Is (Web) Science Ready for Empowerment?

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ABSTRACT
The World Wide Web opens up many avenues for new research. Some of them (Web as observable phenomenon, Web as engineered technology) fall quite well within mainstream academic paradigms of research. However, this is much less so if we position the Web as a mechanism for empowerment related to social development. Informed by our W4RA field research experiences in West Africa, we review contextual as well as general issues of scientific research and scientific method if it is to be relevant to issues of empowerment.

Categories and Subject Descriptors
K4.2 **[Computers and Society]** Social Issues; H5.1 **[Multimedia Information Systems]** Evaluation/methodology

General Terms
Human Factors, Design, Economics, Experimentation.

Keywords
The pro-human Web, evolving technologies, knowledge production, Web futures.

1. PERSPECTIVES ON WEB & SCIENCE
Web Science undertakes to study the full scope of socio-technical relationships engaged in the World Wide Web. We note however that – already from the scientific viewpoint alone – there are inherently different ways to look at the Web, *viz.*, as (i) an empirically observable *phenomenon*; (ii) a *technology* in evolution; or (iii) a platform and channel for human and social *empowerment*.

It is not coincidental that these three perspectives on the Web are reflected in the three main activity lines of the World Wide Web Foundation, founded by Tim Berners-Lee in late 2009 [1]: (a) Web Science (further embodied in WSTnet, the Web Science Trust net of research laboratories across the world); (b) Web standards (as embodied in W3C); (c) the Web in Society program of the Web Foundation – as embodied in a bundle of globally oriented projects, including the *Web alliance for Regreening in Africa* ([2], W4RA) the present authors are involved in, and others (e.g. the closely related EU-FP7 project VOICES [3]). The Web in Society program of the Web Foundation sees the Web as an important source and production *cum* exchange mechanism of knowledge available for humanity and (so) as an instrument of social and human empowerment. Although nearly 2 billion people now have access to the Web, still more than 4 billion people don't. Put very simply, the Web Foundation's *Web in Society* program aims to find ways to extend access to the Web as an empowering mechanism to everyone on the planet.

As this is easier said than done, the Web Science point that we want to make in this paper is that the above-mentioned three different perspectives on the Web lead to significantly different types and styles of scholarship. They have very different implications for scientific research and for *Scientific Method* in particular, and therefore we believe that they must be thoroughly thought through as part of the Web Science research agenda.

In this paper, we make an attempt in this direction focused on the *empowerment* perspective. What does it mean for (Web) Science to have and sustain a relevant role in human and social empowerment? Here, we are informed by our own W4RA field research and demo roadshow in West Africa [2-4]. Furthermore, we will argue that the considerations deriving from such experiences do not only have a local (here, African) or applied relevance (as "pure, fundamental" Western scientists may be inclined to think), but have a *global* (Web) scientific relevance. Referring to a range of ancient as well as contemporary (especially social science) debates, we will discuss how *goals and values* (such as empowerment) enter research, and how they may be handled in a scientific enterprise that endeavours to produce universally relevant and valid knowledge.

This paper is organized as follows. First, we sketch the various specific contexts in which we carry out our research: the mobile Web and how it relates to social development (Sec. 2) and, more specifically, how this relates to current grass-roots activities in rural agro-development and innovation in the West African Sahel countries (Sec. 3). Our W4RA program focuses on this, and aims to enhance rural agro-knowledge sharing by a variety of Web-related mechanisms: Web + mobile + voice services. Our research approach to this and our field research experiences to date are discussed in Sec. 4. Next, drawing upon various current science and methodology debates, we reflect upon these experiences and their global Web scientific relevance in Secs. 5 and 6.

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2. CONTEXT #1: MOBILE WEB AND SOCIAL DEVELOPMENT

ICT services, especially mobile ones, have the potential to play a major role in furthering social and rural development in developing economies such as Africa [5,6]. At the 2005 UN World Summit on the Information Society, goals were set for developing a "*people-centred, inclusive and development-oriented Information Society so that people everywhere can create, access, utilize and share information and knowledge*" [7].

Over the last decade, mobile telephony vastly expanded in developing countries. In Africa, mobile telephony has become the primary mode of telecommunication. In 2009, Africa showed the fastest rate of subscriber growth in the world, introducing 96 million new mobile subscribers in a period of only twelve months [8]. This wide availability of mobile phones creates opportunities for economic innovation and growth and new services.

However, the *Mobile Web for Social Development Roadmap* [6] points out that realizing the full potential of mobile ICT and Web services requires addressing two big types of challenges:

- The leveraging of **content** that is *locally relevant to actors and entrepreneurs* who are key to on-the-ground social and rural development.
- The removal of a range of **access** barriers (notably, limitations related to access channels, literacy, and languages) that hamper *information / knowledge sharing and associated community building* especially in rural areas.

If these challenges are addressed, it could help prompt a wave of mobile-led economic growth, also eventually bringing the benefits of Internet and Web to underprivileged communities. To do so, however, is already challenging from a restricted ICT research and technology perspective: in rural regions of Africa having no computers, no internet, no electricity is a common point of departure. Furthermore, ICT solutions will never really fly without *commitment to and from* specific stakeholders and domain interests on the ground. For, it would be a mistake to assume that stakeholders have any *intrinsic* interest in mobile access, voice content, voice-based services, or even the World Wide Web. [Indeed, during an interview, broadcast live by a rural community radio station in Mali with some authors of the present paper in January 2011, one of the questions posed by the radio presenter was: *What is the Web?*]

3. CONTEXT #2: REGREENING IN AFRICA

The present authors have teamed up with partners involved ongoing grassroots efforts in West Africa, known as Regreening, Reverdir le Sahel, Assisted Natural Regeneration (French: RNA) [10]. *Partnering* is in our view a general key requirement and ingredient of any research strategy that wants to achieve impact outside science.

In the 1970s and '80s, periods of draught severely deteriorated living conditions for the rural communities in the Sahel. Now, 25 years later, conditions have been largely improved through the arduous work of innovative farmers using simple but effective specialized farming techniques. An area of over 5 million hectares has been restored and converted into fertile land. The Sahel in these areas has literally been regreened (see e.g. [11, 12]).

Take as an example the village of Ranawa, Burkina Faso, with now 2300 inhabitants (Fig. 1). In the difficult 1980s many people left, so the number of inhabitants dropped to less than half. This village has now become an example of a community that has actively been regreening its agricultural land area in the past two decades - and it has demonstrably benefited from its own farming innovation. Crops of sorghum, millet etc. and many trees have been grown and now offer shade and other benefits to crops, livestock and farmers. The village is now able to sustain a growing number of people.

Today, the vast majority of households in the Sahel has mobile phones. Basically everyone owns a radio. In a village like Ranawa up to 98% of the households today have mobile phones and own a radio (even though it does not have electricity). Phones are used for business, family matters, to check market prices in town, to negotiate with potential customers about prices of commodities and crops. The radio is another great source of information, broadcasting programs for farmers in local languages. The benefits of the mobile phone and the radio are worth the costs, because they provide essential information to people.

Figure 1: Local innovation: the village of Ranawa (Burkina Faso) that is economically successful in regreening.

The success of regreening activities in Africa is due to the rapid exchange and spread of local knowledge amongst large numbers of farmers. Knowledge about how to effectively and sustainably manage the lands, how to preserve trees and enhance soil fertility and how to improve crops and herds is of key importance to people in rural communities. Word of mouth and farmer-to-farmer visits are traditional means of knowledge diffusion but today also mobile and community radio communications are important here. Our (W4RA) idea is that the latter can now be significantly enhanced: combining existing radio and other spoken content with novel ways for voice based access and mobile Web services may enable to further increase the speed and spread of knowledge sharing among farmers, families and communities. The W4RA aim is thus to *additionally* (i.e. on top of the already existing on-

the-ground regreening initiatives and their current ways of knowledge sharing and diffusion) enhance m-agro knowledge sharing in the Sahel with mobile access, and associated voice content, services, teamed up with Web facilities. Much of the knowledge, technology and expertise to achieve this is however currently not available in Africa itself. So this is where added value from the outside (science, research, technology) comes in.

4. W4RA ROADSHOW FIELD RESEARCH

From the above discussion it is clear that there are quite many and big challenges to deal with, technological as well as non-technical ones. In our approach, these challenges are to be addressed by a multi-faceted research strategy: (a) focus on (mainly low-end) *mobile* channels as an access channel; (b) focus on *voice*-based content, access, tools and services [9] as this addresses *stakeholders*' interests on the ground in the most natural way; (c) helping to identify business models that enable *sustainability* of such services; (d) integration with *Web* facilities to enable future growth; (e) to get there, employ a research design that is *participatory* and *partnership*-oriented.

Accordingly, in January 2011, we did a roadshow across Mali, Burkina Faso and Ghana, organized by local partners, and designed according to the above criteria (a)-(e), to find out about stakeholder interests, important use case scenarios, and requirements, in a participatory and interactive discussion setting.

Workshop discussions were based on a set of mobile/voice service demonstrations (Fig. 2) intended to give an idea of what is technologically possible – not with the intention that demos should be perfect (they in fact weren't), but rather that they should be telling and clear enough to kick off a good discussion [1-4]. The overall goal of our voice-based demonstrations was to show how voice services can work through a simple mobile phone. It comprised a portal that offered three services: listening to a broadcast program à la carte that offers a song and an information broadcast on agriculture; recording a message to be broadcast; and retrieving the messages that have been recorded via mobile phone. In the field we added an FM transmitter to demonstrate that a recorded message could be directly transmitted onto the radio and received by people with their own radio-sets.

Figure 2. Workshop in Bandiagara (Mali), where Aman Grewal, Nana Baah Gyan and Stéphane Boyera show mobile/voice service demos.

Road show target audiences included African project partners, NGOs, agricultural extension agents and ICT practitioners. Field research included conducting focus group discussions related to the technology demonstration(s) with extension agents, farmers and ICT practitioners. Qualitative data and usability feedback was collected at each demonstration site. Brainstorming sessions helped to tease out significant use cases and requirements for Mobile Web and voice technology services.

Figure 3. Farmers-innovators and representatives of seed producers at a workshop in Burkina Faso.

We organised six workshops at different locations (Figs. 2, 3), with the participation of relevant stakeholders (farmers, radio people, NGOs, local ICT entrepreneurs, farmer organisations, civil society organisations). Team members demonstrated possible applications of voice services involving simple mobile phone and radio applications. The local participants were invited to share their thoughts on the usefulness of innovative voice services that could be of benefit to their work.

Figure 4. Radio SENO Bankass (Mali): no internet, no computer, many listeners.

We also visited and had discussions with several local community radio stations (Fig. 4). Radio is an important voice channel for information exchange in this region. Radio not only generates voice content, but also acts as a regional hub for information sharing. During the roadshow we furthermore visited several farmer villages and farmers on their fields, especially those who are involved in regreening activities (Fig. 5).

This field work resulted in a longlist of use cases (about 16) whereby participants indicated that Web + mobile + voice services in different configurations can have practical value for their daily work. Two example use cases are:

Market information system: there is a running project, which is aimed at producers of non-timber forest products (e.g. honey, shea nuts and butter) in 20 villages in Tominian, Mali. Mobile phones are used to communicate (verbally) information to the Sahel Eco coordinator. Information (product, quantity, price, and contact phone number) is typed up, saved on a USB stick and then sent via internet (from a cyber cafe 20 km away) to three radio stations to be broadcast. A hard copy of the information is given to Radio Mountian in Tominian. Potential clients either phone Sahel Eco to be put in touch with the producers or phone the producer directly (phone numbers are broadcast) for more product/price information and to negotiate. Web + voice services could simplify and speed up this process significantly.

Organising events: leaders and members of all farmers organisations we met (CNOP, AOPP, Barahogon, seed producers coop, herders association etc.) use their mobiles to: organise meetings and events; send information to members (vaccination dates; dates of seed certification visits; date and places to collect produce for group sales); receive and reply to technical queries (e.g. banana producers phone Melamine for advice). The organisation of the annual *Bourse de cereals* in Mali, for example, would be much more cost effective if such a "grain market" could be based on voice + internet.

Next step in the W4RA/VOICES projects is to set up a field pilot in Mali based on a selected set of use cases (high value, but technically feasible and doable within the local contexts and constraints). In fact, the selection is close to the above-sketched example use cases. Launch of the pilot is foreseen for late 2011.

5. CONTEXTUALIZED KNOWLEDGE AND THE CONCEPT OF VALIDITY

Although the above accounts of Secs. 2-4 provide very brief sketches of the research situation, a clear impression that emerges across the board is how *heavily contextualized* the involved knowledge is in general. This is a striking feature in both the agriculture and ICT domains.

From the agricultural point of view, the agro-innovations and thinking involved in regreening are in many ways (already just from the technical point view) very remote from entrenched concepts of agriculture that are dominant in well-developed countries at higher latitudes (Mark Dodd's documentary [12] gives a feel for that for viewers from western countries).

In the ICT domain many commonly made assumptions are simply *invalid*, e.g. presupposed capabilities the availability of which is taken for granted and therefore often remain tacit and implicit, but which are in fact highly context-dependent, as they stem from the typical situation in technologically advanced countries. If the aim is knowledge sharing, a starting observation is that one deals here with situations where in the rural regions there is often no electricity, no computers, and no internet (and the traffic roads are often not terribly good either). It is not only the available infrastructure that imposes strong constraints, also societal factors such as (dozens of) languages, education and literacy, as well as the (ir)relevance of current Web content come into play.

In urban areas the situation is different, as infrastructure, levels of education, as well as concentrations of other important resources and capabilities are better. Mobile telephony has (rather unexpectedly, by the way) become ubiquitous in developing countries [8] not only in urban but also rural areas, however in specific ways: usually it's low-end mobiles (not smartphones, for various rather obvious reasons that will not go away very quickly) and SMS is not used at all in rural regions.

It is still very common in today's (west-dominated) science to acknowledge such considerations but construe them as matters of ("just") *application* of science. Science itself is seen as universal, i.e. context-independent, whereas the role of its application is to furnish the contextualized and localized version of it in various specific contexts of use. This has long been the predominant narrative in science (and we note, this performs a service in the interest of "fundamental" science, as being primary and application being derivative), and this tendency is still very much alive (for example) in computer science. A critical underlying but tacit assumption is that it *de facto* assumes that the peer community of scientists is able and warranted to decide about truth and validity.

This, however, is very questionable. In fact, it represents not a universal but instead highly contextualized and localized view of contemporary science. In a truly global view of scientific research, it is – given the highly contextualized issues and knowledge we have sketched above – very dubious to accept that academic scientists are the sole decision makers concerning what is true or valid. It fundamentally ignores the role of communities in society that are affected – positively or negatively – by science, and moreover it denies that such communities possess relevant knowledge and expertise that science better should take into account.

A pragmatic counterargument is that the traditional positioning of science as a one-way street from fundamental research to application is simply not going to work in any real-world practice. This is already the case in the developed countries where there is so much debate on the gap between science and industry. For Web Science such a positioning is plain wrong, witness the role of open source, social media, open access, and other communities of practice that demonstrably have had and still have a key influence on the direction where the Web is going [13]. And certainly it holds for initiatives such as W4RA as representative of *Web in Society* Web Foundation initiatives that have their focus and intended impact outside the traditional borders of science and technology in advanced countries.

A more fundamental counterargument is that such a position is inherently and deeply flawed: it privileges academic science as the gatekeeper of "true" knowledge – even where (as in our case) it is very remote from the everyday on-the-ground expertise needed and involved in e.g. making regreening really work. Generally, effectively denying that communities other than academic science peer communities possess valid knowledge is wrong-headed. Instead, a more convincing position is that the decision about what is valid knowledge is to be taken by an interactive *Auseinandersetzung* by different involved and affected communities, of which the scientific peer community is *only one* out of many relevant.

This takes away the academic scientists monopoly regarding true knowledge which has been the political consensus in the 20th century, especially after World War II [14, 15]. But, in return it brings to the fore the relevance and direct interaction of science *vis à vis* its stakeholders in the 21st century society.

Historically, the direct interaction between science and society has been prominent and dominant in key turning points of science, both in the scientific revolution of the 17th century, where the UK's Royal Society – the oldest academic society in the world – was driven first of all by industrialists (rather than scientists) who had a strong interest in the "new knowledge"; and in the Industrial Revolution of the 19th century where universal laws such as conservation of energy, momentum etc. were coined as reflection upon industrial practice and concomitant scientific experiment. At all historical turning points, the relevance of science itself was not at stake: it delivered value to society in a way that could be made explicit and evident (although this does not deny that one may have to fight for it, witness bishop Berkeley's sarcastic criticism on differential calculus ("*ghosts of departed quantities*") more than fifty years after its invention independently by Leibniz and Newton in the late 17th century).

Web Science in the 21st century has similar (also academic) choices to make: either it sticks to received views of science, or it attempts to break truly new ground. Here is the paradox: if Web Science endeavours to be truly *globally* relevant and valid, it has to do so to a *multitude of local and regional communities* in the world. Universality does not derive from abstract universal principles and laws established by discourse within a scientific peer community, but from multiple proofs that concepts, theories, technologies are valid in a wide variety of different contexts. *I.e.*, it is not so much context independence that counts but cross-context demonstrated validity.

Novotny *et al*. [14, 15] have more generally taken up the theme of what it is for produced knowledge to be reliable and valid, and how to produce such knowledge. They point out that the institutionalized consensus that knowledge production is delegated to scientists in ways and institutions segregated from society and stakeholders is under attack. They argue that another mode of knowledge production ("mode-2" [15]) is arising, whereby a stronger integration is present between science and society, it is acknowledged that relevant expertise is socially distributed as it also resides outside universities and other specialized expert institutions, and external stakeholders and contexts are active co-creators of knowledge. As a result it is no longer the scientific peer community or group of domain experts that is the sole decision maker about the validity and reliability of knowledge. Validity of knowledge resides in that it is proven to be socially robust across contexts. They summarize these developments as "*the context speaks back*" [14, Ch. 4] and – with a reference to the Greek city-states of Antiquity – that "*science moves into the agora*" [14, Ch. 13]. We assert that this is certainly very true for Web Science. Web in Society implies Web Science taking place in the agora of society.

6. EMPOWERMENT AND SCIENCE AS PHRONESIS

As we noted in the beginning of this paper, there are inherently different ways to look at the Web, *viz.*, as (i) an empirically observable *phenomenon*; (ii) a *technology* in evolution; or (iii) a platform and channel for human and social *empowerment*.

The first two views fall well within the standard paradigms of today's science. Web as observable phenomenon is the object of theoretical, computational and empirical work for example on the general characteristics of networks, a theme that has recently matured into a whole range of academic textbooks on the science of networks (e.g. [16]). This line of work certainly has resulted in interesting and useful insights. From the viewpoint of scientific method it does not constitute a great departure from existing theoretical, computational and empirical methodology and philosophy in the style and tradition of the natural sciences. Contributions to the science of networks from social sciences such as [17,18] are informative specimens of social theorizing fitting existing traditions in the humanities and the so-called qualitative style of social science.

The second mentioned view on the Web, that of a technology in evolution, also mainly falls within existing scientific paradigms and methodology, albeit different ones. Much empirical social research on technology and innovation fits mainstream empiricist, positive views on what science is, prototypically framed as quantitative hypothetico-deductive dependent/independent variable research. A typical example of such a one-way variable theory of innovation in the MIS area is the Technology Adoption Model (TAM) [19].

However, what such *post hoc* analysis approaches can tell us is limited, as they have difficulty in capturing the interactive and transactive nature of evolving technologies, or in what is often framed as the "*eco-system*" nature of innovation [20, 13] – which is also a salient feature of the development of the Web. For example Latham and Sassen [21] therefore promote an alternative integrated view on ICT technologies and the emergence of what they call new *sociodigital formations*. They criticize the one-way idea that ICT technologies can be reduced to the question of their impacts on society, as impacts are only one of several forms of the intersection of society and technology:

"The search for impacts means framing analysis in terms of independent and dependent variables, which is by far the most common approach in the social sciences. Our understanding that these technologies are part of transformative and even constitutive processes means we cannot confine the analytic development of this field of inquiry to that type of framing." [21, p. 8].

An additional problem for quantitative empirical social research is the issue of design: how to scientifically theorize about technology as designed artifact. As Latham and Sassen say: "*Design does not sit easily within social science; the latter tends to force a division between normative and positive analysis.*" [21, p. 25]. In other words, it is the (in)famous "*is/ought distinction*" that produces the intellectual hurdle.

From the interdisciplinary point of view the gap here is not so much between social and natural science (sharing the spectator-based view of science with the researcher as observer external to the object of study), but between social science and the engineering disciplines. Computer science (also in Web Science) and other engineering disciplines can be rightfully criticized on their often entrenched view of technology as a one-way street from development to application and user. This terminology itself betrays that the context is not seen as meaningfully speaking back, as application and users are typically end-of-the-line concepts (although some antidotes exist in e.g. HCI and action-research IS [22-25]). But at least such engineering disciplines do not have a problem to accept design as a first-class citizen in research goals. However, social science does. There are some attempts in social science to remedy this, such as recently in MIS design science [26] which is mainly derivative from older views on the Sciences of the Artificial, developed by H.A. Simon [27]. From a Web Science point of view, they are still found wanting, as we discuss below.

Even if we restrict ourselves to the views of the Web – as observable phenomenon, as designed technology – of which the research falls well within existing paradigms of science, the above discussion shows that there is not one coherent interdisciplinary scientific method. Instead, many very different images of science [28] are to be allowed a place under the sun of Web Science.

Yet, we submit, this is still not good enough if we turn to the third view of the Web – that of a mechanism for empowerment related to social development. Empowerment is a much less traditional goal in science, so it imposes new and stronger demands on research; and the Web is no difference here:

♣ Key research concepts such as hypothesis and validity need redefinition. Both are gradually (socially) constructed and tested in a science-society transactive space (the "agora" [14]). They are

highly contextualized and involve learning along the way [24, 25], instead of being business-as-usual concepts thought to be external to investigation. Validity has to include a practical and discursive notion of *adequacy and sustainability in the field*, because this is where the real "threats to validity" reside.

♣ In many disciplines, theories are not suited to serve a societal action goal such as empowerment. Theories lack needed explanatory power as they are shallow in terms of variables and mechanisms (example: TAM [19]) and are often unable to produce *actionable* knowledge that is relevant to the field context in which practitioners work [24].

♣ Another objection to much theorizing is that it does not cover necessary interactive, communicative, argumentative and participatory factors and processes (example: much of computer science, but also design science, both the MIS version [26] and Simon's original [27]). Even where Simon admits "society as the client" [27, p. 153], goals and values are kept out of the equation and are as a matter of fact positioned as exogenous to the researcher-client discourse. But this is artificial. To substantiate this point, one only has to consider the stark contrast between the case examples of social planning that Simon presents [27, Ch. 6] and the much richer and subtler case studies in the same domain as discussed by Flyvberg [29, Ch. 10].

Approaches and methodologies such as Action Research [24, 25] and "Living Labs" (e.g. [29]) stand a much better chance to properly deal with the above issues: to capture a broader notion of validity-in-the-field as research outcome, as well as the inclusive dialectical design nature of the research process that is to lead to socially robust and actionable Web Science knowledge. One of the anonymous reviewers of this paper remarked: "*there has always been action research in the business subjects – though it is hard to receive tenure by doing action research in MIS in the Anglo-Saxon countries.*" Rather than being a rebuttal to the argument of this paper (as the reviewer seems to think), it in fact demonstrates rather the opposite: the problematic is that if you can't get tenure, clearly the scientific methodology you employ is at most tolerated as academic fringe. But our point is that these matters of societal relevance demonstrable in the field are not peripheral anymore in science in general and Web Science in particular. Instead, they are moving to the centre of scientific research. And if one considers empowerment as a research goal, we believe that such a movement is necessary and unavoidable.

Overall, there seems to be missing a level of *reflexivity* in science that can be characterized by two related concepts stemming (!) from Antiquity: (i) *agora* [14, 32] (ii) *phronesis* [29, 31, 32]. We already indicated that science moves into the agora, so that it co-evolves with society in complex interactive and discursive ways [14]; for Web Science this is even more strongly the case, as the societal backdrop of its research is the *global* space of humanity.

Related recent debates about what the role, focus and value of the social sciences should be [29, 31] refer back to Aristotle who already distinguished different important categories of knowledge [32]. Some of these are well known, such as episteme (analytical knowledge) and techne (instrumental skill and rationality), and have found their way into contemporary scientific terminology. These concepts fit almost seamlessly to the views and scientific research style of the Web that we above have conceptualized as Web-as-phenomenon and Web-as-technology. But Aristotle also distinguishes another important but today lesser recognized category of knowledge: *phronesis* [32]: practical reason or prudence. The focus of phronesis is how to properly act under given particular circumstances, e.g. how to run a household, city-state (politics), etc. Already Aristotle argues at length that in such issues it is not the *universalia* that count most in the end (as is the case in episteme), but instead the *particularia*, i.e. it is the specific context at hand that proves to be the decisive factor. [An interesting remark is that Aristotle believes that universals are in a sense the easier part, as they can be taught to and learned by young people, whereas understanding the particulars is much more difficult because they require long-standing practical experience of many years].

As Flyvberg [29] discusses in detail, phronesis deals with key questions of civil society: (i) Where are we going?; (ii) Who gains/loses from this, and by what mechanisms?; (iii) Is this desirable? (iv) What should we do? This does not just include means-ends analysis [27]. The goals and values themselves and how they are exercized in practice are not external or taken as given, but are part of the investigation in the agora, both for science and the societal actors and stakeholders. This strong (double) element of reflexivity includes investigation and co-created knowledge production also concerning (substantive) value rationality, beyond just theoretical or technical knowledge. As Sayer [31] phrases it: people's relation to the world is one of concern, *things matter to people*, and these concerns are not beyond reason.

Empowerment is a concern, so it needs research that matters. In the W4RA program the (phronetic) central research question is: how can we help expand or strengthen networks of people so that they are more effective in rural agro-knowledge sharing?

In summary, Web Science – given the three views of the Web as observable phenomenon, as evolving technology, as empowering mechanism – requires all three Aristotelian intellectual virtues: episteme, techne, and phronesis. However, the phronetic aspect of research that is crucial to empowerment is underdeveloped and too peripheral in today's science. Also Web Science has yet to make significant steps forward here. And as Aristotle points out: *the possession of the single intellectual virtue of phronesis will carry with it the possession of them all* [32, 1145a].

Figure 5. Phronesis-oriented research may not be the most safe and sound route to academic rewards such as citations and best-paper awards, but perhaps it produces suitable alternatives. Here, the authors of the present paper are awarded a goat as a parting gift by the village chief of Tongo-Beo (North Ghana) during their W4RA roadshow.

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