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Intervention or collaboration?

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IMPACT OF THIS RESEARCH

What is the impact of this research for science and society? At the end of this research journey, this confronting question is still open. Did my research matter? Did it contribute to achieving goals of people in low-resource environments? Did it lead to uptake of innovation by businesses? Did it provide new insights to inform policy? Did it contribute positively to the Development Debate? And did I inspire others to bring this research further? I will try to answer these questions, starting with a personal reflection.

A.1 DIGITAL INEQUALITIES

Early 2020, Hans Akkermans and I submitted a proposal for a workshop, titled Digital (In)Equalities, Digital Inclusion, Digital Humanism (DigDivDigHum), to a call from the 12th ACM Conference on Web Science. This event, which would take place in Southampton, UK, was transformed, due to the worldwide Corona crisis in March 2020, into an online conference. This was unfortunate, but had also advantages, as, due to reduced participation costs, it opened opportunities for researchers from the Global South to present their papers. We launched a call for workshop papers and invited researchers from our wide international network. It led to an interesting workshop with rich discussions and a variety of perspectives from four different continents. It also resulted in fourteen papers published in the WebSci'20 12th ACM Conference on Web Science Companion 2020 [378]. We consider this a success, as, to present date, research from and about the Global South is underrepresented in prestigious academic conferences. What motivated me in organizing this workshop, was not only addressing this important issue of digital inequality, and putting it on the academic agenda, but also having the opportunity to give the floor to researchers whose voices are not often heard. My inclination to this theme may be a consequence of my origin, born in the northeast of Brazil, where inequality is still a harsh reality.

A.2 GIVING A VOICE TO THE UNCONNECTED

The design challenge of my research is to build solutions according to *what the unconnected want*. To make this happen, developers have to talk with users, listen to their personal stories and respect their personal goals. Co-creation gives a voice to people whose voices are absent in most project plans and strategic papers.

This also holds for indigenous knowledge. Regreening, the indigenous knowledge that became the context of my research in West Africa, was initiated by farmers-

innovators like Yacouba Sawadogo, Ousseini Zoromé and Ousseini Kindo. Regreening is an important local innovation that can feed many people, but indigenous knowledge and local agency are commonly overlooked in international development and scientific research, and set away as unscientific or are simply ignored. Listening to the voices of poor farmer communities in Africa, puts sustainable solutions in a very different perspective.

Sometimes, voices are picked up. The efforts of researcher Chris Reij brought farmer-managed regreening under the attention of the World Resources Institute in Washington, US, one of the world's influential institutes on environmental policy and research. Our W4RA research was mentioned in one of its publications, titled *Scaling up Regreening, Six Steps to Success*[1]. This has further inspired several international NGOs, including Oxfam Novib, Care and Both Ends, who work in the Sahel[2], to include our ICT4D approach in their projects for international development.

Our research has also led to various development projects on Food Security in Mali, Burkina Faso and Ghana in the period 2014 - 2020, financed by the Dutch development agency Nuffic. Our work with the Malian farmer organization AOPP has also drawn attention of policymakers. In October 2016, I invited representatives from the Dutch, Swedish and Norwegian embassies and staff members from the European Commission for a workshop that I organized together with the AOPP in Bamako, Mali. For the embassy representatives – more familiar with conferences in fancy venues – this meeting, situated at the modest headquarters of AOPP, must have given them the local flavor of low-resource environments in rural Africa. This event has given the floor to the farmers of AOPP, who not often talk to these policy makers from the Global North.

A.2.1 *This research, regreening, rural radio and the voice of citizens*

To support the goals of people in low-resources environments with innovative voice-based information systems, was the objective of the VOICES research project in West Africa, in the period 2011-2013.[3] The field pilot in Mali, which we executed with the local organization Sahel Eco and four local radios, was situated in 19 small villages in the neighborhood of Tominian, Mali. For farmers who were previously unable to sell their products, a communication channel for commercialization was realized through the RadioMarché system, reaching 800.000 listeners.

Zakary Diarra was one of the honey producers (honey is a forest product of regreening) who was heavily involved in our project. Zakary Diarra always visits us in Bamako, when we give our W4RA/ICT4D 3.0 use case and analysis workshops. He told me in an interview how much he had personally benefited from the increased sales through the RadioMarché project. Even after the project was finished, Zakary Diarra continued

1 This is a policy & practice paper published by the WRI [339], page 47.
2 See e.g. https://w4ra.org/2020/04/13/how-to-enhance-the-seed-value-chain-in-rural-mali/
3 See the EU-FP7 VOICES research project website: https://mvoices.eu, (accessed 08-10-2020)

to have a good business – better than before – because he had established contacts with new clients through this system.

In 2012 we started the Foroba Blon project to design a system that gives a voice to citizen journalists in rural Africa, through "interactive radio". This project won the News Innovation Contest (worth 250,000 US$) from the International Press Institute.[4] This radio system for *Citizen Journalism in Africa* was the work of our W4RA team, in collaboration with the French company SBC4D, the Malian NGO Sahel Eco, and the radio stations in Mali: Radio Sikidolo, Radio Moutian[5], Radio ORTM Ségou, Radio Bankass. Foroba Blon was considered a great success. Later, SBC4D delivered a version of Foroba Blon to the media concern Al Jazeera in 2013 to monitor the presidential elections in Ghana and Kenya by citizen journalists in the field. Meanwhile, at VU my colleagues continued to work in parallel on the further development of Foroba Blon on small hardware[6] at the request of one of the radio stations in Mali. For this project W4RA colleague André Baart won the High Potential Award in 2018 in the Amsterdam Innovation Contest for his master thesis work.[7]

A.2.2 *Our research in the news*

Our research was often mentioned in the news for its innovative character in combination with a societal mission. On behalf of the W4RA team, I gave various interviews, lectures and presentations. In April 2013, I was interviewed by Hal Hodson about our research, which resulted in an article in the New Scientist[8], titled: "Voice-based web access helps illiterate get online".

In January 2014, our key-user from Mali, Amadou Tangara and I were interviewed about the RadioMarché project. The whole interview was broadcast by SciDevNet Radio.[9] I was interviewed various times about our research, on the radio in Africa: in 2011 by Radio La Voix du Paysan, in Ouahigouya, Burkina Faso and again in 2017, for the same radio, this time together with two farmers-innovators, Yacouba Sawadogo and Ousseini Zoromé, who were with us in a W4RA workshop.[10]

In November 2013, together with our partner Mathieu Ouedraogo from Burkina Faso, and our business partner, the telecom provider Orange, Hans Akkermans and I presented the W4RA research at the European Development Days in Brussels, Belgium,

4 The winning project Foroba Blon: https://tinyurl.com/IPI-prize2012, (accessed 08-10-2020)
5 Documentary of our research in Mali https://w4ra.org/films/the-web-of-voices-documentary/, (accessed 08-10-2020)
6 This is the Kasadaka small hardware project, initiated by Christophe Guéret and Victor de Boer.
7 See the pitch by André Baart: https://tinyurl.com/kasadaka-highpotential-award, (accessed 08-10-2020)
8 Interview in the New Scientist https://tinyurl.com/newscientist-w4ra
9 Radio interview for SciDevNet: https://tinyurl.com/scidev-w4ra, (accessed 08-10-2020)
10 We gave this historical radio interview together with two iconic farmer innovators https://tinyurl.com/lavoixdupaysan, (accessed 08-10-2020)

in front of a large audience of international development policymakers from the EU and representatives of governments from various African countries.[11]

In March 2016, I was invited to give a keynote speech titled "Connecting the Unconnected", to which I was introduced by the Dutch politician Sylvana Simons at the VU lustrum symposium[12] "Guide to the Network Society". In 2018, I was interviewed again, together with my colleagues Francis Dittoh and André Baart, by the BBC, about our W4RA research in Ghana and Burkina Faso.[13]

In 2019, I was interviewed about our project for citizen journalism in Africa, Foroba Blon, by journalist Anna Pujol Mazzini, for the Los Angeles Times. A small section was written about this project in a larger article in the Los Angeles Times about mobile services in Mali.[14] In May 2020, the online journal Ad Valvas interviewed me and published an article about our ICT4D research to the benefit of seed value chains and food security in Mali.[15]

All these activities have led, not only to dissemination of our work, but also to the general idea that collaborative research, where academics and non-academics work in a trans-disciplinary setting, is key to addressing societal challenges. The importance of giving the floor to people whose voices are not often heard, is the central message.

A.3 IMPACT OF THIS RESEARCH ON EDUCATION

This research has directly contributed to education at VU. Due to our W4RA research in West Africa, ICT4D has become the subject of two courses in the master tracks Computer Science, Information Science and Artificial Intelligence. In the two ICT4D courses, students design and build information systems for people in low-resource environments, for which they use the framework "ICT4D 3.0".

A.3.1 *ICT4D as a master course at VU*

The first ICT4D course, which we[16] started in April 2013 as an educational pilot with only twelve students, is now (in 2020) one of the elective courses[17] given at the Com-

11 See: https://w4ra.org/web-of-voices-at-european-development-days-brussels-26-november-2013/anna_edd/

12 See the keynote on video https://www.youtube.com/watch?v=WQEK3uAIlno, (accessed 08-10-2020)

13 Our research at the BBC https://www.bbc.com/news/business-43409952, (accessed 08-10-2020)

14 The Los Angeles Times mentioning our Foroba Blon project https://tinyurl.com/latimes-fb, (accessed 08-10-2020)

15 Article in Ad Valvas: https://tinyurl.com/ai-afrika-w4ra, (accessed 08-10-2020)

16 This course was set up by Stefan Schlobach, Christophe Guéret, Victor de Boer and myself. André Baart and Francis Dittoh have also greatly contributed to its success.

17 See in VU study guide: https://studiegids.vu.nl/en/2020-2021/courses/X_405101, (accessed 08-10-2020)

puter Science Department of VU. This project-based course has about fifty students every year.

A.3.2 *ICT4D in the Field: education in a real world context*

In 2017, together with Jaap Gordijn and Hans Akkermans, I initiated and designed a second course at VU, in this same curriculum – this time with an extensive field research component. This course is carried out in a period of four weeks, as a community service learning course in a resource-constrained environment in Asia or Africa. This project-based course[18], which also consists of designing and engineering information systems, puts emphasis on context analysis in complex, resource-constrained environments, and user-centered design with "real" users. The course is named "ICT4D in the Field".

I organized and coordinated this course at the request (and with funds) of VU International Office in the framework of a new educational concept called "a broader mind". The course was given in Sarawak in 2018 and 2019. A mixed team of lecturers from VU and UNIMAS[19] taught a mixed classroom of twenty students from UNIMAS and VU how to design and build information systems in co-creation with local communities in the suburbs of Kuching, Sarawak. These field-based student projects[20] cover the full life-cycle of software development. We learned a lot from the community-oriented approach of UNIMAS in ICT4D and community service learning. Conversely, UNIMAS has officially included the e^3*value* methodology and sustainability analysis in their education in the software engineering track. This course led to a Memorandum of Understanding between UNIMAS and VU, which I prepared. This document was officially signed by the executive boards of both universities, on June 8 2018, the first day of the course, during a ceremonial event at UNIMAS.

In January 2020 our W4RA team visited the University for Development Studies in Tamale Ghana, where we concretized plans to give the ICT4D in the Field course in Ghana in 2020. Apart from that plans were made to set up a project for African Artificial Intelligence. This collaboration also led to a signed Memorandum of Understanding (MoU) between UDS and VU.

In February 2020 I selected a motivated team of ten students from VU, doing their master in Computer Science, Information Science or Artificial Intelligence, to follow this course in Ghana in June 2020. Unfortunately, due to the Corona crisis we had to cancel the course of June 2020.

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18 See in VU study guide: https://studiegids.vu.nl/en/2020-2021/courses/XM_0008, (accessed 08-10-2020)

19 The Faculty of Computer Science and Information Technology of the University of Malaysia Sarawak.

20 See the student projects: https://tinyurl.com/BannaTree, https://tinyurl.com/GulaApp and https://tinyurl.com/EDUCOMX, (accessed 08-10-2020)

Also, with Amrita University, India, a collaboration in ICT4D education and research was set up after a brainstorm meeting I organized in 2015 for researchers from Amrita University and the W4RA team. In 2018 and 2019 we wrote plans for joint ICT4D and Living Labs projects, which have still to be implemented.

A.3.3 *Master research projects in ICT4D*

In the period 2015-2020, the W4RA program has inspired a number of students at VU to do their master research project in ICT4D. This has led to about thirty interesting master theses.[21] These are titled for example: "Economic Sustainability of ICT Services for the Rural Poor in sub-Sahara Africa" [102] or "An Intelligent System to Track Tree Loss in Rural Africa using Satellite Image Data" [122] or "Local currency networks in rural communities in Africa: A feasibility study of block chain payment network" [431] and many others. The students were invited to meet the weekly meetings at the W4RA office and discuss with us their research. Some students became core members of our team and did field research with us in Africa, even after their graduation.[22]

A.3.4 *The Digital Divide in Amsterdam*

Student research projects far from home – for example in Africa or Asia – are expensive and often difficult to organize. So, we looked for alternatives. A meeting with colleagues from the VU Athena Institute, Nicole Goedhart and Christine Dedding, who investigate the Amsterdam Digital Divide [165], led to plans to expand our ICT4D research to the Global North. In October 2018, I launched a call for student projects in Information Science. The research question was: *Is it possible to co-create information systems with vulnerable or unconnected people in an urban environment in the Global North?*

This resulted in five master research projects, all in support of disadvantaged citizens in Amsterdam – people who feel excluded by the digital technologies that do not match their context, needs and skills. A news item about the student projects appeared in Ad Valvas.[23]

At the start, the urban "low-resource" context was still *terra incognita* for the team, in terms of problems and living conditions of the stakeholders: who were these homeless people, low literates and people with a migration background?

The five resulting master theses have been published in a book: *Digital Divide, Citizenship and Inclusion in Amsterdam* [48]. The book was offered to a delegation of the Dutch government and representative of the Municipality of Amsterdam during a workshop that I organized to make ICT researchers from VU meet policymakers in Digital Devel-

21 All student theses are at: https://w4ra.org/student-papers/, (accessed 08-10-2020)

22 This has been the case for Gossa Lô and André Baart, who have become great ICT4D professionals, and are working for innovative AI B-corp Bolesian, often in "AI for Good projects".

23 Ad Valvas news item, June 2019: https://tinyurl.com/AdValvas-daklozenapp, (accessed 08-10-2020)

opment and vice-versa. The book is available at the website of the Amsterdam municipality.[24] The Amsterdam Digital Divide project has been endorsed by various charity organizations, including Sant' Egidio in Amsterdam and Stichting Vooruit. Unfortunately, due to the Corona crisis this research project is now temporarily on hold, but it will hopefully soon be continued.

A.4 ORGANIZING THE SCIENTIFIC AND PROFESSIONAL COMMUNITY

Since 2014 I have taken the initiative to organize a series of international scientific events. Together with colleague Victor de Boer I co-chair the annual symposium "Perspectives on ICT4D"[25] with presentations by international guests and panel discussions with the audience. Key questions at the symposium are: What are successful or promising approaches to ICT4D? What is the role of ICT in the broader context of development? What has scientific research to offer? What is the contribution and role of different disciplines, such as computer science and social sciences? Sixty up to one hundred participants participate at the symposium every year. In 2018 and 2020 this symposium was collocated with the ACM Web Science Conference. We also organized some other events, and were invited to participate in larger conferences. The main activities as listed below:

- Workshop: Digital (In)Equality, Digital Inclusion, Digital Humanism, collocated with the ACM Web Science Conference – on 7 July 2020, co-organized and co-chaired with Hans Akkermans [378, 39, 118, 47].
- Sixth Symposium Perspectives on ICT4D – Tackling Global Challenges, Collaboratively, 23 May 2019 – co-chaired with Victor de Boer.
- Fifth Symposium Perspectives on ICT4D – The Web and the Digital Divide, co-chaired with Victor de Boer. It was collocated with the ACM Web Science 2018, 27 May 2018 [43]. I was member of the core organizing team of the ACM Web Science Conference 2018, held in Amsterdam, 27-30 May 2018.
- Turing Lecture by Sir Tim Berners-Lee, inventor of the World Wide Web, for the occasion of his ACM Turing Award, also known as "Nobel Prize for Informatics". The public lecture was held at VU Amsterdam on 29 May 2018, as part of the ACM WebSci'18, with 900 attendants[26]. Hans Akkermans, Wendelien Tuyp, and I were the organizers of this event at VU.
- Fourth Symposium Perspectives on ICT4D – Sustainability and ICT4D - 18 May 2017 – co-chaired with Victor de Boer.

24 https://tinyurl.com/Amsterdam-DigDiv, (accessed 08-10-2020)
25 See: https://perspectives-on-ict4d.org/, (accessed 08-10-2020)
26 A report: https://tinyurl.com/TBL-Turinglecture, (accessed 08-10-2020)

- W4RA at the National Day for Sustainability – 25 May 2017 – Workshop as part of a conference – co-chaired with Victor de Boer[27]
- Third Symposium Perspectives on ICT4D – Community Service & Education - 6 April 2016 – co-chaired with Victor de Boer.
- Keynote which I gave, titled "A World Wide Web for Everyone" at the "VU 130" Lustrum Conference[28] "Guide to the Network Society" – 18 March 2016.
- Second Symposium Perspectives on ICT4D – Data for Development - 22 May 2015 – co-chaired with Victor de Boer.
- First Symposium Perspectives on ICT4D – Exploring this Interdisciplinary Field 16 May 2014 – co-chaired with Victor de Boer.
- Symposium The Web and Social Development – chaired by Hans Akkermans with a keynote from Sir Tim Berners-Lee, and talks by Chris Reij, Mathieu Ouedraogo and Stéphane Boyera in the presence of Yacouba Sawadogo, *The Man who Stopped the Desert* – 20 October 2009. I was member of the core organizing team, with Hans Akkermans and Wendelien Tuyp.

With these symposia and other events, we try to organize the scientific and professional community and to set the agenda for a more inclusive and collaborative ICT4D. In this effort we have found a partnership with the TU Wien, Austria. This university has launched in 2019 the Vienna Manifesto for Digital Humanism, of which the W4RA is an official partner.[29]

These activities have also received some international attention. In March 2020 I was invited to become a senior editor of EJISDC, the International Journal of Information Systems in Developing Countries, published by Wiley Online Library. This was on the invitation of the chief editors Robert Davison and Roger Harris.[30]

A.5 SOCIAL ENTERPRENEURSHIP AND INCLUSIVE INNOVATION

The research of W4RA has inspired – directly and indirectly – several businesses in Europe and Africa to engage in social enterpreneurship and inclusive innovation. One example is the Dutch innovative enterprise Bolesian[31], that has become a partner of W4RA and has taken up our work for further commercialization. On their website

27 See: https://w4ra.org/2017/05/26/w4ra-at-national-day-for-sustainability/, (accessed 08-10-2020)
28 The video of the lecture: https://www.youtube.com/watch?v=WQEK3uAIlno, (accessed 08-10-2020)
29 Vienna Manifesto on Digital Humanism https://www.informatik.tuwien.ac.at/dighum/index.php, (accessed 08-10-2020)
30 See the EJISDC website" https://onlinelibrary.wiley.com/journal/16814835, (accessed 08-10-2020)
31 See https://bolesian.ai, (accessed 08-10-2020)

is written: *Bolesian is a partner of W4RA, the Web-alliance for Regreening in Africa. With Bolesian's expertise in artificial intelligence we contribute to the W4RA's mission to support farmer-managed regreening activities specifically by enhancing information, communication and knowledge sharing for rural development.* Bolesian is considered to be one of the Top-3 most innovative tech companies in the Netherlands.

Another business partner of W4RA is the innovative firm The Value Engineers. Our work is also mentioned on their website.[32]

SBC4D is a French innovative firm, based in Toulouse, led by one of our international partners, Stéphane Boyera, who built the voice services RadioMarché and Foroba Blon with us in 2011 and 2012. Later SBC4D managed to build commercial services from these projects. Foroba Blon was delivered by SBC4D to the media concern Al Jazeera, who used it to collect voices from the field and monitor the presidential elections in Ghana and Kenya in 2013.

In the past five years SBC4D did a project in Senegal and helped to set up a social enterprise, run by a Senegalese team that offers voice services to rural communities. This firm, named Jokalante, has recently become a partner of W4RA. Jokalante's existence can be seen as an impact from the W4RA-VOICES project in Mali in 2011-2013. Even the logo of Jokalante is familiar to us (it is inspired by a design by colleague Victor de Boer).

Early 2020 the W4RA team joined a network of digital innovation hubs or "tech hubs" in Africa and Europe, including tech hubs in Ghana (Mobile Web Ghana), Tanzania (dLab Tanzania), the Netherlands (Waag Society) and Austria (I2C at the TU Wien in Vienna). Together with business partners like telecom operator Orange, tech innovation companies SBC4D in France and Jokalante in Senegal, and knowledge institutes CSIR in South Africa, UDS in Ghana and TU Wien in Austria, a project was designed for Artificial Intelligence for Sustainable Development in Africa. The collaborative design of this project plan, which I coordinated, has been completed but the actual implementation has not yet started.

A.6 THIS RESEARCH AND THE SUSTAINABLE DEVELOPMENT GOALS

The United Nations Sustainable Development Goals[33] have become the guiding principles for a sustainable and equitable world. The W4RA research contributes to SDG1 - no poverty, SDG2 - zero hunger, SDG15 - life on land, in support of farmer-managed regreening. I consider the central theme in my work to be SDG10 – reduce inequalities. This can be done by giving a voice to people who are not often heard.

This goal, which is expressed in the co-creation aspect of framework "ICT4D 3.0", with its critical approach to decolonializing and de-imperializing conventional ICT4D,

32 See https://www.thevalueengineers.nl/stakeholder-driven-ecosystem-development/, (accessed 08-10-2020)

33 https://sdgs.un.org, (accessed 08-10-2020)

has led to some opposition by those who want to safeguard the supposedly a-political neutrality and objectivity of science. Yet, given the grand challenges humanity is facing, value-laden discussions can no longer be avoided, also in science. Reflection about ethical aspects of future technical developments and innovations are becoming more frequent in disciplines as Computer Science, Information Systems, Web Science and – most importantly – Artificial Intelligence and Data Science. I hope this research will contribute to drawing attention, also in these disciplines, to the challenges of people in low-resource environments and poor regions of the world. In this turbulent year 2020 there have been worldwide calls for justice, against racism and hidden power structures, also in science. It is time for a shift. We have only just started.