income countries. So far, such programs have yielded a mixed record of success. While partnerships between international, national and local organizations have become the pre-eminent model for program design and implementation, we know relatively little about their actual contribution. This paper traces the role of renewable energy partnerships in development cooperation, shifting the analytical emphasis from contingency factors to key actors and their relationships. It then presents a relational approach for the analysis of RET transfer through technical assistance, drawing on theories concerning the role of strong and weak ties in inter-organizational networks. Through an analysis of seven empirical cases from Central America, the paper provides insights into how different forms of inter-organizational relationships can facilitate the implementation of RET programs but do not necessarily enhance the capacities of local organizations in a way that they can support a more sustainable adoption of RETs. On the basis of this analysis, theoretical and policy implications are discussed.

Keywords
renewable energy technologies; technical assistance; cross-sector partnerships; capacity building; sustainable development

Building Local Capacities to Monitor Methane Extraction in Lake Kivu

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Biography of presenting author: *Dr. Natacha Pasche is a limnologist with strong interests in biogeochemical processes in lakes. Environmental Engineer from EPFL, she accomplished her PhD on nutrient cycling and methane production in Lake Kivu in 2009. During the last four years, she worked for the Government of Rwanda to develop the Lake Kivu Monitoring Program. She trained a local team to monitor methane extraction in Lake Kivu. Since 1st September 2013, she became the Deputy Director of the Limnology Center at EPFL.*

Abstract

Lake Kivu is a large tropical lake situated in Africa between Rwanda and Congo. This unique lake contains an enormous quantity of dissolved methane and carbon dioxide. Their sudden potential release could have catastrophic consequences for the 2 million riparian inhabitants. To avoid such a risk, the two governments have decided to extract the methane. Methane extraction could produce as much as 700 MW during 50 years. Then, the exploitation will be reduced to the natural recharge of methane, transforming it into a renewable source of energy. This innovative win-win technology is essential for the development of Rwanda that is currently producing 100 MW, and where only 16% of the population has access to electricity.

In 2008 the first pilot plant started to extract and burn methane generating ~1.3 MW. Beside this technological success, the Government of Rwanda created Lake Kivu Monitoring Program to ensure a safe and environmental friendly exploitation. This team is monitoring the main risks associated with methane extraction, namely, the alteration of the lake stability and the deterioration of the lake ecosystem.

Lake Kivu Monitoring Program is financially supported by North-South cooperation to ensure foreign investments in methane extraction technology. During two successive capacity building projects, an international expert has trained five Rwandese technicians to become self-reliant and has set up a laboratory for nutrients, gases and biological analyses. This local team learnt to detect potential impacts on the lake ecology and on the safety of the population. Although transfers of knowledge and practical experiences were successful, the outcome remains fragile and the local team still need to be reinforced. At the regulatory level, the institutional framework remained weak and the rules for extraction still need to be enforced. In the future, these challenges should be addressed to ensure an adequate monitoring with strong local capacities.

Keywords

methane extraction, energy, Lake Kivu, capacity building, monitoring program

Bali, Indonesia: Combating Climate Change and Poverty – Recycling Used Cooking Oil by transforming it into Biodiesel

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Biography of presenting author: *Thorsten Reckerzügl holds a Diploma in Environmental Engineering from the University of Paderborn, Germany. From 2000 to 2006 he worked as technical consultant and project manager on water supply, decentralized wastewater treatment and community based sanitation in Asia. Between 2008 and 2011, he worked for Caritas Switzerland as Program Coordinator and Head of Delegation mainly in the field of rural water supply, sanitation and renewable energy supply in Indonesia. Since 2012 he is Senior Advisor for water and climate at the head office of Caritas Switzerland.*

Abstract

The project's goal is to contribute to climate change mitigation by recycling used cooking oil (UCO) and transforming it into biodiesel. This biodiesel will in turn substitute fossil fuels, thereby reducing greenhouse gas emissions.

The project has been implemented by Caritas Switzerland in cooperation with the Municipality of Denpasar, myclimate and KUONI. Within the framework of the project the social enterprise Yayasan Lengis Hijau (YLH) has been established running the UCO recycling: The UCO is collected from hotels and restaurants with vans in regular routines. In the processing plant, the oil is cleaned and transformed into biodiesel. The produced biodiesel is usable in almost all types of diesel engines and burners and is sold to partnering hotels and other interested customers as substitute for fossil diesel fuel.

By substituting fossil fuels, the project contributes to the reduction of greenhouse gas emissions. This emission reduction is verified by myclimate according to the Gold Standard.

Besides the mitigating effect, the project contributes also to the protection of the local environment and human health. In Bali UCO is commonly discharged directly into the environment and causes pollution of water bodies and soil. A big share of the oil is also reused as foodstuff. The reuse of UCO as foodstuff causes high health risks (cancer etc.) to consumers.

The social enterprise established in the course of the project offers jobs and training to socially marginalized people.

The structures and mechanisms established are planned to remain running for at least ten years, constantly contributing to climate change mitigation and generating tradable emission certificates. KUONI buys the emission certificates to reduce their corporate carbon footprint.

Through the project a best practise example for UCO collection has been developed and implemented. The integrated approach provides impact on different levels:

- Balinese stakeholder such as hotels, restaurants, the government, tourism associations, other NGOs and the public have been sensitized for the ecological and health risks of an inappropriate disposal or reuse of UCO.
- Knowledge on UCO recycling has been imparted to authorities from other provinces and from the national level during visits to the recycling plant.
- Trainings and income opportunities for socially disadvantaged people have been created.
- The project contributes to climate change mitigation by substituting fossil diesel fuel with the biodiesel produced.
- For Caritas the pilot project provides new knowledge and experiences with regard to subjects like renewable energies, carbon finance mechanisms, closing material flows (circular economy) and social business approaches.
- Currently a 45 min. film documentary about the recycling project is being shot for Radiotelevisione Svizzera (RSI). The producers plan to use the documentary also as an educational film for schools in Indonesia and Switzerland.

The physical implementation of the project has been successfully finished and the social enterprise took over the management of the recycling operations. While all structures and processes have been established successfully, the amount of oil recycled is still too low to operate on a cost effective basis. Currently Caritas Switzerland is still subsidizing the recycling operations. In case the current growth rate can be maintained, the social enterprise YLH will breakeven in August 2014.

Keywords
used cooking oil recycling, biodiesel, climate change mitigation, social business, public service provision

DAY 3 – Friday 6 June – Room 3C – Level Garden – 13:30-15:00

[TH2-SE02-09] Low Cost Data Communications for Sustainable and Environment Sound Development

Session Leader: Prof. Ermanno Pietrosemoli, Abdus Salam International Centre for Theoretical Physics, Italy and Fundacíon "EsLaRed", Venezuela

What are the most cost effective and environment friendly technologies to provide data services in underserved areas? Data communications is intensively used for environmental data gathering, disaster prevention and mitigation, health provisioning, education and training as well as productivity enhancement. They are also used to collect environmental sensors data. Yet the traditional techniques used in affluent countries are not always the best solutions to apply in developing countries, in which the limitations of the existing infrastructure and limited resources pose severe challenges Wireless has proved to be the most cost effective telecommunications solution for voice, but to provide reasonable data throughput using 3G or 4G technologies would require such a great number of base stations that make this solution unaffordable in developing countries besides placing and additional burden in the already taxed energy provisioning infrastructure.

Community Clouds for Supporting Data Services in Underserved Areas

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Biography of presenting author: Felix Freitag is associate professor at the Computer Architecture Department of UPC. He received his Ph.D. from the Technical University of Catalonia in 1998. His research interests include the design and evaluation of decentralized systems, services and applications. He coordinates the European FP7 Clommunity research project (A Community networking Cloud in a box) related to building cloud-based applications and services in wireless community networks.

Abstract

Wireless networks have shown to be a cost effective solution for an IP-based communication infrastructure in underserved areas. Services and application if deployed within these wireless networks add value for the users. Community cloud solutions have appeared in commercial environments as a cloud deployment model in which the cloud infrastructure is tailored to the requirements of a specific community. This paper proposes to bring cloud infrastructure into wireless networks, as a particular case of a community cloud, developed according to the specific requirements and conditions of the community. We show in a case study the start of such a community cloud and its deployment in a community network. Users of the wireless network will find applications such as for storage and collaborative work within their wireless network, without need to consume these applications from external providers, improving the user experience, reducing the use of bandwidth for connection to the Internet by keeping traffic within the network.

Keywords
community networks, data services, clouds, collective efforts

Framework for Offline Mobile Data Communications

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Biography of presenting author: Renato Oliveira finished his Master's in Informatics - Specialization in Software Engineering in Universidade Portucalense in 2012. Since then, he has been working at Fraunhofer Portugal AICOS as a scientist, where he develops mobile applications for senior users, in projects like SmartCompanion and Smartphones4Seniors, at the ICT4D Competence Center and in FCCPIL that aims to devise a system to provide precision indoor location using sensor fusion mechanisms running on a smartphone. His interests include software development, mobile technology and usability.

Abstract

The African mobile market is the fastest growing mobile market worldwide, and prices for related technologies, including smartphones, are falling rapidly. The number of mobile device users is growing so fast that there are predictions that those countries will miss the PC era and will accomplish all their needs through smartphones and alike. Many people have adopted mobile phones for daily tasks, which range from basic communication with relatives to small family business support, either for communicating with customers or receiving service requests. However,

missing or intermittent network coverage and low available bandwidth still pose serious barriers to mobile applications which rely on the Internet, especially in rural areas. Additionally, even though mobile phones and even smartphones entry prices are quickly falling, shared phone usage in developing countries remains a very common reality.

Taking these two facts into account, a framework called PostboxWeb has been developed and tested for Android OS which addresses the aforementioned issues. On top of this framework, a developer is able to create offline-capable native Android applications linked to REST services, which synchronize their data with the network only when sufficient connectivity is available. The framework supports data caching, multi-user access and sensitive data protection. The framework allows interested parties to adapt to these countries' realities as it is multi-user-capable with the possibility to manage users and possesses an incorporated personal data storage space that corresponds to each user, thus taking into account the prominent reality that shared phones are a common usage model in developing countries. There is also the possibility of profiling the users and logging their network traffic volumes to support a paid business model thus creating an additional new model for communications and phone rental.

In addition to this, the increased processing power and available sensors in the smartphone (e.g., GPS) provide an excellent way to manage and collect information for applications like medical surveillance, which can be tailored to developing countries.

Keywords
Low-cost communications; communications relay; smartphones; framework; delay tolerant networks

Toward a Spatial Monitoring and Evaluation System, Collecting Indicators to Map and Measure

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Biography of presenting author: Craig Beech has worked as Information Systems Manager for Peace Parks Foundation to develop, deploy and manage spatial information solutions for transboundary conservation practitioners. Spatial information management and deployment has played a key role in the success story of transboundary conservation initiatives in southern Africa.

Abstract
For fifteen years Peace Parks Foundation (PPF) has facilitated the establishment of transboundary protected areas in southern Africa. Focus is on 10 Transfrontier Conservation Areas (TFCAs) straddling 11 countries and contributing over 60 million hectares toward conservation estate in the region. A strong emphasis is placed on spatial planning to advocate, plan and manage TFCAs. Stakeholders of the TFCA process include government officials, wildlife agencies, private entities and local communities. Timeous information sharing and communicating reporting is paramount.

By making use of a user-friendly Geographical Information System (GIS), geoMEtri is a customized software database residing within this GIS platform. Disciplines measured and monitored using spatial and temporal indicators include Human Wildlife Conflict; Crimes against Wildlife; Species Observations; Socio-Economic Indicators; Marine Monitoring; as well as various management and infrastructure related aspects, which include alien plant management and weather recordings. Accuracy is important, and to ease the work flow process, the system allows for direct importation of GPS data.

geoMEtri databases are backed-up and shared amongst users of the software. A central data repository operates as the hub for all incoming data and the redistribution thereof. Data analyses process models run information and produce resultant map services which in turn can be consumed by the users of the software with an internet connection. Reporting of data is also offered in various formats, all geared to be visual and succinct.

Offering standardized tools to all stakeholders suggesting means of data collection, information management and knowledge based results goes a long way toward alleviating misperceptions which may exist between land use options. As technologies merge toward a connected environment based around the use of smart devices, combined with crowd-sourcing a very exciting future exists for leveraging data and information capture and the sharing of these results via effective reporting tools. geoMEtri is in the process of being engineered for Android and iOS mobile platforms.

Keywords: monitoring, evaluation, indicators, spatial analyses, mapping

Successful Process for Deploying TV White Spaces Technology in a Developing Country

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Brief Biography of Presenting Author: *Justice Mlatho holds a PhD in Applied Physics. He is a Senior Lecturer in Physics in the University of Malawi. His current research activities include; TV White Spaces project, solar resource assessment, solar energy for rural institutions (cooking and lighting), electromagnetic dose measurement.*

Abstract

Broadband Internet in rural Malawi is close to zero due to non-profitability of the existing deployed technologies. However, broadband connectivity is key to the sustainable development of any country. This paper discusses the deployment of TV White Spaces Technology in Malawi and details the successes, challenges and opportunities for low cost broadband communications in disconnected areas. White Spaces refer to portions of radio spectrum that are not used at a given time in a particular geographical location. The method for the deployment of TV White Spaces Technology consisted of the identification of idle channels in the TV band, discussions with the regulator for permission to use the technology, lobbying of the potential users and installation of the equipment. The willingness by the Malawi Communications Regulatory Authority (MACRA) and other partners in Europe to study the technology was instrumental to the success of the deployment. The deployment's uniqueness is in its collaborative arrangement among the university, regulator and international research institutions. Three institutions in seismic detection, education and national security sectors have been successfully connected using the TV White Spaces Technology. In conclusion, the TV White Spaces technology thus offers a unique opportunity to providing broadband connectivity in rural and remote areas in developing countries.

Key Words

TV White Spaces, broadband, rural, channel, low cost

DAY 3 – Friday 6 June – Room 5C – Level Garden – 13:30-15:00

[TH2-SE02-18] Medical Devices for the Base of the Pyramid: Where are they?

Session Leader: Mr. Zach Friedman, LIGTT: Institute for Globally Transformative Technologies, Lawrence Berkeley National Lab (LBNL), University of California Berkeley, United States

Medical devices for the poor have been an area of increasing attention in the past decade, as many of the world's largest drivers of mortality and morbidity can be addressed with relatively straightforward technological devices. We have increasingly simple and effective ways to diagnose anemia, treat infants born pre-term, diagnose tuberculosis and measure CD4 counts. These devices are in many cases inexpensive and designed for low resource settings, and appear as if they should be a major factor in the reduction of mortality in developing countries. Yet despite the proliferation of several promising technologies, very few have reached scale, and such devices still remain out of reach for the vast majority at the base of the pyramid. This session will explore these challenges, focusing both on the technologies and the broader ecosystem in which these technologies are delivered.

Development and Manufacture of a Bag-Valve-Mask Device in Ethiopia

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Biography of Presenting Author: Tiffini Diage, President of Raechelon LLC, has 15 years of experience in the medical device industry. She has developed and manufactured over 10 medical devices ranging from basic consumables to permanent implants in the areas of cardiovascular, neurovascular, orthopedics, obstetrics/gynecology, and emergency medicine. As executive manager in clinical and regulatory affairs she has conducted clinical trials and received regulatory approval of devices in U.S. and EU. Tiffini has a Master's in Public Health from University of Wisconsin Madison.

Abstract

Ethiopia is the second most populated country in Africa and the twelfth poorest country globally, thereby creating high demand and extreme shortages of medical supplies. In sub-Saharan Africa 27% of babies are born with asphyxia, which results in 4% of deaths. According to the Saving Newborns Lives foundation, basic neonatal resuscitation using a bag-valve-mask (BVM) device could prevent 30% of deaths of full-term babies, and 5-10% of preterm deaths. In Ethiopia 23% of hospitals lack the necessary BVM supplies to treat neonatal asphyxia. More than 80% of the births are performed at home by Health Extension Workers (HEW's) and midwives. The Federal Ministry of Health recognizes the need for trained health workers and to make BVM's available at every delivery. Local manufacturing of neonatal BVM can improve health and economy for the base of the pyramid population, by increasing access to the BVM device and offering employment.

Raechelon, a U.S. medical device consulting company, partnered with local entrepreneurs and biomedical engineers to create Echelon Medical Device Manufacturing in Ethiopia. We collaborated with University of Wisconsin Madison, Ethiopian physicians, and nurses to design a BVM device specifically for manufacture in Ethiopia. Design team meetings and prototype reviews were held with Ethiopian physicians and nurses to ensure clinical considerations specific to Ethiopia were included. Research on local material availability was conducted by students at Addis Ababa University School for Biomedical Engineering. Injection molding process analysis was conducted by U.S. Instrument Specialists. Meetings with the Ethiopia Ministry of Health were held to determine suitable price points, annual product demands, and the BID process.

We have designed a BVM that sells for $10 U.S. dollars (UDS) and can be reused at least 20 times, resulting in a per use cost of less than $0.50 USD. A pilot lot of product is currently being manufactured and will be tested in Ethiopia in hospitals, health outposts, and with HEW's. During development it was realized that local manufacturing needs to occur in a step-wise fashion. The limitation of hard currency makes it difficult to purchase necessary capital and other equipment. Although injection molding of commercial products is being performed in country manufacture of medical devices requires additional controls to ensure safe reliable devices are produced. Initial manufacturing in country focused on the final assembly, testing, packaging and labeling of product; as well as distribution and device training. Over time injection molding of components will be transferred in country for fully integrated manufacturing by 2015.

Keywords
Medical, Device, Resuscitation, Manufacturing, Neonate

Ecosystem Solution to Screen, Diagnose, Refer & Treat Patients with Chronic Ear Infections & Hearing Loss in Developing Countries

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Biography of Presenting Author: Nicole Leeds is a Market Development Specialist at Medtronic, Inc., a developer of innovative medical device technology and therapies to treat chronic disease worldwide. Her work focuses on the Shruti program, an innovative social business model currently piloting in India. Shruti employs community health workers and a diagnostic device to screen and refers patients suffering from chronic ear infections. Nicole also supports strategy and development of emerging markets for Medtronic's Surgical Technologies business unit. Prior to Medtronic, Nicole worked for the Clinton Health Access Initiative as a Program Coordinator for the Rwandan Ministry of Health's Human Resources for Health Program in Kigali, Rwanda. She has previously worked for The Bridgespan Group, the US Department of State and Fontheim International, LLC. Nicole graduated cum laude from Harvard University with a B.A. in History & Literature and a minor in Government.

Abstract

There are 60 to 330m patients worldwide suffering from Chronic ear infections with >90% of those patients living in the developing world. >75% of these patients suffer from hearing loss leading to a significant global disease burden.

The 'Shruti' program was designed to address this chronic disease through a sustainable and scalable model. An ecosystem solution leveraging community health workers (CHWs) is critical to screen, diagnose, refer and treat patients suffering from chronic ear infections. A critical component of this ecosystem solution is a diagnostic kit that could be used by the CHWs to quickly screen and diagnose patients in a community camp setting.

The Shruti Ear Screening Kit consists of an android phone, an oto-endoscope, a light source and a data enabled SIM card to transmit data. A customized software application has been developed to capture patient information and aid the community health worker in making simple diagnosis. Remote upload of patient information enables ENT physicians to monitor and review the diagnosis via internet. Any complex infections and hearing loss diagnosed are referred to an ENT Surgeon for treatment and potential surgery. Patients with positive diagnosis have the option of receiving low cost care at partner hospitals which includes medicine based treatment, audiometric tests and surgical interventions.

The first pilot was kicked off in partnership with Dr. Shroff's Charitable Eye Hospital (SCEH), New Delhi. The pilot is planned to cover three urban low income settlements – Mustafabad, Jehangirpuri and Trilokpuri with a combined population of over 1 Million. Five community workers and one project coordinator hired were trained and provided with screening kits to spread ear health awareness, conduct screening camps, deliver community counseling and guide patients through medical, surgical and corrective ear care. Beginning in July 2013, till date close to 4000 patients, including children and women have been screened through Shruti Ear Screening camps and community working. Over 200 patients were referred for further consultation and treatment with follow-up rates >30%. Most of these patients would have otherwise either ignored their disease condition or gone for home remedies with increased risk of hearing loss. The pilot aims screen between 600-750 patients every month within the targeted areas enabling better ear care access.

The successful launch of the pilot program in 2013 has provided the opportunity for the Shruti program to begin expansion to Southern India, with a focus on urban slums in Hyderabad in partnership with HMRI, a local non-profit organization. The eventual goal of the program is to expand across South Asia, South-East Asia and Sub-Saharan Africa.

Keywords:
Bottom of Pyramid, Chronic Ear Infections, Healthcare Ecosystem

Lessons from a Rural Social Franchise for Large Scale and Sustainable Use of Low Cost Medical Technologies

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Biography of Presenting Author: Karen serves as Vice President at World Health Partners. One of her key roles is in exploring and adopting new technologies to WHP's rural health platform. Karen's experience ranges from proteomics research, healthcare IT, to HIV/AIDS prevention. She has worked in both the public and private sectors including the Lawrence Livermore National Laboratory, Oracle, and UNFPA. Karen holds a B.S. in Chemical Engineering from Johns Hopkins University, a M.S. in Biotechnology from Northwestern University, and a MPH from UC Berkeley.

Abstract

Many medical technologies designed for the bottom of the pyramid market have not had their intended impact because the technologies don't align with the infrastructural, cultural and financial context of the developing world's villages where 75% of this population lives.

Most technology developers focus on creating a usable technology or adapting existing technologies for low-resource settings. Some are cognizant of peripheral challenges such as access to electricity, end-user literacy levels, etc. The majority of technology developers do not consider two major factors in early stage development: the overall process of implementation and external factors affecting the use and spread of the technology; and the cultural, social or business practices that will define the ethos in which these technologies would be embedded.

World Health Partners, an international non-profit organization, believes that increase in use and impact of appropriate medical technologies can happen only if they are designed from the ground up, with local human resources at the center. The trials and errors World Health Partners experienced with the implementation of a telemedicine solution in rural India resulted in a platform that supports a large-scale network of frontline health providers. All solutions are built and iterated based on the needs observed from the communities. The solution addresses a range of needs to generate significant caseloads, which also enable viable markets to form at these resource-scarce levels.

Rapid spread of mobile telephony and Internet to all corners of the world has the potential to deliver services to communities who have been bypassed by health care systems. However, these technologies have to be judiciously blended with the human resources that understand the social, cultural and financial underpinnings of these communities. Technology developers need to spend time on the ground in early stages of development, and program implementers will need to ensure that the solutions being offered are appropriate in low resource settings and weak infrastructure.
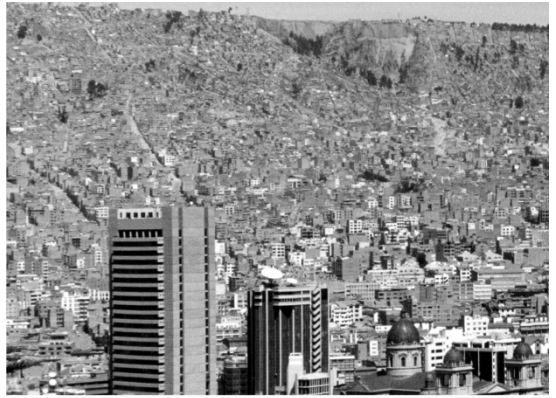
Posters

POSTER PRESENTATIONS – 4-6 JUNE 2014 – LEVEL GARDEN

Poster Number	Poster Presenter	Institution / Organization	Title of Poster
*Disaster Risk Reduction*			
DR1	Caimi, Annalisa	Ecole Nationale Supérieure d'Architecture de Grenoble (France)	From Local Building Practices to Vulnerability Reduction: Building Resilience through Existing Resources, Knowledge and Know-how
DR2	Hofmann, Milo	Ecole Polytechnique Fédérale de Lausanne (Switzerland)	Looking for 'Vernacular Paraseismic Building Workmanlike Manner'
DR3	Rist, Armin	Bern University of Applied Sciences (Switzerland)	How to Adapt the Integral Risk Management Concept as Applied in Switzerland for an Effective Implementation in Mountainous Developing Countries
DR4 DR5 DR6	Duyne Barenstein, Jennifer	University of Applied Sciences of Southern Switzerland (Switzerland)	Understanding the Impact of Changes in Building Technologies in Reconstruction After Natural Disasters
*Energy*			
ER1	Dhingra, Sunil	The Energy and Resources Institute (India)	Decentralized Distributed Generation for Rural Electrification in India: A Case of Two-Stage Biomass Gasifier
ER2	Huber, Christian	Oekozentrum – Centre of Appropriate Technology and Social Ecology (Switzerland)	Ecological Fruit-drying for Developing Countries
ER3	Mariun, Norman	Universitiy Putra Malaysia (Malaysia)	Modelling of 30 Megawatts Photovoltaic Generator Power Plant for Smart Grid Integration
ER4	Sharp, Kendra	Oregon State University (United States)	Development of Open-source Computational Tools for the Estimation of Future Water Availability in Data-Scarce Regions and Associated Micro-Hydro Power Potential
*Habitat & Cities*			
HA1	Bassan, Magalie	Eawag: Swiss Federal Institute of Aquatic Science and Technology (Switzerland)	Technologies for Sanitation Development: How to Determine Appropriate Sludge Treatment Strategies in Vietnam
HA2	Ganesa Pillai, Magesh	VIT University (India)	Development of Sustainable Sanitation Infrastructure for Processing Human Wastes and its Application as Organic Manure.
HA3	Kouamé, Parfait Koffi	Eawag: Swiss Federal Institute of Aquatic Science and Technology (Switzerland)	Improving the Waste Management Systems of Urban and Peri-Urban Areas: Material Flow Modeling of Nitrogen Impact and Environmental Sanitation Assessment in Yamoussoukro, Côte d'Ivoire
HA4	Gallegos, Angel	Polytechnic University of Catalonia (Spain)	Regeneration and Reuse of Runoff and Drainage Water in Agricultural Plots by Combined Natural Water Systems
HA5	Cvetinovic, Marija	Ecole Polytechnique Fédérale de Lausanne (Switzerland)	An Engine for Bottom-Up Urban Development in Action: A Case Study of Savamala Civic District
HA6	Cottino, Valeria	Architettura senza Frontiere Piemonte onlus (Italy)	Re-start from straw
*Information & Communication Technologies*			
IC1	Haemmig, Christoph	Geotest AG (Switzerland)	Early Warning and Hazard Assessment of Glacial Lake Outburst Floods, Yarkant River, P.R. China
IC2	Stoll, Sebastian	hydrosolutions Ltd. (Switzerland)	iMoMo - A Data Assimilation System for the Themi Catchment, Tanzania
IC3	Rinderer, Michael	University of Zurich (Switzerland)	The "Boots & Trousers" Method: Qualitative Field Observations of Shallow Soil Moisture Patterns – An Extension to Dry Soils
IC4	Brant, Jennifer	Innovation Insights (Switzerland)	Improving SME Performance by Enhancing Appropriation
IC5	Tollefson, Sara	D-Rev: Design Revolution (United States)	Evaluating from a Distance: Measuring Impact of Market-based Interventions
IC6	Galati, Adriano	Disney Research (Switzerland)	Opportunistic Networking for Socio-Economic Empowerment in Developing Areas
IC7	Engelhardt, Jutta	The International Platform on Sport and Development (Switzerland)	Communications Platforms as an Essential Technology
IC8	Elkhadir, Awad	King Abdul Aziz University (Saudi Arabia)	Internet Use by Radiology Teachers and Students of King Abdulaziz University: An Analysis

POSTER PRESENTATIONS – 4-6 JUNE 2014 – LEVEL GARDEN

Poster Number	Poster Presenter	Institution / Organization	Title of Poster
		Medical Technologies	
ME1	Payne, Beth	University of British Columbia (Canada)	PIERS (Pre-eclampsia Integrated Estimate of RiSk) on the move – development and evaluation of a mobile clinical decision aid for use in women with a hypertensive disorder of pregnancy
ME2	Loerup, Lise	University of Oxford (United Kingdom)	The 4P Study: Prediction of Physiological Patterns in Pregnancy using mHealth Technologies
ME3	Onu, Charles	The Fisher Foundation for Sustainable Development in Africa (Nigeria)	Harnessing Mobile Technology for the Diagnosis of Perinatal Asphyxia
ME4	Rosado, Luis	Fraunhofer AICOS (Portugal)	Mobile-based Detection of P. falciparum Malaria Parasites in Thick Blood Smears
ME5	Todd, Matthew	The University of Sydney (Australia)	Open Source Drug Discovery for Malaria
ME6	Estuar, Maria Regina Justina	Ateneo de Manila University (Philippines)	Stories from the Communities: Tracing User Behavior from Voices and Actions on Use of a Tablet Based Electronic Health Record and Data Visualization System for Public Health Service Delivery
ME7	Klugman, Noah	University of Michigan (United States)	Putting the IT in QuIT Smoking
ME8	Gani, Matthieu	Ecole Polytechnique Fédérale de Lausanne (Switzerland)	GlobalNeonat: An Appropriate Infant Incubator and Phototherapy Unit for Resource-Poor Settings
ME9	Sahli, Romain	Ecole Polytechnique Fédérale de Lausanne (Switzerland)	GlobalDiagnostiX: Appropriate Diagnostic Imaging for Resource-Poor Settings

Disaster Risk Reduction

[DR1] **From Local Building Practices to Vulnerability Reduction: Building Resilience through Existing Resources, Knowledge and Know-how**

Ratan Kumar Podder[1], **Annalisa Caimi**[2], Olivier Moles[2], Mohammad Shariful Islam[3], Tahsin Reza Hossain[3]
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*Biography of presenting author: **Ratan Kumar Podder** is a civil engineer working as Project Coordinator under Disaster Management Department of Caritas Bangladesh. Mr. Podder has been serving for Caritas Bangladesh for the last 28 years in the disaster management department. He is In-Charge of Shelter Construction Projects of Caritas Bangladesh and member of Shelter Cluster of Bangladesh led by UN and IFRC. He has experience on participatory approaches for design and construction of shelters for disaster-affected people. **Annalisa Caimi** is an architect graduated at the Ecole Polytechnique Fédérale de Lausanne (Switzerland) in 2005. Between 2005 and 2007, she conducted a research on bamboo construction in India. In 2010, she obtains the post-Master degree "Earthen Architecture" at CRAterre-ENSAG laboratory (France). She is currently developing a PhD thesis on local building cultures in hazard prone areas. This research is based on a close link with projects conducted by local and international organizations, particularly in Bangladesh and in Haiti.*

Abstract

This paper presents the experience conducted in the framework of a disaster preparedness programme in Bangladesh, where the understanding of existing building culture and resources represents the starting point to develop vulnerability reduction strategies strongly rooted into local conditions and practices.

Bangladesh is a multi-hazard prone country where damage to housing is extremely high. Housing typologies, construction techniques, resources, lifestyles and risks considerably vary from region to region. Based on lessons learnt from shelter response after 2007 and 2009 cyclones, Caritas Bangladesh jointly with the Bangladesh University of Engineering and Technology and CRAterre laboratory from the Ecole Nationale Supérieure d'Architecture of Grenoble, took the challenge to associate local communities, operational and academic stakeholders as well as to link emergency, rehabilitation and development. After a pilot phase, a 3-years programme has been undertaken at national level to develop strategies for habitat, risk reduction and disaster preparedness, on the basis of a strong participatory and interdisciplinary approach. This process included the analysis of local houses, resources and coping practices in different regions. From the findings, technical solutions have been elaborated, for each area, to improve existing buildings as well as to respond to future crisis, according to cultural, social, environmental and economic specificities of each site. Particular attention was paid to involve local resources for material, labour, supervision and management.

On one hand, past experiences on post-disaster shelter response have highlighted the need for more contextual approaches, that do not focus only on effective and efficient built products but that directly contribute to poverty reduction and sustainable and long-term vulnerability reduction of people and housing. On the other hand, in natural hazards prone areas, local people and builders have integrated these risks into their daily practices, developing particular behaviour, construction techniques or devices to reduce the vulnerability of the built environment. These coping strategies are usually a balance between locally existing skills, resources and risks. Thus, their identification is extremely valuable for the enhancement of local resilience, through the development of a variety of constructive and operational options to reduce building vulnerability according to different technical and economic capacities existing within a community.

However, assessment alone is not enough to foster the development of affordable and sustainable technical solutions; awareness as well as specific skills and tools also need to be developed. Starting from the Bangladesh experience, and its development by Caritas Bangladesh at regional and national level, this paper will explore the contribution of the analysis of local building culture into vulnerability reduction strategies, establishing a strong link between past, present and future of a community. It will focus on the site analysis process, highlighting some main findings related to specific local disaster-resilient building practices and to the dissemination of specific know-how among field officers, technicians and local community. These aspects have been developed in the framework of an on-going PhD thesis at the CRAterre-ENSAG laboratory, which global aim is to contribute to a greater adaptation of vulnerability reduction strategies to local conditions and capacities in housing sector.

Keywords: local building culture, vulnerability reduction, natural hazards, preparedness, community participation

[DR2]   Looking for 'Vernacular Paraseismic Building Workmanlike Manner'

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Biography of presenting author: Architect graduated in 2005 at the Ecole Polytechnique Fédérale de Lausanne (Switzerland). Postgraduate "Architecture de terre" in 2010 at the International Center for Earthen Architecture of the Ecole Nationale Supérieure d'Architecture (France). At present, assistant in the laboratory Archives of Modern Building at the Ecole Polytechnique Fédérale de Lausanne, and doctoral student under the direction of Professor Pierre Frey and Professor Hubert Guillaud.

Abstract

The paper is related to a doctoral thesis going on at the laboratory "Archives of Modern Building" of the Ecole Polytechnique Fédérale de Lausanne and which aim is to appreciate the technological inventiveness of earthquake resistant vernacular architecture.

In the seismic region of the Alpide Belt - a mountainous territory extending along the southern margin of Eurasia - numerous dwelling of the present-day built environment consists of vernacular structures, those implemented by builders with techniques empirically developed, using mainly natural materials and without the supervision of architects or engineers. Technologies elaborated by vernacular builders are of several types: some buildings have proven to perform adequately during earthquakes, some not as much. In the same way as for engineered structures (structures designed by architects and/or engineers), also for these so called non-engineered structures, exploring in details their interaction with earthquake phenomena is crucial in order to seize the building workmanlike manner improving their seismic performance. Yet, due to the heterogeneity of vernacular architecture - in their forms, materials, techniques and details – it is essential to investigate it by combining data related to distinctive building typologies.

The paper focus on the vernacular wall typology whose specific feature is to have timber horizontal elements integrated into load bearing - stone or adobe - masonry. This particular wall typology differs from others (e.g. infill timber frame structure) because until nowadays, it has been recorded only in vernacular architecture of seismic areas. Noteworthy, it has frequently saved life of inhabitants. Issues related to its investigation are mentioned in relation to two fieldworks implemented along the North Anatolian Fault Zone (Republic of Turkey) and in the region north of Ohrid Lake (Republic of Macedonia). Building variables likely to be related to seismic risk have been identified through the analysis of architectures located in areas with different levels of seismicity. The examination of buildings after a moderate earthquake led to the identification of some factors likely to increase or to reduce the seismic vulnerability of buildings. So, critical factors - positive and negative ones - associated to each building variable can be more precisely seized; specific remarks about them can be articulated; and, subsequently, building workmanlike manner governing vernacular architecture that is adapted to local seismicity can be brought out.

Even abstracting about the issue if the seismic vulnerability reduction is an integral part of the inventiveness inherent to every vernacular building cultures developed in seismic areas, all the same, the empirical approach of learning from these represents a creative and pragmatic process which have great potential nowadays; first and foremost, for the strengthening of the resilience of contemporary societies that have to deal with built environment shaped with vernacular technologies whose building workmanlike manner are no more implemented and transmitted. Indeed, the output could become a source of technological inspiration for conservation activities, where a deep knowledge of vernacular practices is essential to prevent - in an accessible manner and efficient way - natural and human phenomena that can dangerously affect the strength of existing buildings.

Keywords: vernacular architecture, seismic vulnerability, Alpide Belt

[DR3]   How to Adapt the Integral Risk Management Concept as Applied in Switzerland for an Effective Implementation in Mountainous Developing Countries

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Biography of presenting author: Armin Rist studied Environmental Sciences at the Technical University of Munich. Within the scope of his studies he did a practical training in the Annapurna Conservation Area (Nepal) where he worked for nature conservation and protection from landslides. In his doctoral thesis at the Swiss Federal Institute for Forest, Snow and Landscape he studied slope stability in mountain permafrost. Presently, he works as researcher at the competence center for Geotechnics and Natural Hazards of the Bern University of Applied Sciences.

Abstract

Worldwide mountainous countries are prone to mass movements, namely flooding, debris flows, landslides, avalanches and rock fall. When these gravitational processes affect people, livestock, buildings, infrastructure, forest or farmland, they act as natural hazards. Many areas of Switzerland are threatened by such events since centuries. The expansion of settlement and land use to endangered areas increased the values at risk and thus the damage potential. Therefore, great efforts were made to reduce these risks resulting in the actual integral risk management concept. All actions in this concept are organized in a cycle: a hazardous event is followed by a response phase including intervention and recondition, then by a recovery phase for reconstruction and finally by the preparedness phase comprising prevention and preparation. An effective prevention is guaranteed by a risk analysis, a risk assessment, and finally the planning and implementation of protection measures including land use planning, technical as well as biological or bio-engineering measures. The consideration of natural hazards in land use planning is based on hazard maps. The Swiss federation commissions the cantons to provide these hazard maps area-wide. They in turn serve the communities to develop use zoning plans which define where and under which obligations buildings are allowed to be erected. The consideration of natural hazards in the land use planning has also impacts on the other prevention measures, both spatial and object-related ones. Consequently, the prevention of natural hazards as an important part of the integral risk management in Switzerland is organized top-down, that means it is based on a clear hierarchy of responsibilities. Developing countries in mountainous regions usually dispose of far less scientific, technical, logistic and especially financial capacities for disaster risk reduction than Switzerland. Therefore, these countries can strongly benefit from development cooperation with Switzerland. However, the Swiss system is very unlikely to function well in developing countries if it is simply tried to be transferred directly. Rather, the socio-economic context of the specific country has to be considered carefully, i.e. the concept of an integral risk management as applied in Switzerland has to be adapted to and embedded into this context. In most developing countries the public authorities do not or cannot assume the responsibility for a sufficient protection of the civil population against natural hazards. Another major hindrance for a public risk management to work well is usually corruption. For these reasons the local inhabitants affected by natural hazards have little confidence in the public authorities and must thus bear the responsibility by themselves. Risk management is therefore much more likely to succeed in developing countries if it is organized bottom-up rather than top-down as in Switzerland. First of all the confidence of the threatened population has to be gained and their needs, experiences and observations must be considered and involved. In close cooperation with the locals the specific risks have to be analyzed, assessed and protection measures to be developed based on the locals' skills and knowledge as well as on the locally available and sustainable materials.

Keywords: mass movements, natural hazards, risk management, socio-economic context, organized bottom-up

[DR4-6] Understanding the Impact of Changes in Building Technologies in Reconstruction after Natural Disasters

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Biography of presenting authors: The authors are currently working together on a 3-years research project on "Understanding habitats, housing, and social change in post-disaster traditional and relocated settlements in rural India" funded by the Swiss National Science Foundation. J. Duyne Barenstein (project director) is a social anthropology specialized in socio-economic and cultural dimensions of housing. She is the head of the World Habitat Research Centre (WHRC) of the University of Applied Sciences of Southern Switzerland (SUPSI). Akbar N. Modan is an architect from CEPT, Ahmedabad, while Katheeja Talha and Charanya Khandhadai are architects from the MEASI Academy of Architecture of Chennai, India.

Abstract

Over the last decade, millions of houses have been destroyed by natural disasters. International agencies often provide assistance to affected people through mass housing project characterized by one-type-fits-all housing typologies. All too often designs, building materials and construction technology fail to recognize people's need and desire to transform and extend their dwellings so as to adapt them to their family- and livelihood-specific needs. As a result, house owners' inevitable adaptations and extensions may be constrained by design and features that did not anticipate such needs and may turn out to be costly and ineffective. Further, lack of knowledge and understanding about new construction technologies may affect the structural safety of the dwelling, thus rendering people more vulnerable to eventual future disasters.

Our interdisciplinary research project analyses through detailed multi-sited case studies carried out in India (Maharashtra, Gujarat and Tamil Nadu), how agency-built houses following three major disasters have been transformed and adapted over the years by their owners, the challenges they faced, and the consequences of their initiatives on the structural safety of the building.

The research aims at enhancing the sustainability and resilience of post-disaster housing by raising awareness about design features and issues related to building technologies that need to be considered by agencies involved in post-disaster reconstruction. The research findings, their implications, and resulting recommendations for improvements are supported by detailed photographic documentation, drawings and plans. The research team aims at influencing reconstruction policies and practices through concrete proposals for improvements, which are shared with concerned communities and disseminated through publications, conferences, seminars, and consultancies in collaboration with NGOs, government agencies, and relevant international institutions such as IFRC, GFDRR, UN Habitat, and the Shelter Centre.

Keywords: post-disaster housing, building technologies, transformations

Energy

[ER1] **Decentralized Distributed Generation for Rural Electrification in India: A Case of Two-Stage Biomass Gasifier**

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***Biography of presenting author:** Mr Sunil Dhingra, Masters in Mechanical Engineering, is a Senior Fellow in Energy Environment Development division of The Energy and Resources Institute. He has acquired vast expertise in the design, development and dissemination of biomass utilization and waste-to-energy systems – like design, development and dissemination of biomass gasifier systems, both for thermal and power generation (of 10 to 1 MWe capacities) for decentralized applications.*

Abstract
In India, as per 2011 census, nearly 44% of rural households do not have access to electricity, and those who have access suffer from unreliable electricity supply. Lack of access and unreliable supply undermines the ability of the households and micro/small enterprises to move out of the vicious cycle of energy poverty. In 2005, Government of India initiated a large national rural electrification programme to provide electricity to all village and households, using option of centralized grid extension and promotion of decentralized distributed generation based on renewable energy technologies such as biomass gasifiers.

Biomass energy contributes to 14% of the world's energy and almost 40% of India's primary energy requirement. It provides an optimal solution for rural areas due to their availability from agriculture and forests. Gasification can convert woody biomass and agricultural residue to electrical and thermal energy. This paper provides insights regarding experience of developing two-stage biomass gasifier for Indian conditions through an interesting technology transfer and intellectual property rights sharing agreement.

The Swiss Agency for Development and Cooperation (SDC) has been supporting collaboration between the Energy and Resources Institute (TERI) and Denmark Technical University (DTU), to localize two-stage biomass gasifier as decentralized energy solution by addressing the technical, economic and environmental challenges associated with the fixed-bed gasifiers.

The two-staged biomass gasifier has pyrolysis and gasification in separate reactors with an intermediate high-temperature tar-cracking zone, which results in extremely low tar concentrations in the producer gas. This also replaces water needed for cleaning and hence does not generate any wastewater. Further, the system can have continuous operation and can meet both consumption and productive electricity demand. The robustness of system design also implies simple operation and maintenance and use of different biomass types, which makes it suitable for decentralized applications.

As part of the project, a two-stage gasifier of 20 kWe capacity, with simple cleaning and cooling system, has been developed, tested and localized to Indian condition. The experience so far has demonstrated high quality gas (tar<25 mg/m3), low specific fuel consumption and no wastewater generation in cleaning and cooling.

In order to sustain decentralized distributed generation, the project is now focusing on developing business models by combining electricity-driven economic activities and meeting household energy requirements in villages in regions of India, where there are sustainable biomass supply-chain available and high level of electricity access deficits continue to hamper social and economic growth.

The experience of adapting two-stage biomass gasifier for Indian conditions and context has so far demonstrated the robustness of technology with minimal maintenance and suitability for field implementation. The challenge now is to develop a viable business model and regulatory support to bring sustainable electricity supply to grid-connected and off-grid villages.

Keywords: Two-stage biomass gasifier, rural electrification, livelihoods, community-based activity

[ER2]   Ecological Fruit-drying for Developing Countries

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Biography of presenting author: Christian Huber is a project manager at the Centre of Appropriate Technology and Social Ecology (CATSE) in Langenbruck, Switzerland in the field of international development. As an engineer in Material Science he has been working for several years both in applied research at EMPA as well as in the industry focused on product development for customers from industrialised countries and from emerging markets. He started a MAS in Development and Cooperation at Nadel ETHZ (Swiss Federal Institute of Technology Zurich).

Abstract

In the recent years locally dried fruits – mainly mango – became an important industry for the rural population in Burkina Faso. Conventionally, the drying process mainly takes place in gas-fired drying ovens. Fruits dried in these kinds of ovens do not always meet the customer's quality requirements. Combined with the rising energy costs the producers' livelihoods are endangered.

The use of a condensation dryer shows a possible solution for the mentioned situation. A small heat pump unit – optimized for the circumstances in Burkina Faso – extracts the moisture out of the fruits in the drying chamber, allowing a gentle drying process. An affordable, economical and robust heat pump that can be built and repaired locally is required for using this technology in developing countries.

A fruit dryer, developed and tested at the Oekozentrum in Langenbruck was successfully installed and tested as a pilot plant in Burkina Faso. The quality of the dried products was essentially increased due to the process with dehydrated air at lower temperatures compared to conventional gas-fired drying ovens.

By the enhanced quality the waste of burned or sere mangos could be reduced to a lower level. Both the energy costs and the CO_2 emissions in particular have been significantly reduced; the latter by an amount of about 50%. A second optimized prototype will be delivered to Burkina Faso in autumn 2013. The drying chamber has twice the volume at a constant heat pump output and therefore generates a considerable higher output of dry fruits. The second prototype is already partially built in Burkina Faso by a local manufacturer; only the complex heat pump components are still produced in Switzerland. This can be seen as a first step towards a locally produced heat pump dryer. A photovoltaic system is installed which covers an essential part of the energy consumption of the two heat pump dryers. To become even more independent from the volatile local power grid and to improve the CO_2 balance, the use of a biogas generator is evaluated. The waste caused by the mango cutting as well as the unused and rotten mangos are building up a significant amount of biomass. This biomass can be converted into electricity for running the heat pump via a biogas reactor combined with a generator.

It was shown that with the technology of a heat pump dryer the quality of dried mangoes was increased essentially with a reduced energy consumption and CO_2 emissions. Using the installed photovoltaic system the dependence of the local power grid and the CO_2 emissions could be drastically reduced. Establishing a local manufacturer for the building of the drying chamber as well as for the installation of the photovoltaic system can be seen as first step toward a local replication of this system.

Keywords: fruit-drying, food processing, energy efficiency, condensation dryer, photovoltaic system

[ER3]   Modelling of 30 Megawatts Photovoltaic Generator Power Plant for Smart Grid Integration

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Biography of presenting author: Norman Mariun is a Professor and Head of Centre for Advance Power and Energy Research, University Putra Malaysia. He was the Head Department of Electrical and Electronic Engineering (2001-2004), Deputy Dean of Research and Post Graduate Studies for the Faculty of Engineering, UPM (2004-2009), Deputy Director of Research Management Center, (2009-2010), and Director of Research Management Center, UPM (2010-2012). Graduated from University of Nottingham in Electrical and Electronic Engineering (1980). He obtained MSc in Electrical Engineering from North Carolina State University, USA (1983) and PhD from University of Bradford, United Kingdom (1998). His area of research interest is Electrical Power Engineering including Energy Efficiency and Renewable Energy, Power Electronics application in power system and drives. He has filed 4 patents and granted 1 patent recently. He has authored and co-authored more than 250 academic and professional papers and reports. He has also served as reviewer for various national and international journals, and conferences. He is a fellow of Institution of Engineers Malaysia and a senior member of IEEE.

Abstract

Presently, the global attention is focused towards the green technology through interconnected renewable energy sources, IT and Telecommunication, term as smart grid distributed generation systems. Distributed generation provides highest potential in meeting the future global energy demand. Climate change, global warming, pollution are attributed due to absolute dependent on fossil fuel sources. This paper presents a MATLAB/SIMULINK based model that predicts the output performance of 30megawatts photovoltaic generator power plant integrated with smart grid for local application. Of course solar radiation is the most influential input for photovoltaic energy conversion. Solar radiation prediction model was developed and validated with actual data from Renewable Energy Research Office University Putra Malaysia (RERO UPM). Also PV generator model was presented. The predicted power based on actual weather data of June 26th, 2012 at the site with coordinates (3.160[0]N, 101.710[0]E) was found to be 28.1MW at noon as maximum for clear sky condition. However, 6.8 oktas was introduced to the model as average Malaysian cloud cover measure to predict at cloudy condition, the output reduced by 44% of the maximum as 11.5MW. The model demonstrated good prediction capability and accuracy for smart grid distributed generation and application.

Keywords: Solar Radiation, Photovoltaic Generator, Smart Grid, Modeling and Simulation, Green Technology

[ER4]   Development of Open-source Computational Tools for the Estimation of Future Water Availability in Data-Scarce Regions and Associated Micro-Hydro Power Potential

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Biography of presenting author: K. Sharp is an Associate Professor of Mechanical Engineering at Oregon State University (OSU) and a Glumac Faculty Associate in Sustainable Technologies. She has been working in the area of renewable energy for developing countries, and is currently leading the development of an educational program in Humanitarian Engineering at OSU. The current project relies upon her group's expertise in thermal-fluids systems and collaborations with faculty in Water Resources Engineering at OSU and at the Centre for Energy Systems at the National University of Science and Technology in Islamabad, Pakistan.

Abstract

A hydrologic model for basins draining through Pakistan is developed with the specific intent of identifying micro-hydro sites and assessing their quality both in terms of current production capacity and expected future production capacity in the face of climate change impacts. The hydrologic model requires inputs of high-spatial resolution monthly precipitation, monthly temperature, and topography. The necessary climate grids are produced as part of this project. Modeled flow rates are combined with information about topographic slope and used together to approximate power potential and thus micro-hydro productivity on a cell-by-cell basis.

A major hindrance in building and applying models to this and many other regions is the lack of dense and consistent meteorological data. This is partially ameliorated by downscaling available climate data, which improves both its resolution and ability to represent the underlying processes. We have developed computational tools for generating datasets with monthly total precipitation and mean temperature climate surfaces for all global land areas gridded to 30-arcseconds (~1 km at the equator). A Delta downscaling method is used incorporating 30-arcsecond WorldClim climatologies and 0.5-degree time-series datasets from the Climate Research Unit (CRU), Willmott and Matsuura (W&M), and the Global Precipitation Climatology Centre (GPCC) to generate these surfaces. The downscaled products are shown to perform well through a comparison with Global Historical Climatology Network (GHCN) station data. These computational tools are open-source and distributed at *globalclimatedata.org*, and can be used to generate similar high-resolution grids for any global land surface. Perhaps more importantly, these tools have been extended to enable their use for forecasting future water availability based on the emissions paths developed by the Intergovernmental Panel on Climate Change (IPCC). The forecasting capability is designed to be compatible with a number of general circulation models (GCMs). The present implementation uses time-series data from the National Center for Atmospheric Research (NCAR) Community Earth System Model (CESM1) in conjunction with future decadal climatologies distributed by the Consultative Group on International Agricultural Research (CGIAR), for a range of emissions scenarios.

Results are given in normalized form as a demonstration of the model's utility for assessing potential micro-hydro site quality. These assessment tools can be applied to other regions with relatively limited streamflow data. The usefulness extends beyond power potential assessment for micro-hydro, because these tools can also be implemented to assess water availability for future agricultural needs.

In summary, the development of these types of easy-to-apply tools for estimating current and future water availability for both power potential assessment and agricultural needs is critical for improving planning capabilities for infrastructure development. This product is the first one available that combines high-spatial resolution, global

coverage, and an open-source approach. As such it greatly expands our ability to predict local changes to water resources in data-scarce regions and is suitable for use by a wide range of organizations.

Keywords: Micro-hydro, Climate Change, Water Availability, Resource Assessment

Habitat & Cities

[HA1] Technologies for Sanitation Development: How to Determine Appropriate Sludge Treatment Strategies in Vietnam

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Biography of presenting author: Magalie Bassan graduated from EPFL in environmental engineering, specialized in the field of sanitation in developing countries, and works at Eawag/Sandec. She is now a PhD candidate at EPFL, and manages a project focusing on co-treatment of faecal and wastewater sludge through anaerobic digestion in urban areas of Vietnam.

Abstract
Developing appropriate technologies for the entire sanitation chain in low- and middle-income countries is crucial to protect public and environmental health, and for the economic development. This includes treatment systems for the sludge produced in both onsite and centralized systems (i.e., faecal and wastewater sludge). As the quantities and characteristics of faecal and wastewater sludge differ from city to city, context specific technologies are essential.
A study was conducted to identify adequate treatment technologies for faecal and wastewater sludge in five cities in Vietnam (Bac Ninh, Son La, Lang Son, Hoa Binh and Ba Ria). The influence of the enabling environment, existing infrastructures, local sanitation practices and socioeconomic contexts on the selection of technology were assessed through literature reviews, household surveys and interviews.
In Vietnam, onsite and centralized treatment systems coexist in a variety of urban contexts, and sludge is dumped in the environment or in overloaded landfills. Increasing volumes of faecal and wastewater sludge will be produced in the coming years, augmenting the urgent need for treatment systems. Co-treatment of faecal and wastewater sludge through anaerobic co-digestion is an innovative solution that can diminish the costs of the design, construction and operation of treatment technologies, with interesting opportunities for resource recovery.
The case studies allowed the evaluation of important information that need to be considered when developing treatment strategies for faecal and wastewater sludge in low- and middle-income countries. A checklist of influential aspects is presented, to make best use of local opportunities, and minimize the risks of technology failure. This approach is applicable in other cities, where onsite and centralized sanitation systems coexist, and technologies for the treatment of sludge are required.

Keywords: Vietnam, faecal sludge, wastewater sludge, co-treatment

[HA2] Development of Sustainable Sanitation Infrastructure for Processing Human Wastes and its Application as Organic Manure

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Biography of presenting author: The author is actively involved in experimental, theoretical and computer simulation studies in the areas of microwave drying, biosorption, fertilizer technology and waste management. He has researched on a variety of conductive and non-conductive materials from the past nine years and published ten research articles in peer reviewed international journals. Very recently, a beginning has been made his group to recovery urea from human urine using microwave activated coconut shells, and the results were highly commended by his host university for its socio economic responsibilities.

Abstract
Though the objective of any sanitation system is to protect and promote human health by breaking the cycle of disease, the present day techniques of human excreta disposal have represented threat through contaminated groundwater leading to public health risks from drinking water. As a consequence, it is necessary to develop an economical, eco-friendly, safer and sustainable technique for minimizing water usage, in addition to the processing of

human excreta which needs to work side by side rapidly without any delay. Microwave irradiation is considered effective in environmental engineering, waste processing, sludge treatment, owing to the rapid heating caused by molecular friction and rotation. Taking into consideration the nature of the sample, microwave irradiation will be potential alternative and attractive technique, since they provide volumetric heating at improved heating efficiencies compared with other techniques. Thus, these aspects were experimented for proper sanitation using microwave, in laboratory scale for the most relevant domestic systems of interest.

Human faeces were collected from source separated dry toilets in standup microwavable pouches placed on trays, and were subjected for immediate removal of moisture content using a domestic microwave oven. The entire drying studies were conducted under optimized microwave output power, mass of sample and the time of drying. In selected experiments, before collection of specimen, 5 gms of analytical grade urea were added in the pouches to enrich the essential nutrient content of the manure. Finally after drying, the microwave dried samples were crushed and powdered before application as manure.

Microwave Activated Carbonized Coconut Shell (MACCS) was prepared and used to recover urea from human urine. Batch adsorption studies were conducted to evaluate the effect of initial adsorbate concentration (25 % – 100 %), contact time, carbon loading (1-3 g) and shaking speed (150–200 rpm) on the removal of urea at 30°C. Microwave activation was performed at 180 W for 10 min. The application of MACCS powder for plant (*Vigna mungo and Vigna radiate*) growth was performed in pots. The effect of MACCS addition on plant growth was studied with four replications. Seperate field studies were conducted to determine the percentage biomass increase and relative agronomic effectiveness for soil treated with the urea adsorbed MACCS powder. With reference to all treatments, the plants subjected to the treatment of absolute control had the least values for all the growth parameters. Tests were also performed to determine the residual effects of the fertilizers on the crops. The results indicated that the use of powdered feaces or desorbed MACCS powder (when compared to commercially fertilisers), resulted in a significant growth rate and a better yield in the test crops. MACCS as well as dried feaces has shown a promising results in terms of yield of crops.

The validation of results in bench scale operations clearly confirmed that instantly microwave dried feaces and urea adsorbed MACCS power will be a better alternate for the reuse of human waste streams and play an important role in Sanitation Technology development for following sustainable agricultural practices in future.

Keywords: Human excreta, microwave drying, dry toilets, urea, carbon

[HA3]   Improving the Waste Management Systems of Urban and Peri-Urban Areas: Material Flow Modelling of Nitrogen Impact and Environmental Sanitation Assessment in Yamoussoukro, Côte d'Ivoire

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Abstract Text: The environmental sanitation issues become a new challenge in developing countries, where shortcomings were affecting seriously the health system and water quality. Contaminated wastewaters from anthropogenic activities were directly discharged to the lakes in Yamoussoukro city, Côte d'Ivoire. Collected solid wastes were landfilled. Fecal sludge were also released to the lake and into the nature. Exposures due to the use of polluted waters for urban agriculture and fishery practices and on water quality are important in the study area. The objective of this study was to assess the environmental sanitation threats linked to nitrogen contamination of waste and to propose solutions to the existing sanitation problems in the city of Yamoussoukro. The overall goal is to provide insight into how to improve the well-being of people living in urban and peri-urban areas. The methodological frame was based on a Material Flow Analysis approach (MFA), which is successfully and widely used in developed countries to evaluate environmental sanitation impact. We conducted a multidisciplinary systematic assessment of the flow and stock of nitrogen within the environmental sanitation system. System flows were assessed based on a deep understanding of environmental sinks, secondary data from scientific reviews, mathematical calculations, and laboratory analyses over a six-months period. Mass flow and nitrogen flow assessment was implemented using the R

Software version 3.0.1. Based on probability distribution and parameters statistics (mean, standard deviation), flow values were assessed using Monte Carlo simulation with 100,000 iterations.

The results of MFA showed the main paths of environmental threats by describing the distribution of wastes and nitrogen with Sankey diagram within the study area. Mass flows of the water supply, household wastewater, wastewater released into the lake system, solid waste and fecal sludge were estimated at about 21.68±2, 19.66±2.2, 5.83 m^3/cap/year, and 0.16±0.02, and 0.33±0.1 kg/cap/year, respectively. In the same range, nitrogen flows for household wastewater, wastewater released in the lake system, solid waste and fecal sludge, were estimated at 1.56±0.62, 1.2±0.1, 3.78±1.3, and 1.04±0.36 kgN/cap/year, respectively. Finally, three scenarios were developed that would enable the sustainable management of the sanitation system by the year 2020. The proposed technological infrastructures are complementary with the existing system and are: (1) composting with waste stabilization ponds, (2) co-composting associated with flow constructed wetlands, and (3) co-composting with planted beds. This study helps for understanding urban wastes production dynamics and gives skills for reducing the water quality contamination by the reuse of nitrogen in agriculture, in order to improve well-being in the city of Yamoussoukro.

Keywords: Environmental Sanitation, MFA, Wastewaters, Solid wastes, Nitrogen

[HA4] Regeneration and Reuse of Runoff and Drainage Water in Agricultural Plots by Combined Natural Water Systems

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Abstract

Within the context of sustainable water management, the transformational participative process of the "Morro de Moravia", a landfill in Medellin Colombia, carried by the UNESCO Chair on Sustainability at the Polytechnic University of Catalonia, has become an example of how water and sanitation technologies can be specifically suited to the complex reality of urban degraded areas in developing countries. The site was declared Public Calamity in 2006 and the pollution and related health problems for people still living there were increasing. This situation motivated local authorities to design altogether with universities and NGO's the Macro-plan "Integral Recovery of Morro de Moravia: Restoration and management for public use" which promoted public participation and encouraged community learning while applying low-cost alternatives like constructed wetlands and buffer strips to remove pollutants from the runoff.

Following the same path, the Regeneration and reuse of runoff and drainage water in agricultural plots by combined natural water systems (REAGRITECH) Project, part of the European LIFE+ Environment Policy and Governance Program, aims to demonstrate a method for recycling water resources (through constructed wetlands and buffer strips) at parcel scale to optimize the resources in the ecosystem achieving a more sustainable river basin.

The decrease in water consumption for agriculture and the minimizing of the impacts that this region has on the environment are the main objectives of this project. In 2006, groundwater and surface water extraction in the EU was about 38,900 million m3 (Eurostat, 2006). In recent years, 41.4% of the territory of the EU27 has been declared as nitrate vulnerable zones (Eurostat, 2006), as a direct result of pressure from farming on the environment.

The demonstrative pilot system, which will reuse irrigation water in two different agricultural management scenarios, is a combination of two appropriate treatment technologies of polluted water with natural systems: constructed wetlands and buffer strips, combination designed to optimize system efficiency in removing pollutants (nitrates, phosphates, and pesticides). The treated water will recirculate within the system, where a part of it will be reused for plot irrigation, while the rest will be used to recharge the aquifer in the area of the head of the riverside forest, thus ensuring the water table and natural processes of the river recharge in the study area.

Improving the chemical characteristics of the reused water, the surrounding natural environment is also enhanced by reintegrating the natural water cycle. Some advantages of this demonstration project are the optimization of water resources within the supply system, the recovery of ecosystems degraded by human pressure, the development of

alternatives to environment fragmentation for changing to irrigated agricultural areas, and reducing investments in water treatment facilities for consumption.

It is noteworthy that this project has a specifically demonstrative nature and its diffusion is mainly directed to agrarian organizations both in Europe as in Latin America. This is due to the adaptive and participative character of the procedures and activities as well as how the whole conception of a project designed to meet local needs and to answer water sustainability issues.

Keywords
Technology innovation, natural water systems, constructed wetlands, sustainable water management, ecosystems, water stress reduction.

[HA5]   An Engine for Bottom-Up Urban Development in Action: A Case Study of Savamala Civic District

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Biography of presenting author: A PhD candidate at EPFL, her research focuses on urban development, post-socialist urban planning and participatory processes and their potential to reduce the negative effects of globalization and urbanization in post-socialist cities. She obtained her Master degree in Architecture (University of Belgrade), has worked in architectural practices, and been involved in artistic and social activities in Belgrade which gave her a broader picture of current potentials and conflicts in transitional countries.

Abstract
This poster presents a model of a bottom-up urban transformation run by the social participation of proactive people that are ready to invest themselves in converting their deprived environment into a series of economically self-sustainable common places, fighting against big businesses and the possible threat of gentrification. It justifies how the series of unsolicited activities in the last two years contribute to setting up economic, political, cultural and spatial transformation in Belgrade, the city that is going through traumatic post-socialist transition.

Such a set of bottom-up cultural activities promotes sustainable urban development of the city district, surpasses current profit-orientated neo-liberal trends, benefits from spatio-social contradictions as an opportunities for creative participation. Moreover, it emphasizes diversity and reciprocity of people in action in order to set a comprehensive overlay of urban scenarios for interventions in Savamala.

This local development program enables the residents of Savamala to participate in the process of scrutinizing alternative methods of urban development within unclear legal regulatory framework and beyond big financial means for investment. In lack of official strategies and without powerful business initiatives, it is this economy of social exchange that could continually contribute to an improvement of life and functionality of urban structures and systems, and effectively provide an opportunity for developing a model of urban transformations, based on social interest rather than on real estate speculations.

[HA6]   Re-start from Straw

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Biography of presenting author: Graduated in Architecture, Polytechnic of Turin, with Professor Roberto Gabetti, has gained experiences both in Italy and abroad, particularly in Berlin and Hierapolis di Frigia. In 1996 she has opened her professional study, specialized in restoration, bioclimatic design strategies and integration of renewable energy, environmental and improvement, revaluation of the territory. In 2011 her project for the reconstruction of Paraloup hamlet was awarded by Konstruktiv for Alpine architecture. She is president of ASF Piemonte and of the ASF Italian Network.

Abstract
In 2012, ASF Piemonte built an orphanage that is set in Leogane, Haiti: wood has been chosen to accomplish bio climatic comfort and anti-seismic requirements. Nevertheless a very comfortable facility has been given to children, upon the completion of the construction doubts had arisen about the utilization of the wood as prime construction material, since was to be imported.

Lessons learnt gathered from the project set in Haiti, we questioned the sustainability of the imported material.

Could be this a sustainable project replicable by local labors? Is welfare a solution? Can such a cooperation project have a key role in the economic development?

Some answers to these questions came out from the research carried on by Matteo Restagno and Gian Nicola Ricci in their degree thesis in Architecture. The thesis compared different results in cooperation projects and investigated local and sustainable building materials.

The main purpose has been to find out some alternatives to such imported construction materials, keeping in mind the key role that these goods may play in local economy.

Their proposal meant to introduce a "straw bale construction" in the Artibonite valley, on the Northern path of Port au Prince. The land is mainly used to harvest rice as main sustain of the local population in terms of food and economy. Rice straw needs to be cleared out: common practice has been to burn the fields to get rid of the unwanted waste. Instead of wasting such precious left over could be utilized in building anti-seismic, fire-resistant, sustainable and comfortable constructions.

Having said that, it should be considered a different aspect of the word "innovation": generally straw bale constructions are not innovative; in the other hand they are not used commonly or known in many contexts, such as Haiti. Essential can be not inventing, but analyzing, searching among existing materials, sharing, adapting, and developing. The introduction of a new, better utilized technology is a long term process composed by many phases: several aspects are essential depending on the timing; in this very phase social acceptance and capacity building are prominent. At the end of the process, if all the goals have been accomplished, the creation of enterprises, cooperatives, and a complete chain may have an improved key role: straw bale construction will be a brand new suggestion for Haitian rice farmers and for local productive chains.

The goal is to dwell people in quality building and consequently develop design and technologies suitable to local means. Our technical challenge is developing a straw bale construction in Haiti, simplifying the whole construction process only in few phases; to realize aesthetically perfect prototypes, in order to make this construction accepted by community. Finally, to demonstrate the economic feasibility and comfort advantages. In other words: the "new" material should be fully accepted by the local communities that usually aim at "cement block houses" as a status symbol; while the straw bale construction, in order to be more effective, shall be easier to build, aesthetically improved and increase the comfort that otherwise the cement block house wouldn't provide.

The technical challenge goes hand in hand with a social challenge that is sharing knowledge, expertise, ideas of architectural quality and the right of beauty.

Keywords: straw bale construction, rural development, community, capacity building, architectural quality

Information & Communication Technologies

[IC1]   **Early Warning and Hazard Assessment of Glacial Lake Outburst Floods, Yarkant River, P.R. China**

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Biography of presenting author: Christoph Haemmig is a geologist and currently works as a project manager at the engineering geology department of GEOTEST, Switzerland. GEOTEST is an internationally experienced consulting company. Christoph's primary work projects are linked to natural hazard assessments (i.e. rockfall, landslides, and glacial lakes), planning of mitigation measures and risk management.

Abstract

The catchment area of Yarkant River is located in the Karakoram Mountains in the southwest of Xinjiang Uygur Autonomous Region, P.R. China. In the last decades, several glacial lake outburst floods (GLOF) damaged infrastructure and claimed human lives along Yarkant River in the Tarim Basin. The spontaneous floods pose a threat to over 1 million inhabitants on the floodplains of Yarkant River and are causing an annual monetary loss of approx. 10 million Euros. There are 33 recorded flood disasters between 1949 and 1999. The floods are provoked by melt water, by rainstorms and – most violent and disastrous – by glacial lake outbursts, effectuating peak discharges of more than 6'000 m^3/s. The largest and most frequent glacial lake outbursts occur in the area of Keleqin River in the upper Shaksgam Valley of the Karakoram Mountains. Keleqin is one of several tributaries of Yarkant River. The GLOFs originate from a remote ice-dammed glacier lake at 4'750 m a.s.l., approx. 560 km upstream of the floodplains. There, Kyagar Glacier tongue entirely blocks the riverbed.

Based on a Memorandum of Understanding between the Ministry of Water Resources of P.R. China and the Swiss Federal Department of the Environment, Transport, Energy and Communications, it was decided to initiate a Sino-Swiss project with the goal to implement an early warning system, allowing authorities and population to take the

necessary measures in order to avoid victims, to raise the safety of settlements and livestock and to minimize damages to infrastructure and agricultural land. A further goal is to assess the long-term development of the flood hazard situation in the catchment area of Yarkant River by analyzing past and real-time information/data on the glacier lake situation. In addition, scenario based forecasts of the future glacial lake developments are elaborated, considering climate change.

A GLOF early warning system (EWS), combining satellite remote sensing and three automatic terrestrial observation and warning stations, was implemented between 2011 and 2013. The stations are equipped with modern High-Tech instruments: a robust all-in-one weather station with precipitation radar, an ultrasonic wind sensor and sensors for air temperature, pressure, and humidity that allow for maintenance-free climate measurements. All stations are equipped with webcams that take one picture a day during normal operation. All stations are powered by solar panel and equipped with batteries that allow for operation during times with little sunshine. The two gauging stations are complemented with two independent gauging radars that measure the distance to the water surface even during times with bad weather conditions like heavy rain or snowfall. All instruments are controlled by a datalogger and connected to the internet by a satellite link. The datalogger collects the measurements and transmits them periodically to a data server. In case thresholds have been exceeded, a message is sent to the data server. The server then alerts the local authorities by SMS and email. The data collection is intensified and webcam pictures are taken at shorter intervals. Sensor values and webcam images can be accessed through a password-protected website. Both datalogger and sensors can be accessed via the satellite-based network connection to modify their configuration.

Keywords: glacial lake outburst flood (GLOF), early warning system, risk management, climate change monitoring

[IC2]   **iMoMo - A Data Assimilation System for the Themi Catchment, Tanzania**

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Biography of presenting author: *Sebastian Stoll studied hydrology at the University Freiburg, Germany. Afterwards he did his PhD at the Institute of Environmental Engineering at ETH Zurich on the impact of climate change on groundwater resources for which he was awarded the Otto Jaag Water Protection Prize.*

Abstract
Modern information systems are important tools for decision-makers so as to a) manage resources in an integrated way, b) plan their allocation more effectively while taking into account sustainability perspectives and c) for assessing tradeoffs between alternative uses and users throughout the basin. With the goal of better decision-support, information systems (DSS) synthesize different types of spatial and time-based data, including in-situ ground data (called bottom-up data), e.g. from stations and crowd-sensing, and remotely sensed data (called top-down data), and let users manage these in a coherent way.

Such a DSS was set up for the Themi basin, a small catchment at the foot of Mt. Meru in northern Tanzania near the town Arusha. To simulate the hydrological fluxes in the Themi, the Budyko-Framework is used (Zhang et al., 2008). According to climate and catchments properties, precipitation is portioned into evapotranspiration and runoff. Thus, the water balance can be calculated on a daily basis and estimates of groundwater storage, soil moisture, actual evapotranspiration and discharge are obtained. To calibrate the model parameters, the Ensemble Kalman Filter (Evensen, 2003), a well-known data assimilation technique is applied. Data assimilation is an approach to incorporate observations in the hydrological modeling aiming at obtaining the most likely results. Every time new observations are available, these are combined with the model outputs to provide the best estimates of model states (for example filling of groundwater storage) and parameters. This is done by setting up a number of model realizations (e.g. 100) accounting for the uncertainty deriving from the parameters, input data, initial conditions and observations. When a new observation is available, the parameters and states are updated ensuring the most likely description of the natural system.

The data collection, data processing and hydrological modeling are set up as are real-time application. In a first step, it is checked if any new data is available in the database (ground data) or downloadable from the internet (remote sensing data). If yes, this data is preprocessed and prepared for the usage with the hydrological model. The hydrological model accesses the latest states and parameters from the last run, which are updated by running the model with the newly available data. In total 100 different model realizations are evaluated. These updated model states are then the starting point for generating a five-day forecast by driving each of the 100 realizations of the hydrological model with the latest available weather forecast ensembles.

Model results will be discussed and compared with traditional deterministic modeling approaches. The value of crowd-sensed information will be quantified and value propositions of the dissemination of model results to stakeholders listed.

Keywords: data assimilation, hydrological modelling, remote sensing

[IC3] **The "Boots & Trousers" Method: Qualitative Field Observations of Shallow Soil Moisture Patterns – An Extension to Dry Soils**

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Biography of presenting author: Michael Rinderer studied Geography at the University of Innsbruck/Austria and University of Aberdeen/Scotland/UK and specialized in natural hazard processes. After his graduation in 2002 he gained work experience in the private sector (flood hazard assessment) and also continued his research on hydrology and bedload transport modeling. Sind 2009 he is holding a PhD position at the Department of Geography / University of Zurich focusing on key-controls of groundwater dynamics, hydrological connectivity and runoff response.

Abstract

For rainfed agriculture in Sub-Saharan Africa the soil water storage is of key-importance as it can serve as water buffer during dry spells. Information on spatio-temporal patterns of shallow soil moisture is an important indicator of this soil water storage and can therefore serve as measure for decision making. Common techniques for measuring soil moisture are time consuming and/or rely on sometimes expensive instruments (Time Domain Reflectometry, TDR), which need power supply, maintenance and repair. Here we present a qualitative field method which was developed to offer a supplement to common quantitative measuring techniques as it allows a quick and inexpensive mapping of soil moisture conditions based on qualitative topsoil indicators. The scheme consists of seven wetness classes from "very wet", when water is visible at the soil surface to "very dry", when a person could sit at that spot for a longer time period without getting wet trousers. A test of the new method with 18 non-experienced people showed that more than 95% of all classifications were within +/- one wetness class and that the rater's agreement was particularly high for wet sites. The qualitative wetness classes corresponded to quantitative soil moisture measurements determined by TDR and gravimetric sampling. The qualitative wetness classification was originally developed for wet conditions but has large potential to be extended to dry soils by defining additional qualitative indicators. A pilot project with partners from Switzerland and the University of Arusha / Tanzania is currently initiated to optimize the qualitative scheme to the soil- and environmental conditions of the selected study area of the iMoMo project in the northwest part of the Pangani River basin in Eastern Africa.

Keywords: qualitative field method, soil moisture, spatial patterns, dry soils

[IC4] **Improving Small and Medium Enterprises (SME) Performance by Enhancing Appropriation**

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Biography of presenting author: Jennifer Brant, a principal of the strategic consulting firm Mercator XXI, provides policy analysis and strategic advice to companies, NGOs, and inter-governmental organizations on global market access and regulatory issues, notably in the areas of innovation, technology, intellectual property, and trade. Among her projects, she is the Director of Innovation Insights, a cross-sectoral initiative aimed at sharing business perspectives on innovation and technology diffusion with policy-makers and other stakeholders. Previously, Jennifer worked on WTO dispute settlement at Sidley Austin LLP in Geneva, and for Oxfam on bilateral and global trade negotiations. Jennifer has also worked for Gianni Origoni & Partners in Milan, and she has consulted for WIPO, the ILO, and the Open Society Institute.
Jennifer has an M.A. in International Development and Economics from Johns Hopkins SAIS, an M.A. in International Law from the Graduate Institute of International Studies in Geneva, and a B.A. in International Relations from UCLA.

Abstract

This paper relates to processes for developing and deploying innovative technologies, focusing on the activities of small and medium enterprises (SMEs) in high technology sectors.
Specifically, the paper considers ways to improve how SMEs capture the value of their ideas and of their investments in bringing them to market. It gives an overview of the various internal and external factors that may influence their approach to intellectual property (IP) management, presents the main types of strategies they adopt to this effect, and articulates a number of recommendations for policy-makers. The analysis focuses on the protection of inventions and physical processes, drawing on recent academic literature covering a range of emerging and developed countries, and on interviews with business leaders from innovative SMEs in high technology sectors.

The authors find that while innovative SMEs tend to possess expertise in a technical niche area, they generally lack the resources and non-core business expertise, in particular marketing and manufacturing capabilities, that are needed to bring an invention to market. Partnership with entities with complementary assets can help to fill resource gaps, enhancing SMEs' chances for success in the marketplace. At the same time, collaboration carries the risk of knowledge leakage. Given their relatively scarce resources, SMEs must find resource-effective ways to protect and manage their intellectual assets, especially in the context of collaborative work, to ensure they capture ("appropriate") the value of their innovation.

The authors determine that those SMEs that most successfully appropriate use a combination of registered rights, such as patents, and complementary approaches, such as lead time or secrecy. They conclude that, to support innovative SMEs in effectively appropriating, a cornerstone of commercial success, policy-makers should endeavor to: improve the quality of patents, so they can be used to signal to potential investors and partners; enhance knowledge among SME managers of effective IP management practices; increase SMEs' access to the patent system; and enact modern trade secret laws. They also recommend that policy-makers enact measures to stimulate the flow of know-how, for instance by fostering the creation of innovation networks.

Keywords: SME, intellectual property, innovation, technology, appropriation

[IC5]   Evaluating from a Distance: Measuring Impact of Market-based Interventions

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Biography of presenting author: Sara Tollefson is Director of Impact at D-Rev, a non-profit product development company that develops market-driven products to improve the health and incomes of people living on less than $4 per day. D-Rev utilizes cutting-edge research and technology to develop user-centric products and strategies that are scalable and allow for people to lift themselves out of poverty. Prior to D-Rev, Tollefson worked as a lawyer. She is a graduate of Stanford University and NYU School of Law.

Abstract

As more NGOs and development agencies look to market-based interventions to address development challenges, impact evaluation becomes more difficult. Access to end-users is increasingly mediated by third parties, and products are distributed more efficiently throughout larger geographic areas. US-based product design company D-Rev has utilized a variety of strategies to overcome these hurdles, with mixed results.

D-Rev currently employs two sales/distribution methods for the medical products it designs. In the first, D-Rev closely supervises the manufacturing process and contracts with a third-party logistics company to distribute prosthetic knees to pre-screened clinics. In the second, D-Rev has partnered with an Indian medical device company that both manufactures and sells D-Rev-designed neonatal phototherapy devices to hospitals (in India) and to distributors (outside India). In both instances, the products are distributed throughout the developing world.

While D-Rev has a more direct relationship with the customer (prosthetics clinic) in the first model, the end-user (amputee) experiences most of the impact of the intervention after he or she has left the clinic. For this distribution model, D-Rev is employing three techniques for measuring impact: (1) comprehensive longitudinal studies of a subset of amputees during product field trials; (2) submission of impact data as prerequisite for follow-on orders of the device; and (3) periodic telephone or in-person surveys of a representative sample of amputees.

Access to customers (hospitals) in the second model is more challenging, since D-Rev does not control sales or distribution. No long-term follow-up with individual patients is required, however. For this distribution model, D-Rev is utilizing three techniques for measuring impact: (1) estimation of intervention impact based on information from our partner, field research, and medical literature; (2) collection by phone/SMS of device usage data; and (3) in-person collection of device usage data.

Results:

- Control of sales (including pre-approval of customers) available in the first model gives D-Rev more leverage to demand impact data for follow-on orders. It also enables D-Rev to limit sales to customers who treat D-Rev's target population.
- In second model, close collaboration, aligned goals, and contract-dictated participation in data collection process helps facilitate data collection through manufacturing/distribution partner.
- Lack of contractual obligation or aligned goals makes securing cooperation of foreign distributors more difficult.
- Collection of device use data through phone/SMS is time-intensive, spotty, and annoying for customers (doctors) in second model as they are most accessible on their mobiles, but when reached on their mobiles, are not always near the device.

In conclusion, unlike in a donation model, in a market-based intervention model it is difficult to "attach strings" to an intervention (that is, the sale of a product) for the purposes of tracking impact. In the health context, non-mediated data collections systems such as tracking devices raises privacy concerns, but we should continue to explore creative solutions that balance these concerns with cost-effectiveness and scalable collection of meaningful, useful impact data.

Keywords: health, impact, mobile, market-based

[IC6]   Opportunistic Networking for Socio-Economic Empowerment in Developing Areas

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Biography of presenting author: Adriano Galati is a Postdoctoral Researcher at Disney Research Zurich. He received a PhD in Computer Science from the University of Nottingham in 2011, a Master's degree from the Polytechnic of Milan in 2004 and a Bachelor's degree from the University of Bologna in 2002. In 2004, he worked as Research Assistant at Cefriel, a research institute affiliated with the Polytechnic of Milan. In 2007, he completed a second Master's degree at the University of Utrecht. From January 2012 to March 2013, he worked as Research Fellow at the Faculty of Engineering of the University of Leeds.

Abstract

ICT and mobile technology in particular may play a significant role in the economic and social empowerment of rural communities in economically growing regions. However, rural areas often suffer from slow and unreliable network infrastructures. This limits access to content and services that may promote economic development. Focusing on under-served areas in economically growing regions, we aim to explore how ICT systems for collective intelligence and awareness can be used to foster economic and social empowerment of rural communities. In our model, micro-entrepreneurs equipped with low-complex small cinema-in-a-backpack systems (with mobile projectors, leased or purchased) travel between remote villages to deliver educational and entertainment content. A collective intelligence ICT system that runs on low-cost commodity mobile phones is used to provide content insights, predict local needs, and guide future business innovations.

Opportunistic (delay-tolerant) networks can be used for content distribution to capacitate and support entrepreneurs and enhance the sustainability of their enterprises. In such networks, mobile infostations mounted on public transportation vehicles are used to distribute content, without the need for any other dedicated network infrastructure or support of telecom operators. The delay tolerance of opportunistic networks makes them ideally suited to environments with under-developed ICT infrastructures.

We discuss the technical challenges behind distributing digital content with a low-cost delivery mechanism and opportunistic networks. We present our work in an on-going project that provides communities in rural South Africa with cinema experience. We present methodologies to measure and evaluate the impact of the cinema experience on local communities.

Keywords
delay-tolerant networks, opportunistic communication, multimedia content distribution, mobile business development

[IC7]   Communications Platforms as an Essential Technology

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Biography of presenting author: Jutta Engelhardt joined the International Platform on Sport and Development (sportanddev), an online communications platform operated by the Swiss Academy of Development and entirely dedicated to the field of sport for development, in April 2008. She has worked in the field of development and social change for over fifteen years in Switzerland, the Netherlands, and Belgium. She is a firm believer in the potential for ICT and other technologies to make significant contributions towards development information exchange, policy making, research and capacity building for project implementation.

Abstract

Information and Communication Technology (ICT) has been a crucial means to achieving sustainable integrated development. The growth of the sector over the last two decades has led to unprecedented opportunities. The knowledge sharing enabled by communications platforms, in particular, offers a crucial means to work towards global development goals. Increasingly, evidence suggests that learning gained from communications platforms is being used

successfully to achieve meaningful results, from an NGO implementing new monitoring and evaluation methods to a young person sharing knowledge on HIV prevention; the most effective platforms are those guided by a participatory approach, facilitating both "north-south" and "south-south" collaboration and encouraging vulnerable and poor communities to take the lead in solution-focused thinking and tackling of developmental challenges. This presentation will highlight the importance of ICT and online platforms in reaching development goals, advocate for the wider participation of communities in generating solutions and feature several case studies of www.sportanddev.org doing this successfully.

The most effective online communication platforms in the development sector create connections between stakeholders on a variety of levels. sportanddev.org is an example of a platform that does this effectively. Working in sport and development, its content is community driven with a web-based system encouraging users to share views and exchange practical information. The involvement of academics and pages dedicated to research as well as the ambitions of the Operating Team to summarise feed with evidence and interlink information, enables learning within the sector. The platform hosts a lively community that advances and contributes to the evidence base for using sport in reaching development goals. Communities can benefit from exchanges of experiences with each other, learn from knowledge shared by universities, and contribute to the research process itself as information published on the platform is commonly consumed by academics. sportanddev has 10 years' experience in developing a "place of identity for a community". This has been about maintaining a neutral stance of facilitating learning rather than getting involved, listening to everyone rather than only just the larger or more experienced actors and being impartial and still concerned about pushing the right information as best practice. The presentation will share the networking skills that have been required to set up and maintain such a space of identity and communication for a community.

ICT offers a widely available pathway to facilitate local knowledge building and creation of partnerships so essential to development. The web-based, technology-driven nature of ICT is a key aspect, making information and resources contained within them readily accessible via the internet. Partnerships between actors sharing information online allows for transparent learning and sharing of best practices. Intelligence on improving capacity, implementing programmes and maximising the potential of scarce resources can be shared via technology-based platforms. When managed correctly, they act as a social leveller, enabling the participation of voices that would otherwise not be heard. Further, their ability to facilitate communication between communities separated by geographical distance but connected by similar challenges creates a vital opportunity that makes the learning a global experience.

One of the fundamental aspects of using online communications for sustainable development is the nature of development itself - a sector that when implemented most effectively requires collaboration between actors operating at all levels. A common criticism of international development is that the communities affected are not involved – let alone leading – the process to a large enough degree. Communications platforms provide an important part of the solution to make voices heard and local capacities grow to seek solutions to human development.

Keywords: platform, communications, learning, networking, communities

[IC8]   Internet Use by Radiology Teachers and Students of King Abdulaziz University: An Analysis

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Biography of presenting author: *Dr.Awad Mohamed Elkhadir is an Assistant Professor in the Department of Diagnostic Radiology at King Abdulaziz University, Saudi Arabia. He holds a PhD from L.U.de.S. University of Human Sciences and Technology of Lugano, Switzerland. His doctoral research was on Ultrasonic Differential Diagnosis of Thyroid Pathologies.*

Abstract
An analysis of the study documented 100 respondents, (10%) were teachers and (90%) were students. Of the respondents (59%) were male and (41%) were female. (27%) were aged 15-20, (61%) were 21-25, (1%) were 26-30, (1%) were 31-35, (5%) were 36-40, (3%) were 41-45, and (2%) were 46 years or over. It was found that (79%) of them had been using the Internet for more than 4 years. Another (9%) of respondents had used it for 2-4 years; (4%) respondents had used it for 6 months – 1 year, and (4%) respondents had been using it for six months or less. It is evident that the majority of respondents have been using Internet for more than 5 years.

85% of them reported that they used it every day. (12%) indicated that they used the Internet (2-3) times in a week. Again, this indicates that most of them use it every day. The maximum number of respondents i.e. (32%) use the Internet for more than 20 hours a week. (30%) use the Internet for 10-20 hours a week, (14%) for 2-4 hours a week, (12%) for 5-6 hours a week and (10%) for 7-9 hours a week. Only (2%) respondents have indicated that they use Internet for less than one hour a week. (71.1 %) indicated that they accessed the Internet from home, while only (21.5%) accessed the Internet from their college or work place. (7.4%) also used other places such as internet cafes, friends or colleague's homes etc., for accessing the Internet. It indicates that most of the respondents use the Internet from their home.

Study showed that only (34%) of respondents feel fully satisfied with the Internet facilities, (44%) partially satisfied, (8%) least satisfied and (14 %) have not expressed any opinion regarding the service. A majority of the respondents i.e. (50%) feel that the Internet can replace library services, if they find free downloadable books, because they find that it is easier to locate the desired information on the Internet than in the library. (40%) respondents feel that the Internet cannot replace library services. Only (5%) had no comments. It was found that the most popular method of acquiring the necessary skills to use Internet is self-instruction (57.8%).

One of the significant research questions was to explore the purpose for which they are using the Internet. (25.5%), (24.7%) and (24.3%) responded with research, education and communication respectively. This indicates that majority of respondents mainly uses the Internet for educational purposes. The biggest problem encountered while using the Internet was slow access speeds and difficulty in finding relevant information (31.25%) and (22.22%) respectively. The Internet is more effective, more useful and more informative as it provides desired information in short space of time. There seemed to be some influence of the Internet on the academic efficiency of the respondents.

Keywords: internet use, independent learning, information seeking, radiology education

Medical Technologies

[ME1]   **PIERS (Pre-eclampsia Integrated Estimate of RiSk) on the move – development and evaluation of a mobile clinical decision aid for use in women with a hypertensive disorder of pregnancy**

Beth Payne[1], Dustin Dunsmuir[2], Garth Cloete[3], Guy Dumont[4], David Hall[5], Joanne Lim[2], Rozina Sikandar[6] Rahat Qureshi[6], Erika van Papendorp[5], Mark Ansermino[2], and Peter von Dadelszen[1]

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Biography of presenting author: *Beth Payne is a PhD candidate from the University of British Columbia whose focus is development, validation and implementation of prognostic models for maternal, neonatal and child health. While completing her PhD she is also working as a project manager at UBC coordinating a multi-country cluster randomized control trial of community level interventions for pre-eclampsia (CLIP).*

Abstract

Pre-eclampsia is one of the leading causes of maternal death and morbidity in low-resourced countries due to delays in case identification and a shortage of health workers trained to manage the disorder. The objective of the PIERS on the move (POM) project was to provide mid-level health workers with an evidence-based and low-cost tool to improve diagnosis and management of pre-eclampsia, to improve outcomes.

POM was developed by combining two previously successful innovations into a mobile health (mHealth) application: the miniPIERS risk assessment model and the Phone Oximeter. miniPIERS is a clinical prediction model that uses symptoms and signs to determine the risk of adverse pregnancy outcomes in hypertensive women. The Phone Oximeter is a cellphone based pulse oximeter (a non-invasive device to measure blood oxygen saturation). These innovations were combined to create a clinical decision aid that can provide an evidence-based recommendation for interventions for women with pre-eclampsia. Development of the user interface for the POM application involved three phases of usability testing with target end-users in South Africa. Users were asked to complete clinical scenarios, speaking aloud to give feedback on the interface and then complete a questionnaire to rate all aspects of the tool. A final stage in development included piloting the tool in Tygerberg Hospital, Cape Town, South Africa to confirm accuracy of the decision algorithm. During this clinical evaluation, recommendations generated using the POM application were not used to change practice or guide care.

After ethical approval and informed consent, 37 nurses and midwives (15: Tygerberg Hospital; 22: Frère Maternity) evaluated the user interface between November 2011 – January 2013. During the first round of usability testing, major issues in the functionality of the touch-screen keyboard and date scroll wheels were identified; during the second, major improvements in navigation of the application were suggested; and finally during the third round, the feedback was satisfactory and only minor improvements to navigation were required. Overall, users felt the application was pleasant and would improve their ability to care for hypertensive women.

Pilot clinical evaluation at Tygerberg Hospital occurred from September 2012 - October 2013. During this time, 165 inpatient women with a hypertensive disorder of pregnancy were evaluated. Of these, 3 had an adverse maternal pregnancy outcome, 2 of whom were correctly classified as high-risk by the POM tool. Due to the low numbers of

adverse events in this study, this data was combined with miniPIERS data to create a cohort of 726 women, 118 with an adverse maternal outcome. Classification accuracy of the decision aid in this cohort was 86%.

By including target end-users in the design and pilot evaluation of the POM tool, we have developed an application that can be easily integrated into health care settings in low- and middle- income countries and will be useable by mid-level health workers. The POM application can accurately identify women at high-risk of adverse maternal outcomes before the event occurs. Larger scale impact evaluation of this tool is planned.

Keywords: Pre-eclampsia, decision aid, pulse oximetry, mHealth

[ME2]   The 4P Study: Prediction of Physiological Patterns in Pregnancy using mHealth Technologies

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Biography of presenting author: *Lise Loerup is currently undertaking a DPhil with the Centre of Doctoral Training in Healthcare Innovation, University of Oxford, UK. Her research focuses on two main aspects: the development of mHealth applications for management of conditions in pregnancy and on developing new systems for early prediction of physiological detoriation and pregnancy complications. Lise has a strong passion for healthcare technologies for maternal and neonatal care and has worked on a number of projects both in industry and academia.*

Abstract

There is great scope for improved monitoring and prediction of complications in pregnancy. Serious complications, such as pre-eclampsia and sepsis, may have severe outcomes if appropriate treatment is not initiated in a timely fashion. An essential pre-requisite for the early detection of physiological deterioration is knowledge of "normal" physiological patterns of pregnancy.

We have developed an mHealth application for the collection and remote monitoring of vital sign data longitudinally in pregnancy and in the immediate post-partum period.

The system has been developed together with healthcare professionals in the Oxford University Hospitals NHS Trust and implemented in two phases; firstly as a data collection application to be used by midwives in the antenatal clinic; secondly to collect and monitor data from women measuring their vital signs at home.

Heart rate, oxygen saturation, temperature and blood pressure are recorded using a pulse oximeter, a tympanic thermometer and a blood pressure monitor. Devices are interfaced to a tablet or smartphone running a custom-designed Android application that includes instructions (pictures and videos) to guide the user through data collection. To minimize the risk of user input error, devices with Bluetooth transmission are used where possible. Electronic measurements of respiratory rate are obtained from detection of chest-wall movement using the in-built smartphone accelerometer with subsequent application of signal processing techniques to extract the dominant frequency. This method of respiratory rate estimation is validated against the gold standard of a midwife observing and counting chest-wall movements.

Records are transferred in real-time from the tablet via 3G to an NHS server. Midwives access home-monitoring data through a website and provide advice and feedback to women via phone or text messages. This allows prompt identification of issues that women experience during data collection at home and intervention if abnormal readings are submitted.

To date, 1,245 datasets have been collected from 277 women in the clinic. 1,402 datasets have been submitted from 124 women who measured vital signs at home. The system was reported to be easy to use by healthcare professionals and women at home. The efficiency and accuracy of the data collection and remote monitoring have been improved through regular feedback from the women and midwives.

In the estimation of respiratory rates from accelerometer signals, feature-based methods using peak-detection have been found to give the most accurate estimates of breathing rate, with a mean absolute error of 2.2 breaths per minute with respect to the midwife's counting of chest-wall movements.

The mHealth system has enabled the collection and remote monitoring of a large number of physiological measurements from women in the antenatal clinic and at home post-partum which will allow creation of gestation-specific normograms. A smartphone accelerometer may provide a viable solution to obtain electronic measurements of respiratory rate.

The next steps include adapting the system for use in low-resource settings. This will involve reducing the cost and numbers of peripheral sensors and devices, for example by using a low-cost pulse oximeter or by using the phone camera for collection of heart rate, temperature and oxygen saturation.

Keywords
mHealth, pregnancy, physiological monitoring, antenatal, postnatal

[ME3]   Harnessing Mobile Technology for the Diagnosis of Perinatal Asphyxia

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Biography of presenting author: Charles is a 24-year old Software Engineer and Social Entrepreneur. He holds a Bachelor's degree in Electronics and Computer Engineering from the Federal University of Technology, Owerri (FUTO), Nigeria and has taken courses in Entrepreneurial Development at the Pan-African University, Lagos, Nigeria. He is an active member of the Computational Intelligence Society of the Institute of Electrical/Electronic Engineers (IEEE) and for the last 2 years, has been actively involved in research focused on technology for improved health.

Abstract

Globally, the mortality rate in under-five children dropped significantly from 12.4 million in 1990 to 6.6 million in 2012 – indicating a significant progress in achieving the 4th Millennium Development Goal. However, of recent concern, is the rising proportion of infant deaths within the neonatal (first month after birth) period, which currently accounts for a whopping 4 million annually. Perinatal Asphyxia – a respiratory-related condition in newborns – is currently a leading cause of neonatal morbidity and mortality. Every year, about 1.2 million infants die from perinatal asphyxia and about an equal number suffer severe life-long conditions such as cerebral palsy, deafness, and different degrees of damage to the Central Nervous System (CNS). This high casualty, occurring mainly in the poorest regions of the world, is largely due to the inadequacy of qualified medical personnel and equipment, which creates little room for early detection, and delays consequent application of care to affected newborns.

This work thus explores the roles which technology can play in developing a solution that would enable the timely recognition of Perinatal Asphyxia in a newborn and especially, be easy to scale in the developing world – in terms of cost and skill required for implementation. The approach of machine learning was adopted in seeking solution, principally based on previous work which reveals that asphyxia causes significant alteration in the acoustic pattern of infant cry; and that such pattern can be modeled and used as a basis for classifying 'new' infants as having asphyxia or not.

To develop this system, a dataset containing cries of normal and asphyxiating infants was obtained for the experiments. Each cry sample went through several processing stages during which feature vectors were extracted and then used as input to the learning algorithm. After experiments on three (3) major machine learning algorithms, the best classification accuracy of up to 85% was obtained using a Support Vector Machine (SVM).

The performance of this system, though not yet at a practically acceptable level, is indicative of the potentials of a viable solution through more research and access to a larger, diverse dataset. The target solution is a Mobile Application which will utilize the speech processing capabilities of today's mobile devices; it will have the ability to diagnose an infant born with Perinatal Asphyxia by simply recording the newborn's cry and letting the encoded algorithm classify. This will make possible a reliable, quick, inexpensive, and less-skill-intensive diagnosis of Perinatal Asphyxia; and also significantly contribute to achieving MDG 4.

Keywords: perinatal asphyxia, machine learning, infant cry, MDG, mobile application

[ME4]   Mobile-based Detection of P. falciparum Malaria Parasites in Thick Blood Smears

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Biography of presenting author: M.Sc Luís Rosado received a Master's degree in Biomedical Engineering from Instituto Superior Técnico of the Technical University of Lisbon in 2009. After 2009 he undertook an internship in the company Reverse Engineering, focused on the research and implementation of image and video processing solutions. He is a researcher at Associação Fraunhofer Portugal AICOS since 2011, focusing its research in the development of techniques for automatic detection and classification of skin lesions, and recently in the detection of Malaria parasites using computer vision techniques.

Abstract

Malaria is one of the most severe public health problems worldwide. It is a leading cause of death and disease in many developing countries, where young children and pregnant women are the groups most affected. It's estimated that 3.3 billion people (half the world's population) live in areas at risk of malaria transmission, and in 2010 caused around 655,000 deaths, 91% of them in the African Region. Thus, there is an urgent need of new tools that can facilitate the rapid and easy diagnosis of malaria, especially in areas with limited access to quality healthcare services.

This work aims to create a mobile-based solution that can provide an effective pre-diagnosis of malaria to be used in medically underserved areas. It is intend to use the new generation of cellular phones in the system architecture, which exhibit significant improvements in terms of image acquisition and image processing and that are becoming widespread worldwide, even in developing countries, and to create a magnification gadget that can be connected to the smartphone and provide the necessary magnification capability.

For the optical magnification, the project aims to develop a cheap alternative to the current microscopes, that can easily be adapted to a smartphone and to be used in the field. The aim is to use the smartphone built-in camera to capture the images for further analysis. The process will be to place the smartphone in the adapter along with the blood smear and have the smartphone image sensor to record a set of magnified images. This collection of images will then be processed, analysed and provide the patient diagnose. It is expected that the step for recording the several images to use a fixed magnification factor, discarding the need for a complex mechanical mechanism (currently available in a typical microscope). It will be a bonus to obtain a self-powered motorized automated stage system that can move the blood smear and allow the capture of several snapshots of the sample to obtain more reliable results.

The initial image processing tasks are already being developed, and promising results are being achieved in the identification of the parasitemia levels. The initial results are being conducted in cooperation with the Instituto Nacional de Saúde Dr. Ricardo Jorge, Infectious diseases Department, under the supervision of Dr. José Manuel Costa, in Portugal. A prototype smartphone application and a smartphone magnification box aimed for low cost production is underway. It is expected that this provides a cheap and alternative solution to the Malaria Rapid Diagnosis Tests (RTDs) allowing to be conducted at early stages of the disease.

In conclusion, the proposed mobile-based system could work as a first triage framework for isolated laboratories, where a technician with no special skills in terms of malaria diagnosis collects blood from a patient, prepares the blood smear and uses the system to analyze the blood sample and shares results in order to provide the correct medication.

Keywords: Malaria, Diagnosis, Blood, Smartphones,

[ME5] **Open Source Malaria (OSM): The First Open Source Drug Discovery Project**

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Abstract
Study Rationale: Open source drug discovery operates on the principles that all data and ideas in a project should be freely shared, anyone may participate in the project at any level and there will be no patents. By working in this manner, research is accelerated through the recruitment of expertise from a variety of participants.
Methods: Synthetic chemistry and biological evaluations are recorded using online electronic laboratory notebooks. Project coordination is effected through the use of online project management tools, and participants are encouraged to join the project through social media.
Results: The open source malaria project involves a hit-to-lead campaign in antimalarial drug discovery, using the GlaxoSmithKline (GSK) Tres Cantos open dataset as a starting point. The project was initiated with the synthesis of some known active compounds from the original GSK set. Once the activities were confirmed, the team began synthesis and evaluation of four series of compounds; aryl pyrroles, 'near-neighbours', aminothienopyrimidines and triazolopyrazines.
Conclusions: The open nature of the project means that anyone can take part and this has led to wide ranging contributions from a truly international team. Chemists, biologists, informaticians and many other interested people have all influenced the project in ways that have directly altered its direction. Thus the iterative cycle of analog synthesis in response to biological data that is normally guided by luck and medchem intuition is now guided by the intuition of the collective.

[ME6] **Stories from the Communities: Tracing User Behavior from Voices and Actions on Use of a Tablet Based Electronic Health Record and Data Visualization System for Public Health Service Delivery**

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Biography of presenting author: *Maria Regina E. Estuar is an Associate Professor at the Ateneo de Manila University where she has been teaching for over 20 years. She currently holds the position of Executive Director of the Ateneo*

Java Wireless Competency Center, already running on its 10th year, an R&D laboratory which designs and develops mobile and web solutions for health, education and disaster. She also heads the Social Computing laboratory where big data is modeled and analyzed to better understand social network behavior.

Abstract

The Philippines is an archipelago with over 7,100 islands making health inaccessible to geographically challenged areas. Information communications technology has been seen as one of the possible bridges to this widening gap. As of March 2012, the Philippine Department of Health has listed over 26 health service delivery systems, each designed to address specific needs in public health. Out of these 26 systems, the community doctor and health workers are required to use a minimum of 5 systems in a week to encode patient related information which serves to provide national statistics on public health. However, there is still an obvious delay in data submission as most health statistics provided in the public website are still outdated. The proposed solution was to design a tablet based electronic patient record system that will allow for the easy recording and real time visual reporting of health data. A bottom up and rapid prototyping approach were used in designing the system to incorporate natural workflow and preferences of health workers. Because public health systems do not exist in a vacuum, a devolved approach was used to ensure that all stakeholders are well informed of the different phases of change in the system. After deployment, each community was given user guides on how and when to use eHealth TABLET. Users were also sent reminders on use of the system. This paper discusses the experiences and behavior of users as eHealth TABLET (technology assisted boards for local government unit efficiency and transparency) was pilot tested and deployed to 8 municipalities, representing provinces from the three major islands of the country. Initial themes on experience include on one hand, problems related to network infrastructure, standardization of data, data entry and data retrieval, authentication and security. On the other hand, logs on user activity show steady increase in number of patients recorded and preferences in use of data visualization options. The results of the study provide a framework on how to ensure high adoption and acceptance of essential technologies in the public health setting in a developing country.

Keywords: electronic health records, data visualization, user experiences

[ME7]   Putting the IT in QuIT Smoking

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Biography of presenting author: *Noah Klugman is a research associate at the University of Michigan, where he received a Bachelor of Science in Computer Engineering in 2013. He is fascinated by the potential for technology to alleviate suffering around the world. He researches impactful wireless sensor networks and embedded systems under the guidance of Dr. Prabal Dutta.*

Abstract

Cigarette smoking is responsible for millions of deaths, despite valiant individual efforts to quit. In response to these failures, new programs have been proposed that would offer incentives for smokers to quit. The adoption of effective smoking cessation programs is critically important in developing countries where smoking rates continue to rise. Unfortunately, these programs suffer from dependence on unreliable, self-reported data to determine a participant's compliance [Abroms11]. We claim that information technology can offer a better compliance mechanism. Because cigarette smoke contains carbon monoxide (CO), the absence of CO from a program participant's breath offers reliable evidence of compliance with an intervention program. We propose a CO monitor that pairs wirelessly with a smartphone to measure the CO concentration in an individual's breath. An app running on the participant's smartphone stores the sensor data locally, displays CO concentration to the user, and delivers the data to the cloud for analysis and compliance verification. Our prototype offers comparable accuracy to existing monitors while greatly improving usability and user satisfaction.
We intend to form a North-South research collaboration to develop a smoking cessation program using our prototype. The high adoption rate of smartphones in developing countries, the ability to interface with a participant's existing smartphone, and the small form of our prototype make the development of this program attractive in countries where other programs either do not exist or have failed.

Keywords: Mobile Phones, Smoking Cessation, Public Health, Carbon Monoxide

[ME8] GlobalNeonat: An Appropriate Infant Incubator and Phototherapy Unit for Resource-Poor Settings

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Biography of presenting author: Mr. Gani is a scientific collaborator at EPFL's cooperation and Development Center (CODEV). After completing an M.Sc. in Electrical Engineering, he worked on cochlear implants at the Geneva University Hospital, developing research interfaces and conducting tests with patients. He was then employed as a social worker and assistant manager at the Soup Kitchen in Lausanne, Switzerland, providing free meals and guidance to people in need. He joined CODEV's EssentialTech team in 2013 to manage the GlobalNeonat project.

Abstract

The aim of the GlobalNeonat project is to develop a preterm and low-birth-weight infant incubator system combining a non-electrical heating system and ultra-low power consumption, together with a phototherapy unit. It must additionally be affordable, effective and durable in the context of district hospitals in low and middle income countries.

The reduction of child mortality is listed as a priority target under The Millennium Development Goals. The number of under-five deaths worldwide has declined from more than 12 million in 1990 to 7.6 million in 2010 with the highest rates of child mortality still in Sub-Saharan Africa. Unfortunately, the decline is not seen across all age groups: Neonatal mortality (i.e. below 4 weeks of ages) thus currently represents an increasingly large share of overall child mortality, well over 40%. Sub-Saharan Africa is the region of the world that has the highest risk of death in the first month of life and that has shown the least progress.

Among the causes of neonatal mortality, hypothermia (low body temperature) is one of the most important in developing countries, even though up to 40% of deaths associated with hypothermia could be prevented by simple and appropriate thermal management. Skin-to-skin contact ("kangaroo mother care") that is advocated as the first line intervention to prevent hypothermia is not always possible, especially when phototherapy is also required for the treatment of jaundice. Jaundice affects one of four neonates and more severely premature and growth retarded infants. If left untreated, it is one of the main causes of cerebral palsy in developing countries (Kernicterus).

Existing incubator and infant warmer technology developed for Western countries is costly and not adapted for the use in the context of developing countries, in addition to generating high running costs. Instability of local electrical supply causes failures in the sensitive electronic control systems leading to heat loss and significant additional safety and hygiene issues whilst the ventilation mechanism is off. This project aims to develop an entirely new technical concept for providing thermal therapy combined with phototherapy, which will be affordable and adapted to the environmental constraints of developing countries.

The research phase of the project has been ongoing for a year, and this poster shows the first results in the fields of power consumption reduction, heat transfer simulations, and the use of novel materials.

Keywords: infant incubator, phototherapy, appropriate, resource-poor

[ME9] GlobalDiagnostiX: Appropriate Diagnostic Imaging for Resource-Poor Settings

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Abstract

Basic diagnostic imaging, mainly radiography and ultrasound, are crucial for taking adequate diagnostic decisions for a wide variety of conditions such as pregnancy, road traffic accidents, tuberculosis, complications of infant pneumonia and cardiovascular problems. Yet over two thirds of the world's population does not have access to these vital medical

instruments. Regarding radiography, solutions based on film technology have proven being not adapted to district hospitals in developing countries and modern digital imaging solutions are too expensive, complex and fragile.

The goal of GlobalDiagnostiX project is to develop an appropriate diagnostic imaging system, by a coalition of leading technology research laboratories, public and private partners, as well as local actors in developing countries. The project is aiming in building a comprehensive value chain at each stage of its deployment, from research to industrialization and distribution, as well as maintenance of the product and education of local users.

The main technical challenges are the development of a digital radiography machine that:

1. takes excellent images for the typical applications
2. targets a tenfold reduction in the total cost of ownership (including lifecycle costs) as compared to existing solutions
3. offers a ten-year lifespan with minimal maintenance
4. is adapted to the context of developing countries: climate, dust, infrastructures, culture, language and level of training, etc.
5. is compliant with applicable international standards and regulations.

The system will include a solution to transfer the images to remote doctors (teleradiology) in order to compensate for the insufficient number of radiologists and specialists in developing countries.

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