

**ICT, INNOVATION SYSTEMS  
AND THE ROLE OF UNIVERSITIES  
IN SOCIETAL DEVELOPMENT  
– A (POST)COLONIAL STRAIN?**

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NATIONAL UNIVERSITY OF RWANDA PRESS

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PUBLISHED BY:  
NATIONAL UNIVERSITY OF RWANDA PRESS LTD.  
P.O. Box 56  
BUTARE  
RWANDA  
TEL: + 250 530122  
FAX: + 250 530121  
© NATIONAL UNIVERSITY OF RWANDA, 2004

ISBN 91-7295-997-5

TYPE SETTING AND BOOK DESIGN: PETER EKDAHL  
PRINTED BY MIXI PRINT AB, SWEDEN  
CO-PUBLISHER BLEKINGE INSTITUTE OF TECHNOLOGY, SWEDEN

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## Preface and acknowledgements

This research project is the beginning of a continued and deepened collaboration between Blekinge Institute of Technology (BTH) in Sweden and National University of Rwanda (NUR). Despite the geographical distance, we have found many areas of meaningful exchange of ideas and experiences. The work has been going on for almost two years, while we have all been busy with other projects as well. We are proud and happy to be able to present this material in the present form. The major work has been done by Elisabeth Gulbrandsen, who is a visiting researcher at BTH, and who also work parallel at the National Research Council of Norway, Albert Nsengiyumva, who is Director of the Computing Center at NUR, Birgitta Rydhagen, senior researcher at BTH and Lena Trojer, professor in Technoscience studies at BTH. The research project has been financed by Sida/SAREC. Peter Ekdahl at BTH has been a strong support in both research and final production of the book.

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## INTRODUCTION

## ICT, Innovation Systems and the Role of Universities in Societal Development – a (post)colonial Strain?

BIRGITTA RYDHAGEN AND LENA TROJER

- How can postcolonial ICT (Information and Communication Technology) exceed the dominating discourse of western technological determinism?*
- How can postcolonial ICT meet the needs of developing countries?*
- How can the ICT development at universities become a driving force for societal progress in developing countries?*
- How can innovation systems including the role of universities be understood and developed in postcolonial situations?*
- How can potentials for a triple helix model be dealt with?*

These are questions elaborated by a team of researchers from Rwanda, Sweden and Norway in a study supported by the Swedish International Development Cooperation Agency, Sida SAREC.

The aim of this book is thus to develop knowledge and understanding about how ICT can be involved in local and national innovation systems in developing countries. Special attention is paid to the role of the university as an important stakeholder in local and national development processes. For this purpose, the interdisciplinary group of researchers has made the study carrying the question about the prerequisites for postcolonial identities to make their mark on a nationally situated ICT development and implementation. The study addresses the emerging implosion of postcolonial situations and ICT development. The

theory frame of feminist technoscience studies is included in the analysis as a special resource.

The rhetoric used in strategy and policy documents for ICT is overwhelmingly monolithic – no matter if it is formulated in economically rich or poor countries or in international organisations. ICT seems to be a mantra for economic development – on the global as well as the local level. The emphasis on global ICT development has changed over the years and moved from infrastructure through regulatory issues, application areas, content and knowledge creation to empowerment (Conhaim, 2001). However, there are opinions<sup>1</sup> of stressing the focus on implementation. This gives us opportunities to go beyond the rhetoric and face realities of the postcolonial situations of women and men in low income countries. Implementation of ICTs that secure cultural and economical sustainability is not possible without accountability for the reality producing aspects of ICT - does ICT reinforce the resource gaps or start to close them?

Academic ICTs and their applications in society and every day life force our attention towards the relation between dominating actors, of which the university is one. It stresses not only the development of innovation systems but a relevant knowledge about its prerequisites resulting in transformation challenges for the traditional universities. The model explored for these processes is the triple helix model stating that the three institutional spheres university, industry and government are increasingly working together.

## Theoretical background

### ICT and development

ICT has, as already mentioned, become a mantra for economic development – on the global, national as well as the local level. One major motivation for this mantra practice is the circumstance that the information and communication sector has been expanding globally at a much higher rate relative to other sectors in the world's economy (d'Orville, 1996<sup>2</sup>). The fundamental arguments for investing in ICT are situated in the view of ICT as a necessity for successful integration into the world economy. ICTs are regarded as having great potential to promote development in key social and economic areas where a shortage of capital, knowledge and local capacity obstructs progress. The following changes are recognised at the official WSIS (World Summit on the Information Society) webpage<sup>3</sup>:

- The digital revolution offers...
- ...changes of the way people think, behave, communicate, work and earn their livelihood.
- ...changes of the ways the world conducts economic and business practices, runs governments and engages politically.
- ...new ways to create knowledge, educate people and disseminate information.
- ...speedy delivery of humanitarian aid and healthcare.
- ...a new vision for environmental protection.
- ...new avenues for entertainment and leisure.
- ...the capacity to improve living standards for millions of people around the world.
- ...enhanced communication which will help to resolve conflicts and attain world peace.

### Postcolonial ICT?

The situation in developing countries addresses the emerging implosion<sup>4</sup> of postcolonialism and ICT development. The theories of post-colonial identities and situations are research areas of great importance and volume. We want to address some threads in order to come closer to an understanding of the process of combining post-colonialism and ICT. Referring to Sandra Harding (1998), we recognize post-colonialism not to be monolithic; the term has many referents and meanings. Temporally, it indicates the period beginning in the 1960s, marking the end of formal European colonialism.

The postcolonial context in sub-Saharan Africa today is characterised by a lack of leadership and understanding of new technologies, political instability and weakness in the regional institutional building, several basic issues to address, and a need for ownership<sup>5</sup>. The imbalance in power remains, and makes it difficult for the postcolonial nations to define their own visions without having to rely on the intentions of donor nations and organisations.



The colonial and postcolonial efforts to retain or change power relations affect the technological development. “It is not coincidental that the growing division between the techno-literate and the techno-illiterate replicates old models of hegemony and oppression, as evidenced in the use of terms such as information neo-colonialism and technological apartheid” (Mejias, 2001, p. 212). It is therefore necessary to investigate and de-naturalise the discussion of former colonies as nations in need of ICT transfer. As Nsengiyumva has stated<sup>6</sup>, all electronic technologies have been brought in from outside.

The anthropologist David Hess (1995)<sup>7</sup> suggests that we think of post-colonialism as “a kind of discursive space opened up both within and after the end of formal colonialism, where diverse positionings, discussions and other practices can occur”. In Manuel Castells’ book (1998) *End of Millennium Volume III*, he discusses the power battles of the “information age”, claiming that these battles are in fact cultural battles.

Power, as the capacity to impose behaviour, lies in the networks of information exchange and symbolic manipulation, which relate social actors, institutions and cultural movements, through icons, spokespersons and intellectual amplifiers. [...] Culture as the source of power, and power as the source of capital, underlie the new social hierarchy of the Information Age (Castells, 1998, p. 348).

Is it possible to develop multicultural battles / negotiations in the contemporary “Information Age” – negotiations that include autonomous, formerly colonized countries? And what form would these negotiations have to assume in order to make space for the lives lived by women and men in economically poor countries?

Furthermore, since ICT is not a separate technical and economical sector, like motorcars or refrigerators, but instead crosses almost every sector, we must ask ourselves if this situation accommodates a potential for sustainable development, when regarded from the perspective of a catching-up approach. What does seem clear is that there are no immediate links between equal-level<sup>8</sup> participation and ICT development or ICT policy development. Rather, the links are created by means of hard work and tedious dialogues, multidimensional partnership co-evolution with developed and working sensitivity and awareness of diverse interests, gender dimensions and cultural–ethnic pluralism, among other components in an increasingly complex world.

Another aspect that is easily overlooked when ICTs are discussed, is that these technologies are connected to each other in specific ways having different meanings in different contexts. Often, ICTs will need to be reviewed separately, since they are used in different ways. Mobile phones, for example, might be readily integrated in a society with primarily collective or social identities (see the example given by Trojer in this edition, and Leonardi, 2003) and oral communication. Computers favour a completely different mode of communication or even substitute for socialising.

What we have indicated above, which is also confirmed in the reading of the rhetoric employed by the different actors concerning attitudes to the ICT strategies of economically poor countries, is permeated with faith in development linearity (see discussion given by Gulbrandsen in this edition) and ICT as a panacea. In order to create a broader and more complex understanding of how ICT is intertwined in cultural, social and economic structures, it is necessary to expand the notions of other lines of interpretation.

Is it possible to work out “national ICT strategies, which also permit bottom-up approaches”<sup>9</sup> in economically poor and in addition formerly colonized countries? Is it possible to create prerequisites needed for postcolonial identities to make their mark on a nationally situated ICT implementation?

### **Feminist technoscience studies**

Vandana Shiva once said “New technologies travel on old social relations”<sup>10</sup>. Experiences reveal that new technologies simply reinforce old social structures rather than transforming them. This means that the discourse of ICT as a universal tool, which also must include the possibility to change deeply ingrained structures like gender structures, is highly questionable. The concern to understand the underlying cultural and cognitive structures, which are reality producing in the evolving information society, has been and still is comprehensive in feminist technoscience studies.

Participatory ICT design is emphasized in gender research as well as in human work science, computer science and elsewhere. Birgitta Rydhagen (1999, p.75) regards the feminist understanding of power relations and their impact on the production of knowledge and technology as highly relevant in participatory research and technology design. Combining participatory ICT design and feminist research promotes:

- diversity potentials as strategies to handle non-consensus situations
- enforcement of situated knowledge and technology development (Haraway, 1991, Gulbrandsen in this edition)
- emphasis on the importance of power relations and their impacts, including complex understanding of gender structures
- process-oriented development through a broader understanding of transformation processes.

An example is given by Michelle McKinley and Lene Jensen (2003), who have studied the emancipatory and participatory potential of a radio program. The purpose of the program was to address women’s health issues in remote rural areas in the Peruvian Amazon where a majority of the indigenous population lives. The listeners were encouraged to send in their stories and questions, which were then raised in sociodramas, answered by experts or investigated through interviews. Listener groups were also invited to produce the different programs together with

the producer team. It turned out that both women and men listened to the program in single-sex groups (and not individually) in the villages. The producer received hundreds of letters from women, telling their life stories and raising specific issues of sex abuse, household violence etcetera. Through the radio, the women in these remote areas succeeded in connecting to each other, communicating about important women's issues with a radio studio as moderator.

Christina Mörtberg (2000) holds that equal access to ICT ought to be a basic principle, when the slogans are no longer "technology in a democratic society" but "democracy in an information society". She problematizes the discourse of equal access by showing that the limitations of equal access are rendered visible by a multiplicity of variables such as gender, class, race, religion, etc. "There are no automatic links between the political goal of equal access and the opportunities that are opened up by information technology."

### **Innovation systems and the role of universities**

Gibbons et al. (1994) view science or academic knowledge as increasingly embedded in, and hence more accountable to, society at large. We are thus approaching practices and understandings of socially robust knowledge and technopolitics, embracing the notion of accountability (Strathern, 2003). This is connected to the view that knowledge needs to be socially robust as its validity is no longer determined predominantly by scientific communities, but by much wider communities of engagement comprising knowledge producers of several kinds, disseminators, traders and users (Nowotny et al., 2003). This provides relevant views for postcolonial ICT where ICT development is placed in the spiral of transformation and transgression trials until the condition of survival exists.

One of the technoscience fields provoking the borders between academic research and politics/society is ICT (Gulbrandsen, 2000). We can experience how the 'negotiations' (Aas, 1999) about the character of academic research takes place in society. The emerging situation can be conceptualised by the so called Triple Helix model. As Uhlin and Johansen (2001) evidently go into particulars about, this model states that

three institutional spheres (university, industry and government) formerly operated at arms' length now are increasingly working together, with a spiral pattern of linkages emerging at various stages of the innovation process, to form a 'triple helix'. The complexity of the reality that the Triple Helix model indicates is envisaged by four dimensions in which these linkages are said to emerge in innovation processes. First, there are internal transformations in each of the helices, e.g. universities more and more (are forced to) behave in an entrepreneurial way in order to finance education and research. Second, each one of the helices influences the others, e.g. university-industry strategic alliances. Third, there are "spin-offs" of trilateral networks and organisations from the interactions among the three helices in order, for instance, to promote local and regional development. Fourth, there is a recursive effect on these exchanges among institutional spheres, both on the spirals from which they emerge

and on the wider society. Etzkowitz and Leydesdorff (1997) summarise this spiral-like mode of knowledge production by saying that "knowledge is no longer transferred, but co-developed" (Uhlin and Johansen, 2001, p. 15).

John de la Mothe (2003) emphasizes that innovation and innovation policy are to be seen as not simply bodies of practice but also as bodies or cultures of understanding the nature of learning, evaluating and selecting. This understanding gets increasingly complex and it is undesirable to approach complexity with a centralized mind-set, when systems require the capacity to adapt. One impact of these arguments stresses the innovation policy and organizational learning to be understood as a co-evolutionary process. That process certainly involves organisations like universities, its ability to transform into societal relevant role(s). Jasanoff (2003) suggests "technologies of humility" to make apparent the possibility of assessing the unknown and uncertain, to make explicit the normative that lurks within technology and to acknowledge from the start the need for plural viewpoints and collective learning.

The interdependence and increased collaboration between the University, the Government and the private sector is particularly evident in the postcolonial context, where the University has a much clearer mission to contribute to the development of society through appropriate research projects and the development of ICT systems and e-learning programs to reach the rural population with education programs (e.g. Nsengiyumva and Trojer in this edition). The context of the universities in post-colonial Africa must however be considered with great care in order to understand the relations between the University and the Government in particular. The situation is specifically precarious in a political situation characterized by single party states. The threat of increasing state repression to institutional autonomy becomes a reality for a number of universities.

## Introduction to the chapters

In the following chapters, these different issues will be discussed from various angles. Case studies and empirical research is presented, as well as theoretical reflections and literature reviews. Birgitta Rydhagen presents a discussion of the relevance of postcolonial theory in ICT development, based on an extensive literature review. Albert Nsengiyumva gives a well founded example of the development of an ICT infrastructure through collaboration between the University and other institutions in Rwanda. Lena Trojer presents the example of Tanzania, and develops thoughts of this situation as a technopolitical and postcolonial challenge. Elisabeth Gulbrandsen highlights some prerequisites for responsible innovation by drawing on emerging discussions in Europe focussing science, technology and society as co-evolving bodies.

Rydhagen gives different examples of how ICTs are received and used differently according to the social context where they are introduced. This is still often neglected in practice, even if it is acknowledged in principle. The global hierarchical structures that were established during the colonial period still remain to a large extent, despite talk of a “New era” and of rupture into the postcolonial, post-Cold War and postmodernity. Only now, hierarchies between the “haves” and “have-nots” are legitimised by technological know-how, instead of racial differences. However, the appropriation of foreign technologies has always taken place, in partly unexpected ways, and this is the case with ICTs as well. Therefore, we might want to speak of the “Digital Swamps” rather than of Digital Divide. By recognising/acknowledging the digital swamps, where the uses of digital technologies take on shapes that we do not intend or immediately recognise, we also acknowledge that the people in the former colonies are autonomous, capable and authorised to take part in the innovation systems of ICTs.

As both Nsengiyumva and Trojer have shown, the role of the Universities in Rwanda and Tanzania and most of their neighbouring countries differ from the classic (and contested) ideal of the University as a free, knowledge searching institution. In Rwanda as well as in Tanzania, the researchers are well aware of their importance for the development of the nation, and their research is necessarily prioritised as relevant to society. This means the University is an integrated part of a Triple Helix, where the University and other institutions in society collaborate for the development of the nation. An example is given as the University supplies the Government with telephone and Internet connections. Nsengiyumva argues that the introduction of ICTs promote the communication between the universities and the surrounding societal institutions, thus changing the ability of the University to take part in the development of the larger society. The universities are also important sites from which to spread the access and knowledge about ICTs per se to the wider society. Trojer also elaborates the potentials in develop-

ing innovation systems focusing ICT, where the transformation of universities is challenged and a context sensitive approach is necessary.

Gulbrandsen gives an introduction to the idea of technoscience as a turning point, where the linear model of technological development is no longer valid. With the entrance into the knowledge society, societal interventions in nature occur potentially on a large and life decisive scale. In the knowledge society, technological development thus requires constant questioning and participation from local and situated perspectives. “Technoscience as culture” indicates awareness of the necessity to develop real-time technology assessment with different specific situations in mind. Co-visioning future solutions between marginalised and dominant actors together may be a constructive way to design innovations for a socially robust development of science and technology.

What we can see in the different examples, is what David Morley and Kevin Robins (1995) claim; the postcolonial fractionality of identities and the complex web of global cultural interactions is new only to Europeans. To the people in the former colonies, these circumstances/situations were experienced already a couple of centuries ago.

## Notes

- <sup>1</sup> [www.hsw.fhso.ch/ruddy/Workshop\\_2.htm](http://www.hsw.fhso.ch/ruddy/Workshop_2.htm) and WSIS (World Summit on the Information Society)
- <sup>2</sup> Referred to in Ekenberg and Asker, 1999, p. 9.
- <sup>3</sup> <http://www.itu.int/wsis/basic/why.html>, read March 19, 2004
- <sup>4</sup> The irreversible amalgamation of two entities into a partly new, possibly unrecognisable entity.
- <sup>5</sup> Albert Nsengiyumva in a workshop 23/10/2003 at Blekinge Institute of Technology, Sweden.
- <sup>6</sup> In a workshop 23/10/2003 at Blekinge Institute of Technology, Sweden.
- <sup>7</sup> As referred to in Harding, 1998.
- <sup>8</sup> We have borrowed Jan Åhländer's concept of the equal-level perspective in order to overcome the dichotomy of the top-down / bottom-up perspective.
- <sup>9</sup> Suggested in the DOT Force report Genoa July 2001.
- <sup>10</sup> Vandana Shiva, guest professor, lecture focusing biotechnology, Luleå University of Technology, 5 March 1998.

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## CHAPTER 1

## Postcolonial ICT – a Continuum or a Rupture?

BIRGITTA RYDHAGEN

### Introduction

In this text, I will discuss ICTs in the light of a few postcolonial theoretical perspectives. The motive is the great impact that ICTs (are supposed to) have on the development discourse and on the lives of those who are subject to development efforts in Africa, Asia and Latin America. Colonialism has meant different things in different localities, but the discussion of how new technologies developed (mainly) in North America are (or should be) spread in other nations through a collaboration between nation states, universities and corporations does have some general implications in these localities. Postcolonial theory is a relevant point of departure for a critical examination of the promotions of this spread, given the theory's insistence on the perspective of the marginalised, supposed-to-be beneficiaries. The postcolonial perspective brings light on the idea of success of technologies that travel well, since the angle from which the technology is viewed determines the interpretation of successfulness.

A literature search on [postcoloni\* AND techno\*] or [postcoloni\* AND ICT] offers few hits in the databases Cambridge Science Abstracts, EBSCO Hosts, Ingenta, while either of the terms separately give too many hits to be useful as search terms<sup>1</sup>. The sparse connections between postcolonial theory and technoscience can partly be explained, as the most wellknown postcolonial theory is developed in literary studies by authors including Edward Said, Gayatri Spivak and Homi Bhabha (Kapoor, 2002). While these theories provide a crucial debate around questions of identity in the West as well as the South or the East, they do not



necessarily connect directly to the artifacts and technological materialities that are parts of society. In this paper, I will give a short introduction to postcolonial thinking, after which I will focus on the implications that postcolonial theory might have and has on the politics of technoscience and ICTs in the former colonised parts of the world.<sup>2</sup>

## Postcolonial theory

The postcolonial condition [...] is the violent name of the colossal failure of the project of European modernity and its master tropes such as democracy, self-determination, civil society, state, equality, the individual, free thought, and democratic justice – tropes that showed their limit and betrayed their own logic in the moment of colonialism (Shome and Hegde, 2002, p. 254).

According to Kapoor (2002), Said's orientalism problematises the way the westerners have been, and still are, characterised as rational, peaceful and liberal, while the easterners/orientals are supposed to be primitive, irrational and mystical. The representations are integrated in the Western will to control the rest of the world. Said's wellknown concept of orientalism has been criticised for its overly unifying tendency, but it has inspired much debate and theoretical development. Spivak and Bhabha both speak about hybridity and an unstable discourse of colonialism. Kapoor gives the example of the stereotypes which are often shown to be contradictory, such as the noble savage or the innocent warrior or the simpleminded liar. Spivak insists on the resistance and agency of the objectified Others. Still, the agency is "emergent only from within the master discourse" (Kapoor, 2002, p. 652). Postcolonial theorists emphasise that there is no possibility to return to precolonial identities or origins, thus warning of "the dangers of direct opposition to dominant power, arguing that the result is often reverse orientalism and racism or substitution of one power for another" (ibid.). Negotiation is a more appropriate approach in this sense. Heterogeneity is a major virtue in postcolonial theory, and the marginalised are in focus.

Shome and Hegde (2002, p. 251) argue for postcolonial theory as a theoretical practice and a "transformation of knowledge from disciplinary competence to activist intervention". Although related to other critical theory, including marxist, feminist, postmodern, queer theory and cultural studies, the particular importance with postcolonial theory is, obviously, the focus on a geographical, historical, geopolitical problematisation of "institutionalized knowledge in the West" and the effort to redo the epistemic structures "by writing against them, over them, and from below them by inviting reconstructions to obliterated pasts and forgotten presents that never made their way into the history of knowledge" (op.cit., p. 250).

Shome and Hegde (2002) remind us about the fact that the colonial era ended in the mid-twentieth century only with regards to European colonies. The USA as well as Israel and some Asian countries have colonised or tried to colonise other parts of the world more recently. These processes will need to be analysed in their own light. The same is valid for the diaspora, which has its own problematics.

Citizens in the former colonies are obviously a very diverse group of people. Although this is recognised, Western policy makers and researchers still show surprise and discontent over the heterogeneous reactions to different actions directed

towards development in the Third World. It is as if the whole of the Third World ought to speak in one voice, and that the invitation of one or a few “representatives” would be enough to hear the “voice of the Other” over particular issues. Spivak bears witness of this idea, as she has been criticised for not giving voice to the indigenous people of her home country. “As if I were not indigenous” (Spivak, 2001, p. 58). Spivak is fully aware of her own position within the academic system, being part of the imperialist culture, and she needs the imperialist culture in order to criticise it in ways that are understood and acknowledged. When doing this, she is criticised for betraying her “fellow Others”.

Postcolonial theory is criticised for its neglect of interest in economic inequalities, with the primary focus on culture and questions of identity (Kapoor, 2002). Critics argue that it is not enough to deconstruct capitalism epistemologically, as postcolonialists do, if this does not change the reality of poverty. Kapoor’s review of dependency theorists’ critique of postcolonial theory also include the problem of structural perspective versus the fragmentary narrative approach. Dependency theorists prefer a structural perspective in order to aim for a structural change, while postcolonial theory often present narratives on a microlevel and local discourses. (Postcolonial theorists on the other hand critique dependency theory for its mere reversal of power relations and its adoption of modernist framework; *ibid.*). Shome and Hegde (2002) refer to a handful of theorists who implode postcolonial and Marxist theory to address the more material relations of colonialism.

Anderson (2002) suggests that postcolonial studies of science and technology could enrich the actor-network theory (ANT) and provide answers to some of ANT’s questions. The ANT concept of fluidity, for example, is partly derived from studies of the Zimbabwean bush pump. The introduction of the pump was successful because it was stable and fluid – open for improvisations in each locality where it was introduced. ANT contributions to postcolonial technoscience are for example the toning down of center and periphery in favour of the nodes in a network metaphor (*ibid.*). This latter approach opens up for the more complex perspectives of resistance and agency on the margin.

However, ANT is also criticised for the refusal to regard hierarchies. Although all knowledges and practices are local, “are they equally local?” (Redfield, 2002, p. 792). “The relative length and orientation of networks affect their representation, ...Scale is not an inherently neutral quality ... local knowledges and techniques that are more or less expansive”. (*op.cit.*, p. 793). With reference to Chakrabarty (2000) and to the quality of scale, Redfield argues that postcolonial theory and other discussions of modernity need to relate to Europe in some way, since it is a discursive frame for modernity as such. The necessity of reference to Europe suggests that ANT need to consider different scale and levels of localness.

‘the West’ is not just a physical location; it is also a state of mind that has now come to exist for increasing numbers of key figures in developing-country organizations. This transfer of context can be said to occur directly through education of these key figures in the West or even in Western-developed educational systems (Heeks, 2002, p. 106).

The aim of postcolonial studies will, thus, in some way or the other, always include the ambitions to “decentre and diffuse the place of the West within accounts of modernity” (Redfield, 2002, p. 793). In these destabilisations, inequalities of capital flow, knowledge and expertise need to be taken into account as well. In his critique of ANT, Redfield refers to Latour but argues that “we may never have been modern, [...] but some of us have certainly been more colonized than others” (*op.cit.*, p. 795).

What we end up with, it seems, is a call for a postcolonial theory and an actor network theory of technology that pay attention to the scale of power and hierarchical structures.



## Science in the colonial and postcolonial

Landström's (2001) account of postcolonial theory focuses on the critique of science as a western and colonial project. Research and scientific universalism has in many ways represented a continuum of the colonial conception of knowledge. Yet, it is possible to present a radical critique of the scientific epistemology within the academic system, and this is what postcolonial theory does.

Colonial science in many ways became a legitimisation of colonialism, since it represented rationality and superiority to the colonial people (Chambers and Gillespie, 2000). MacLeod (2000) claims that the western science, as it became part of colonialism or imperialism, became assimilated and transformed by local peoples and thus also became part of an empowering body of knowledge. Scientific knowledge was integrating parts of the indigenous knowledge in the colonial context. This heterogeneous practice was probably done within, although transforming, the master discourse (see Kapoor referred above). This process was not simple and straightforward. In the early postindependence years, the new elite in India as well as in many African countries wanted to follow the path of modernisation and developmentalism, in order to end dependence and replace traditional customs with modern habits and ways of life<sup>3</sup>. The people were thus continuously part of the "developmentalist discourse of experimentation" (Bonneuil, 2000, p. 267) and forced to, for example, follow scientific agricultural programmes. This process led to a division between innovation and execution, which deskilled the local farmers who had been used to cope with the risks in the local context. Bonneuil's has analysed a situation where African farmers were forced to resettle in scientifically planned agricultural villages aimed at a reorganisation of African agriculture and a quick move into modernity. Part of the aim was also to show how the Africans would prefer individual profit to the communal system that was replaced. However, although the yield increased, the farmers preferred the old system. We can conclude that the technology worked, but only from a specific perspective (see also Gulbrandsen, 1995 and Keller, 1992).

It can be discussed whether the "post-ness" of society has translated into science and technoscience, or if we still "talk of transcendental, supracultural genius". "I do not see science finally unlocking elusive secrets of the 'old one'. I see white men constructing the technoscientific culture of postmodern global capitalism. To interpret their culture as transcendental is to take the first step toward mystification and the boomerang of technototemism" (Hess, 1995, p. 114).

To highlight that the critique of Western science and technology is diverse and partly contradictory, I want to give voice to three Indian researchers. Shiv Visvanathan (1997) regards science as violent, and pushes for a self-reflective, ecological science that can challenge and rework modern science. Vandana Shiva (1993), too, calls Western science violent, as its reductionist way of addressing problems causes neglect of local diversity and strategies of e.g. forest and water

management. Dhirendra Sharma (2000), on the other hand, is critical of the glorification of the ancient knowledge and spiritual systems, which is often a strategy in the struggle against Western hegemony. According to Sharma, the traditional knowledge systems often involve oppressive social structures and unhealthy or unsustainable rituals. The claim for equal rights is a modern scientific principle, and "there is little scope for finding a sustainable developmental model in the traditional culture" (Sharma, 2000, p. 180).

## Who is actually postcolonial?

If we are indeed in a 'post-' or a 'post-post-' Cold War world, then it's the same kind of 'post-ness' that we find in the 'post-colonial'. The infrastructures and discourses of Cold War technopolitics continue to shape the parameters of global and local action, just as the infrastructures and discourses of colonialism do. We ignore those roots – and the contradictions they produce – at our peril. (Hecht, 2003, p. 7)

The new ICTs are often referred to as a sign of the rupture of the modern into a postmodern age. Hess is very critical of the reference to a global postmodern age;

before claiming that 'we' are living in a postmodern age, it is worth remembering that not everyone is included in that we. Cyberspace is an elite space [...] There is a glass ceiling, and for many in the world a large part of postmodern technoculture lies well above it. Molecular biology, the new physics, and nonlinear computer models are sites for the reproduction of big medicine, big science, and big technology. Yet, because many of the cutting edge fields are new and unstabilized, they are also sites where the decisions have not all been made and black boxes not firmly sealed shut (Hess, 1995, p. 116).

In addition, Morley and Robins (1995) argue that if postmodernism builds on a sense of dislocation, hybridity or displacement, these senses are new only to Europeans and white North Americans. For the colonised people in the world, the experience of fragmented realities is not new. The globalising process takes place simultaneously with a localising process, and thus, for some, the horizon widens and for others it narrows.

Harding (2000, p. 249) goes as far as calling the development policies as “colonialism by other means”. In the same collection, Lange (2000) also compares the “late twentieth century beliefs about the mission of liberal political ethos” with the development fallacy of colonialism, where local people’s sufferings were regarded as negligible or even necessary during the introduction of the colonies into the path of development that Europeans had walked. From this perspective, it was unfortunate that the Europeans did not regard the Others as Others, but “deficient examples of 'the same'”, i.e. not different but inferior and in need of supervision into development by the European “forerunners”. What led to colonialism was, according to Lange’s reading of Enrique Dussel, not rationality but, quite contrary, the irrational myth of a universal developmental process which Europeans had travelled further than other people. With reference to their own superiority and the “development fallacy”, the Europeans could argue that the colonised people were not yet capable to participate in decisionmaking. The resistance was based on the claim for participation now (Chakrabarty, 2000, p. 5).

## Postcolonial technoscience

Warwick Anderson and Gabriella Hecht were guest editors of Social Science Studies special issue on Postcolonial Technoscience (no. 5-6, 2002). Together with three other authors, they provide examples of how postcolonial theory is, after all, related and deeply integrated with technoscience<sup>4</sup>. In Anderson’s introduction, he identifies the theme thus:

A postcolonial perspective suggests fresh ways to study the changing political economies of capitalism and science, the mutual reorganization of the global and the local, the increasing transnational traffic of people, practices, technologies, and contemporary contests over 'intellectual property'. The term 'postcolonial' thus refers both to new configurations of technoscience and to the critical modes of analysis that identify them (Anderson, 2002, p. 643).

Anderson agrees with Kapoor’s analysis of literary postcolonialism “erasing the materiality and specificity of neocolonial encounters” (Anderson, 2002, p. 643), and argues for the development of postcolonial technoscience. This includes the study of how technologies travel, how ideas about difference act on technoscientific practice, and a focus on the commercialisation of science and intellectual property. The implosion of the two; postcolonial and technoscience will not only show how Western technologies travel outside the West. It will also destabilise Western technoscience at home.

Redfield’s discussions derive from the case study of a French rocket base in French Guiana. The space can be seen as the final and ultimate imperialist goal, where no natives, endangered species or diseases will hinder the colonisation. What Redfield has seen in French Guiana is two different attitudes towards the rocket base. While France sees it as a flagship and an important technical achievement, the inhabitants in Guiana feel alienated and see the base as a continuation of colonisation manners rather than a space adventure. “In some sense, the rocket has clearly 'worked' and, from the perspective of Paris, worked very well. [...] On a local scale, the rocket has not 'worked' in any simple sense, contributing to as many problems as it has solved” (Redfield, 2002, p. 801-2). Although the French have introduced modern technologies like refrigerators and paved roads, the accelerated social changes with high immigration of work force but with few locals employed in advanced positions has created suspicion and discontent with the rocket station. This relates to the case of African farmers referred above preferring the old systems of farming despite the lower yields (see Bonneuil, 2000).

In one of the examples that Redfield gives of the “rival spatial-temporal frames” (Redfield, 2002, p. 803), a road is closed down by the rocket base because it is too close to the base. The closing of the road is regarded by the French as a technical issue, but the local population regards it as a political issue; yet another sign of the colonial attitude and the ignorance they feel from the French. “Within the moral framework of an anti-colonial struggle, no technical rationale could out-

weigh asymmetries of rule” (op.cit., p. 806). The French also failed to recognise that their present activities or networks needed to take into account their historical activities in the same location. This is a concrete example of the need for ANT to pay attention to the context, in this case historical as well as present localities (see above). It is also an example of the now opposition to the thought that the colonised people were not yet ready for freedom (Chakrabarty, 2000; see page 17 above). The Guianas react towards the French activities from a position of being left behind, failing to be(come) modern, or “having never as much” (Redfield, 2002, p. 810) and inevitably, they have to relate to Europe as the forerunner, whether they want it or not.

Again, in critique of ANT theory, Redfield argues that his case study does not present “society” in singular form, opposed to nature. The rocket base or a rocket launch could be described as a functioning actor network, where resistances have been overcome, but the success depends on where in society, or which society that is taken as a standpoint. “Every place is local, but not equally so” (op.cit., p. 813) and the length and direction of the networks affect the significance of their presence and their being local. The empire did not vanish with the end of colonialism.

## Postcolonial technoscience as a rupture?

Hecht (2002 and 2003) relates the concept of postcolonialism with the nuclear age. Both the concepts were given an aura of rupture or a break with the past, which Hecht problematises. The turn into a nuclear age transformed former colonisers into nuclear “haves” and simultaneously former colonies into “have-nots” (nuclear power stations or weapons). In other words, “colonialism proved central to the technopolitical success of the nuclear age” (Hecht, 2002, p. 692). The rupture was thus not very sharp, but “rupture-talk had material effects. It was inscribed in sociotechnical practice, it staked claims to power, and it created expectations among both *élites* and non-*élites*.” (ibid.)

The case in Hecht’s work is the uranium mining that French authorities started in Madagascar and Gabon in the 1950’s. The mining was a way to secure uranium for French nuclear power and weapons development, as France feared being left behind by the US nuclear development. With access to former colonies, i.e. the newly independent states in Africa, France could ensure its “independent” nuclearity. Racial superiority was not claimed anymore, but the master role the colonialists had taken with reference to racial superiority, the “nuclearists” did with very similar argumentation relating to technological knowledge and expertise. The now versus not yet conflict continued to exist.

To the workers in Gabon, where the French-led uranium mining was on a rather large scale, the discipline that the employers required to avoid dangers represented a continuation of the colonial power relations rather than a rupture. While necessary with regard to the radiation risks, the danger sanctioned the continuation of hierarchies and discipline according to French standards among the workers. Information about radiation was transmitted, “not as knowledge, but as discipline” (op.cit., p. 719). The workers resisted the normalness of the work environment regulations in different ways. On the social side, they continued with polygamy, and with extended families living together in the nuclear family houses provided. At work, they did not necessarily regard dangers at work as a normal situation, but reacted with strikes when colleagues were hurt or killed in the riskful mining work. In response to what the employees experienced as a continuation of unnecessary dangers and discipline, the employees in Madagascar and Gabon reinterpreted their roles as “have-nots” in the nuclear age and in turn, reconstructed the nuclear age itself, e.g. by forcing the mining company to negotiate with the local conditions.

Hecht (2003) relates the post 11/9 era<sup>5</sup> to the same rupture-talk history-lessness. Many official persons in the United States referred to the event as a rupture, as, they argued, their technologies were suddenly used in unintended ways by the terrorists, and these technologies were turned into weapons “against its inventors” (quote in Hecht, 2003). Contrary to this argument for a new international politics, technologies were never not used outside their intended uses, and the

dichotomisation between the allies and the enemies was actual during the Cold War as well as now. The created gap between nuclear and non-nuclear provided a solution to the “loss of status threatened by decolonization” (op.cit., p. 3). In the development package that developed during the first post-colonial years, agreements with the non-proliferation treaty could therefore be seen not only as prevention from immature use of nuclear forces, but also a symbolic power gap that former colonisers wished to maintain.

By crossing the nuclear/non-nuclear divide, you’ve committed an act of pollution: you’ve made a ‘dirty bomb’. What qualifies such bombs as ‘dirty’ is not so much the technical infraction of mixing the ‘nuclear’ with the ‘conventional’, but rather the technopolitics of who’s doing the mixing, how, and to what ends. The stubborn persistence of global technical hierarchies figures here in important ways, most interestingly in the ‘how’ part: calling these bombs ‘dirty’ signals not just moral outrage at technological pollution, but also a disdain for the inability of the bomb builders to produce a ‘real’ nuclear weapon (op.cit., p. 7).

Some, however, did not accept these dictates, and for example India developed its own nuclear programme as part of its post-colonial “self-construction”. Bongo, President of Gabon at the time, promised to supply Iran with uranium from the mines that France had started in Gabon, without consulting the former colony in advance.

Hecht gives these examples to counter the idea that nuclearity is a matter of all or nothing: “there are dozens of intermediary steps between finding uranium in the ground and exploding it in a fission bomb. Each of these steps has its own technopolitics.” (op.cit., p. 5).

## Themes

### **ICT for development – a rupture or continuum?**

To begin with, I find it important to recognise that the argument for ICTs as a way to solve matters of vital importance risks ending up as “the boomerang of technototemism” (Hess, 1995) or “hICTeria” (Menou, 2001). Menou sees hICTeria both among proponents and critics, who seem to regard ICTs as the solution or the threat, while forgetting about other divides like “the fair working conditions divide” or the “healthy life divide” which are persisting divides that have been known for a long time. “Information itself does not feed, clothe or house the world”, and it remains to be seen whether ICTs in developing countries will create wealth among the poor in those countries or among the already wealthy (Main, 2001:96). Martín-Barbero (1993, p. 183) comments that many Latin American countries introduce the new ICTs without considering economic or social costs, as the implicit message from the producers is “adapt to the information technologies or die”. The new electronic technologies still seem to pose the same question; are you for or against development?

Menou (as well as others) suggests that the focus among proponents of the spread of ICT, more than an equity concern is “the appetite for new markets” (Menou, 2001, p. 113). It is therefore important to ask, if people in the Third World would actually gain access to the Internet on a large scale; would the contents of the web sites be of interest and value to these people? Would they be able to make use of the ICTs according to their own preferences and needs? Which of the different ICTs will be appropriated (Leonardi, 2003)? If not; what is required to make the ICTs useful to people in the Third World? And what happens with the global nature of the Internet when (if) local content in local languages begin to spread (Main, 2001)?

The question reflects Jane Summerton’s discussion about the non-users’ or marginal users’ ability to participate in agenda setting and policy making (presentation at EASST Conference, July 2002). In her example, she has shown how electricity companies prioritise customers with high consumption levels, i.e. house owners, offering different alternatives and rates, and a personal advisor. Customers living in flats, using less electricity, are offered expensive and non-flexible subscription. In development policy, as well as in software design, user participation occupies a steadily growing space of engagement, but what about those who are marginal users or non-users? Will their entrance into cyberspace be solely on the premises of those who are already in? Will they be delayed by the now versus not yet controversy?

Hecht’s notes on the continuum between colonialism and postcolonialism, and the parallel thoughts of “who counts” in the nuclear technology development, bring into mind a few questions relating to ICT. ICT is not a lethal technology in the same sense, nor has it developed in such restricted forms. What President Bongo in Gabon did when he promised uranium to Iran on his own decision,



Internet users do all the time. Yet one might wonder if the worries about Internet use and abuse do not relate to these conceptions from colonial times. At least in some modes, the paternalistic view of ICT reminds of the arguments presented in the work of Hecht. When the French authorities sent Frenchmen overseas in the postcolonial era, they were instructed to behave different from colonisers. They were told that the Africans were not inferior, but only less developed, and they needed to be treated with respect. Expertise should not translate into arrogance or violence. Also, technology was used to “uplift Africans” (Hecht, 2002, p. 698), and not to suppress them, but the obvious dominance over the Africans prevailed from colonial times into the postcolonial era. The Africans did not, as far as this account reveals, witness about any sharp change in the attitude from the French towards the Africans. The way ICT & development policies are discussed will probably not be interpreted as a rupture in relation to the development policies that Harding (2000, p. 249) calls “colonialism by other means”. This does not mean that nobody will welcome and embrace the new technologies, but they should not be expected to present the beginning of a new global era in contrast to the past.

With reference to Spivak’s (2001) experiences of being invited to represent the Third World while being accused for not representing the indigenous people in the Third World (see above), we are reminded that we cannot expect to find one single answer to questions about the introduction of ICTs in Third World contexts. Some will welcome the technologies in line with the World Bank visions of increased economic growth. Some will argue that the private sector will be able to meet the demands in the Third World. Others will argue that the technologies should be supplied or subsidised by the state in order to build independent and locally situated systems and information networks. Still others will dismiss the ICT hype altogether, arguing that every amount of money spent on ICT technology should be better spent on health or education. All these arguments are perfectly legitimate from the particular perspective, but neither of them can be taken to represent what “the Third World in general” wants or needs.

What we can do is to reconsider what forms of technological systems as well as software and content that we favour or make possible through specific development strategies, and how these will lead towards specific uses and applications and not others. We can also reconsider the different meanings that different ICTs have for people in different contexts. A specific ICT does not necessarily make sense in any particular context (Leonardi, 2003). In line with this argument, Westrup (2000), like many others, emphasises the need to ask what the introduction of a particular information system in a particular situation should be for, since both the symbolic value and the influence on relations will change. In extension, we will need to ask if ICTs are appropriate technologies in this particular situation, and be prepared for both “yes” and “no” as an answer.

## Context

Postcolonial theory and ANT have given important insights into the context dependence of technological applications. Although this is increasingly recognised in theory and in policy, it is still often overlooked in practical applications. The reason is a lack of recognition that the actual technology is not a neutral device that allows the user to choose his or her own way of using it according to the local understandings. The actual difference in local understanding and preconditions is also often underestimated. The colonial time has indeed spread European ways of doing things, but these ways have also been adjusted to the local context through fluidity and improvisations. In Suchman’s (2002) account, the perspective from locations outside the West magnifies the situatedness and the fluidity of technologies, although these are actual within the western context as well.

Paraphrasing Donna Haraway, Suchman (2002, p. 140) argues that the design from nowhere is a result of the idea that technical systems could be constructed with a minimal cultural connection “as commodities that can be stabilized and cut loose from the sites of their production long enough to be exported en masse to the sites of their use”. Suchman calls this phenomenon “the fallacy of the empty vessel”; “mistaking one’s own ignorance of what exists elsewhere – knowledges, information systems, practices – for their absence” (ibid.).

Malling (2000) has analysed ICTs in the light of three different ways of communication. These are personal communication between two or more persons without technical mediation, passive externalisation of meaning, where meaning is produced by people with the assistance of technical devices like written promemorias, calculators etc., and active externalisation of meaning, i.e. the possibility for the technology to analyse data and take action according to its analysis without the interaction by humans (as soon as the programming is finished). Malling has identified the main use of ICTs as “active externalisation of meaning”, and according to Malling, ICTs were developed to meet the needs in the West for this externalisation of meaning, although we are still in many ways busy developing the passive modes of externalisation.

In his report from Nepal, Malling witnesses about the lack of need for an active externalisation of meaning, making the introduction of ICTs of rather low priority. People in the office where he worked still relied almost solely on oral personal communication, and hence, did not need the computers to facilitate written communication or documentation. On the contrary, information was kept away from written documentation in order for the owner to control who would gain access to it (i.e. by asking the person). Information was in this way regarded as a currency which could be traded for other information or other assets, not, as in the West, as something all employees should have access to in order to facilitate non-hierarchical cooperation within the organisation (see also Suchman, 2002 for a discussion about invisibility of the work and the spaces for action and hiding of local innovation that this offers).

Walsham (2000) gives a similar example from India, where geographical information systems (GIS) were supposed to facilitate the planning. GIS, however, require an acquaintance with maps, which Walsham did not find in his Indian case.

These cases exemplify Westrup's (2000) conclusion that the implementation of a computer system "is not introducing a neutral material artefact". The organisation will have to change its practices to enable the use of the system accordingly. Some of these changes may only be recognised in implementation, and all changes will not be regarded as an improvement. The users (employees) may resist the implementation of ICTs that bring unwanted organisational/social changes by using the systems in their own ways rather than the prescribed ways. Walsham's (2000) response is a demand for technologies to be "plastic" to some extent, so that actors in a local context can engage with the technology and mold it to their improvised work practices. Silva (2002) describes the same processes, where "unexpected, institutionally rooted actions" evolve in response to the implementation of information systems, as improvisations. Through participant improvisations, if these are allowed, the users (employees) become more committed to the final system.

Technologies are not transparent tools that can be used in any manner. [...] The key lies in taking the original imported technology as energy, as a potential to develop on the basis of the requirements of the national culture. This does not ignore the fact that at times the only way to actively take control of what is imposed on us is the tactic of the anti-design, a design which is parody and involves technology in a game which denies it as a value in itself. In any event when the machinery itself cannot be redesigned, at least its function can (Martín-Barbero, 1993, p. 185-186)

Heeks (2002) elaborates on the gap between the design of information systems and the actuality in which they are supposed to function. These gaps are always present, but are particularly evident in Third World actualities, since the information systems are developed in (or with close connection to) the West (see also Suchman, 2002). The closing of design-actuality gaps can be met both by improvisation of the actuality, making it closer to IS design, and improvisation of design.

The width of the gaps that Heeks discusses, will determine the need for improvisations, and, in the extension, the success of implementation. Information systems have most often failed in Third World contexts, usually because of the wide gaps between design and actuality. Heeks argues that designers may actually deliberately design the systems "to choke off opportunities for local improvisations" (op.cit., p.109), for example by designing large systems that need to come in package instead of divisible subelements. These attempts ("design-imposing applications with deep inscription") will reduce the likelihood of success. On the other hand, systems that allow for (and require) contingent design improvisation, require local capacity to improvise, which is far from always present.

To complicate the discussion further, Suchman problematises the distinction between designer and user, pointing both to the designers as users of their own

products, and to the invisible design-in-use often taking place without rigorous documentation. "Even to keep things going on 'in the same way' in practice requires continuous, mundane forms of active appropriation and adaptation of available resources – discursive and material – to the circumstances at hand" (Suchman, 2002, p. 143). "Artful integration" is used by Suchman to make visible the small, gradual transformation that is more likely to produce change of lasting value than discrete change events that Heeks has analysed. Martín-Barbero (1993) and Morley and Robins (1995) similarly argue that the recipients always re-interpret, adjust and transform what they receive through the media, even if this is not the intention from either side.

Arunachalam (2002) has given an example of when the introduction of new ICTs in poor, rural villages in India have made a change to the people. Through MS Swaminathan Research Foundation, solar powered computers with Internet access have been installed in ten remote villages in Tamil Nadu. The participating villages must ensure access for all villagers, and they have selected volunteers within the village to run the service. Intranet and Internet pages are produced in Tamil language, and the pages are fully devoted to the villagers' interests and needs. For example, weather forecasts are published for the fishermen, health advice is searched for by the volunteers when villagers need it, wages and prices of agricultural products are discussed within the region, and local transport is announced. The success of this project is, according to Arunachalam, that the focus has not been on the delivery of technological equipment, but on finding technologies that could support the needs of the people as they themselves define them. In this way, the success is declared by the people in the local context.

This story reminds us of the nature of the Internet. It is not just a global blanket spread over us all, but a myriad of localities that are no longer entirely geographically local. Still, they are situated, which is especially understood when the language is not English (although obviously, English, too, is local). The content of each web page is not of universal interest, but of interest to a specific group of people. In the Tamil Nadu case, the group is a geographical locality, but in other cases, the locality might be virtual (ideographic), gathering birdwatchers or railway enthusiasts or postmodern theorists or environmentalists. The global nature of Internet access will be affected by the increasing emergence of sites in other languages (Main, 2001).

While the postcolonial thought requires recognition of the local context, we are reminded by Rolland and Monteiro (2002) that the Internet connects sites all over the world, and policies and technological development need therefore to balance between situatedness and "economies of scale", translationability of content and form, technological compatibility etc. (see also Everard, 2000).

### Individual and national identity

The concept of identity is not universal or stable. A simple example of this is the Cameroonian proverb “A child is one person’s only in the womb”, which means that every person, as soon as she/he is born, will be in relation with and in responsibility towards a range of other people, including family members and neighbours. Only in the womb, the child belongs to the mother alone (Nyamnjoh, 2002). I interpret this approach towards the person as different from the tradition that I am part of, where the freedom of the individual is taken for granted as a fundamental condition. To be someone else’s would be quite contrary to this ideal, although the “free individual” in the western sense is of course also in relation with others. In a postcolonial perspective, the different perceptions of individual and group identity will have consequences for the view of what ICTs may mean. The emancipation of the individual is also not a neutral claim, but rests on Western values of individualism.

According to Leonardi (2003), United States Latinos, for example, are generally viewed as part of a collectivist culture rather than individualist, and this has consequences for their uses of ICTs. Mobile phones, for example, are regarded as a positive tool to keep contact with family members and friends. Computers and the Internet, on the other hand, are regarded as negative, stealing time from the social interaction with the family. The computers are thus not seen as communicative tools, but information gathering tools, and as such, they do not contribute to the maintenance of the collective identity or the social network.

At the same time as the freedom of the individual is expected as a result of ICT spread, many fear the loss of cultural identity on a group level, given the cultural hegemony spread through the ICTs. What will seem to be empowering on an individual level might cause a loss in collective and cultural terms. The fear of nation-states to lose control over what citizens read and hear can be regarded as a conservative, undemocratic activity (e.g. Robins and Hilliard, 2002), but it also contains elements of protection of cultural traits and national virtues, especially in the fragile postcolonial states that have to mobilise around nations geographically determined by the former colonisers (Fürsich and Robins, 2002). Malaysia’s Prime Minister Mahathir was quoted expressing suspicion or fear over the private ownership of the major TV channels available in Malaysia, and we are reminded that the content of the Internet is not more neutral than the governments that resist its uncontrolled spread (Wang, 1997).

Everard (2000) reminds us that the nation-state is challenged mainly as an economic unit, while it still remains the security unit (with police force etc.) and in other ways remains unchallenged. As long as the need/desire for national security persists, some kind of nation-state will need to be maintained. The identity of the nation-states will be influenced by the new ICTs. “Computer-mediated communication in a globalizing economy does not automatically transcend old

categories such as nation and the nation-state, as many cybertheorists hope, but may reinforce them and fill them with new, corporate, meaning” (Fürsich and Robins, 2002, p. 208).

Martín-Barbero argues that media was used politically by the states to create the nation state during the period 1930’s-1950’s, but in the 1960’s, the media turned into an economic function, with the idea “to make the poor dream the same dreams as the rich” (Martín-Barbero, 1993, p. 165). He differs between radio and press, which he regards as expressing diversity, and TV, which seems to absorb and deny differences in order to attract as many viewers as possible.

In a study of 29 African governmental Web sites, the issue of nation-state identity is raised by Fürsich and Robins (2002). What they found in their study was that the Web sites were directed towards foreign investors and tourists, rather than the nation’s citizens<sup>6</sup>. The self-image of the nations and their citizens that was presented was very much in line with a western colonial image of exotic Others. The Web sites generally aim to present the countries as nations of harmony and aspirations towards modernisation and capitalist progress, with an additional flavour of traditional cultural heritage. While the sites seem to aim at emphasising the nation-state as a unity (in reaction to internal differences and in line with the colonial mapping of Africa), the different nations have set out to compete with each other for foreign investment, rather than creating a potential for a pan-African identity. In addition, many of the Web sites were produced by commercial companies in the West, and the technological logics and aesthetics “reinforce the dependence of these texts on Western knowledge production” (op.cit., p. 190).

Fürsich and Robins conclude that “the new technologies are being developed and implemented in ways that reinforce existing power structures” (op.cit., p. 193). Hypertext, which could be argued to promote non-hierarchical and multicentered politics and relations, in this case seems to reinforce the authority of Western knowledge producing institutions. Blurring of boundaries has not offered the African Web site producers new ways of expressing themselves, but instead imploded foreign and native to the advantage of the foreign (see also Abbott, 2001).

The images that reveal themselves on the Internet and Web sites are important, as the Internet is an important arena of negotiation of the “global identity crisis” that globalisation has brought with it (Fürsich and Robins, 2002). In the governmental Web sites that were studied, Fürsich and Robins note a self-image that says “This is who we are to you (the West)” or “This is who we want you to believe that we are” rather than “This is who we are” (op.cit., p. 205). The creation of this image could be regarded as a powerful competency for the African nations, not only as a victim position, but still within the master discourse (Kapoor, 2002, referred above).

Fürsich and Robins see the images not as a response to the colonial past, but a reflection of the current global economic and political inequalities. Everard



(2000, p. 57), however, argues against the idea of rupture-talk of the new ICTs as non-hierarchical, by referring to the present situation as the countries being “virtually colonized”.

While there is a fear that modernity will have a strong influence on traditional cultures, Nyamnjoh (2002) has also noted that the traditions influence modernity, leading to a “marriage of both” rather than the triumph of either. In his case from Cameroon, the young individuals who had become successful in the modernised sense were aware of their connection and their place in the traditions and the collective in which they were raised, and the traditional leaders were open to negotiate with these changes.

Hongladarom (2002) gives an account from Thailand where a similar two-way exchange has taken place. Hongladarom discusses different times, and sees that the local times, which determine ceremonies, seasonal activities and celebrations in the local society exist parallel with the modern, linear time model. He argues that the new time that Internet has introduced, when everything happens simultaneously in a nonlinear individualised way will contribute to the possibility of coexistence between local times and Internet time. He argues that many theorists neglect the power of local people to react, negotiate, adopt according to their own interests.

Wang (1997, p. 313) also found that the audiences to television in developing countries, especially the rural population, “tended to cling to their own music, drama, dance, language and customs”, despite the access to international influences. The production of locally adjusted or “culturally sensitive” TV programmes has been done by transnational as well as local companies in e.g. Turkey and Singapore.

To me, it seems that there are two opposing interpretations of the process: either, a fear of monoculturation through the ever increasing flow of Americanised cultural expressions globally, a fear legitimised by what has already changed in the different countries and cultures. Or: faith in the strength of the local cultures, which have shown to resist and remain until now despite the flow of Americanised culture. That is, has the change been alarming or less that could have been suspected? The question clarifies the different standpoints. In part, the different expectations depend on if you regard the introduction of ICTs as a rupture or continuum. Do they represent more of the same, possibly at a higher speed, or do they present a change? Change in terms of individual access at any time, possibility to be active and add comments rather than only receive information etc. The answer will also depend on whether the individualised conception of identity is welcomed or not.

#### **End user agency**

Rathgeber and Adera (2000, p. xvi) writes, in the executive summary to *Gender and the Information Revolution in Africa* that information must be made “directly

relevant to the needs of rural women. [...] This will involve careful selection and repackaging, often repackaging into local languages”. I do not suspect that the authors of the book aim to control rural women’s use of the Internet, but the argumentation nevertheless resembles the dichotomous thinking relating back to colonialism. The rural women are expected to need the provision of ready-chewed, mildly spiced applications that they can use despite their backwardness, in order to improve their lives a little bit with the help of modern technology and information. They are not yet expected to have any influence in return on the technology or the technopolitics of ICT. But what if they do? What if they already did?

ICTs and the Internet are often argued to be empowering for subordinate people. Grassroots organisations can have contact with each other over distances, and people can communicate without the control of the governments. People can also take on different identities or be anonymous, if they fear discrimination or prosecution, or if they want to experiment with their identities (e.g. Loader, 1998 and Warf and Grimes, 1997). The avoidance of control by the governments is often regarded as the major empowering benefit that the Internet offers<sup>7</sup>. Social action based on remote, international networks of common perceptions may also challenge existing social structures (Loader, 1998). Holderness (1998, p. 35) claims that “ideography replaces geography” as everyone on the Internet is in the same place and need not be restrained by their geographical location.

Warf and Grimes argue that the communication with people with whom we share ideologies and possibly socioeconomical situation, cannot replace the interaction with others in our daily, nonvirtual lives, and we should not “ignore nearby persons of different ethnicities or social classes who experience the world very differently” (Warf and Grimes, 1997, p. 6). Abbott warns that the Internet can never “substitute for more traditional forms of political mobilisation and action”, and the voices of activists in the developing world may be drowned by the voices from the developed world and from the commercialisation of the Internet (Abbott, 2001, p. 111). “A cyberpolitical danger is that it may become an ineffectual substitute for politics in the real world” (Westrup, 2000, p. 8). This is specifically problematised by Mejias (2001, p. 220), as it is in particular the elite which is provided with a “means to distance themselves from the ‘ugliness’ of reality while maintaining the control”.

Colby (2001) argues strongly for a network that does not only provide the possibilities to receive information (and commercials), but the ability to produce speech. The dichotomisation between producer and “end-user” or consumer increases as commercial interests are prioritised and public intervention in supplies of symmetrical band-width are minimal. While the public debate in the US mainly concerns the provision of instrumental access to communication networks, information content is less frequently discussed and the power to produce speech – input on the Internet is hardly ever raised. As long as the digital divide is defined as lack of access to information for end-users/consumers, the solutions will



continue to be the supply of ICTs that are sufficient to receive information but not to produce expression interactively (see also Karelse and Sylla, 2000).

A postmodern “network-of-networks”, according to Colby (2001), also requires open-source software like Linux, where the users are free to modify the code according to her/his needs. With reference to the US First Amendment, Colby argues that there is a need for “governmental attempts to require the new media to make the factors of producing speech more accessible to citizens” (op.cit., p. 133). Not only technical equipment and training is thus required, but also “ubiquitous connectivity that strives evenly to distribute the means of producing speech” (ibid.). Colby argues on the basis of the US Constitution and the Telecommunication Act, situating the discussion on a national level. However, his arguments apply just as well on a global scale, where asymmetrical band-width and technical equipment is as burning (see e.g. Abbott, 2001).

Martín-Barbero (1993, p. xi) does not debate the media ownership, or the intentions that the owners have, but instead looks at how “the masses” make use of and transform popular media and mass culture within “the texture of everyday life”. For Martín-Barbero, culture is always negotiated between groups, and national culture is always provisional. The media producers have, in some of his examples, clearly adjusted their production according to the reactions by the masses, although mass culture and popular culture is regarded as primitive or absence of culture. The masses do not suffer under simple domination, but resist and transform the dominant cultures when appropriating them. And the media and its technologies need to “make sense” if people are going to use them (see also Morley and Robins, 1995).

### **Modes of communication**

Several instances where ICT in Africa or in the Third World are debated (e.g. WSIS), comment on the need for different languages on the Internet. Most web sites are in English, but there is a need for both different languages, different alphabets, and pictorial sites for illiterate users (e.g. Main, 2001). The language is however not the only barrier to Internet access.

In her reflections about cross-culturalism, Margaret Kumar (2000) contributes important insights into the relations between what is said and how it is understood within a specific culture. According to Kumar, “culturalism denotes the flexibility of the Self to engage in the communication of verbal and non-verbal signals”, and is thus “a continual process of movements of ideas and values” (op.cit., p. 84). Cross-culturalism denotes the crossing of barriers, and in reality, the constant crossing of ideas, values and linguistic terminology between cultural groups have led to cross-culturalism and hybridity in all societies. Kumar argues that new cultural expressions entering a social system will gradually be embraced and integrated into the culture in a desire for similarity and comfort/recongnisability.

In a diverse community, this means that individuals need to have knowledge of how language differ from one construct to another. What may be correct in one situation may be incorrect or ‘not nearly as right’ in another. [...] Consequently, learning a language does not merely entail learning a new phonology or syntax; an individual must also learn how to work out or think things through in an unfamiliar way [...] and learn] to make the right predictions and to look at language in the context of a society. [...] In a diverse community, speakers from different cultures talk about issues in several ways. Topics, incidents and problems are regarded in various ways and may follow different codes of behaviour (op.cit., p. 87-88).

Especially in a cross-cultural setting, speakers’ ignorance of this may lead to either non-communication, miscommunication or communication breakdown. Recognition, on the other hand, requires a dialogue that alternates between speaking and listening in order to establish common knowledge for cross-cultural understanding. The lack of understanding between the French and the Guianas (see reference to Redfield, 2002 above) could be read as an example of a cross-cultural miscommunication or non-communication.

A postcolonial perspective necessitates a problematisation of theories of communication. According to Shome and Hegde (2002), communication studies at large rest upon a Western, modernist perception of communication, that is unreflectedly regarded as general or universal.

This relates to the communication and reception of information through ICTs. This will not necessarily be similar in societies where the main communication is that of “few to few” (Mungoshi, n.d.), compared to societies where “few-to-many” communication is common (Holderness, 1998). Holderness calls the Internet a “many-to-many” medium. Colby (2001) similarly argues that the major change with the new ICTs compared to TV or radio, or telephone, which are the latest previous ICTs that were introduced, is the possibility of one-to-many communication, and peer-to-peer, in addition to the more common authority-to-masses (TV, radio) and one-to-one (telephone). Warf and Grimes (1997) support the possibility for personal rather than expert texts.

Communication also differs between oral and literal, where “the spoken word articulates reality and embeds knowledge in our immediate environment” and involves a “constant negotiation between the Self and the Others” (Mejias, 2001, p. 218). The written word requires distance and the interaction between the word and the person is more abstract. In a similar way that nuclearity or technological acquaintance is used to maintain the (colonial) divide between “haves” and “have-nots”, the hierarchical sorting between literal and oral communication is maintained with the use of text-based computer interfaces (ibid.). Mobile phones were originally oral, but the recent development has favoured literal communication, including SMS, WAP etcetera.

In the West, we are used to receive non-personal/standardised messages from authorities, although we have problems learning how to select reliable information from the floods of messages on the Internet, and how to sift out our main interests

in order not to drown with the volumes of available resources. We are used to the neutral/impersonal tone in the messages, and are used to interpret them according to our personal framework. In communities where personal encounters form the main way of learning new things and discussing different standpoints, we cannot take for granted that the adaptation to ICT use will be similar. Walsham (2000) argues that, in his study of geographical information systems in India, personalised relationships for communication were preferred. As information technologies disembed social relations from local contexts, they are therefore regarded with scepticism or disinterest. The empty vessel fallacy is easily adopted, and failures of ICT implementation explained as lack of competence.

### **Pluralism or imperialism?**

It is often argued that the ICTs and the Internet are non-hierarchical and democratic, allowing for diversity and non-oppressive relationships. Gunkel (1997, p. 18) reminds us of the fact that the non-hierarchical characteristics of the Internet did not arise from the vision of grass-roots connections, but out of “nomadic military strategy”. Indeed, the Internet was developed to reduce the risks of complete destruction of central information during an attack. This origin does, according to Gunkel, still have effects on the Internet that is used internationally. American users are privileged, having no nationality domain addresses but organisational suffixes (e.g. .com and .org), “virtually universalis[ing] American netizens” (op.cit., p. 19). The language, likewise, privileges English-speaking people, which is also a result of the colonial history. Not all Indo-European languages have all their characters represented, let alone non-alphabetic scripts.

Statements that locate socio-cultural emancipation in the very material of technology efface history by actively disengaging technology from its cultural context and genealogy. Technologies are never neutral [...] This is not to say that the Net could not eventually begin to disentangle itself from the web of its own genealogy. This disentanglement, however, would need to take this complicated paternity and its consequences seriously (op.cit., p. 20).

In Redfield's (2002) study, referred to above, it was shown that what the French regarded as a technical issue was regarded as a highly political (and contested) issue by the local population in French Guiana. In the promotion of ICTs for development, the introduction of these technologies are similarly discussed in technical terms, considering the problems of electricity, telephone access and expensive computers. The argument for introduction is also rather instrumental, expecting income generation and economic upliftment. But, as e.g. Weckert and Adeney (1997) argue, the spread of ICTs in diverse cultural settings might very well be regarded as culture imperialism, given the unequal access to resources for alternative technologies or content.

“Much of the Internet's use [...] reinforces entrenched ideologies of individualism and a definition of the self through consumption”. Commercial applications

and public agencies that sustain existing ideologies lead to hegemonic discourses being reproduced unintentionally on the Internet (Warf and Grimes, 1997, p. 2). Internet is a cultural product, and reflects social categorisation and power relations.

The position of “having never as much” (Redfield, 2002, p. 810) will for a long time be the position from which people in the Third World will receive ICTs. Redfield showed what reactions and tensions this position may create. Are ICTs yet another way of imposing control, of deciding what is important to know and to have, of showing who is in charge of globalisation? Are they yet another demand on transfer from national to private and commercialisation of common goods? A tool “to make the poor dream the same dreams as the rich” (Martín-Barbero, 1993, p. 165)?

In his interest in the recipients' agency rather than the producers' intentions, Martín-Barbero (1993) concludes that the mass culture has its own ways of developing. There are also two alternative ways to look at ICTs; as a tool spread by transnational corporations and Western governments to assist other people to “catch up”, a tool to support the spread of Western hegemony, or as a tool that “the masses” make use of and reinterpret in their own social context to their own benefit. There are also counterhegemonic users of the Internet, both progressive and reactionary (Warf and Grimes, 1997). Progressive users include marginalised people who cannot express their identities and needs in the “real” world due to e.g. discrimination, activists in the Third World who can communicate with partners abroad at low cost, and, more generally, activist groups that can communicate widely. Expertise unavailable locally can also be reached. The capacity to judge critically what is found at the Net is underacknowledged, though.

The latter interpretation is obviously more optimistic, expressing a belief in the empowering potential of the non-hierarchical structure of the Internet. This question was touched upon earlier, and Colby's request for a technology that opens for the freedom to make oneself heard highlights the borderline between ICTs supporting imperialism or pluralism (Colby, 2001; see also Loader 1998 and Morley and Robins, 1995). “Our challenge lies in theorizing exactly this interstitial space between agency and the lack thereof, between being constructed within structures of domination and finding spaces of exerting agency” (Shome and Hegde, 2002, p. 266).

Agustín is critical of the unreflected top-down ideas that all information poor yearn to become included. Some do, but not all. And, if they do not; “should they be forced to be included, if being included could ‘help’ them?” (Agustín, 1999, p. 152). Agustín is also sceptic towards the idea that the technologies will liberate the unheard voices, for “those voices have been talking all along. The question is who is listening” (op.cit., p. 155). If the voices are published on the Internet but nobody is reading, no improvement or empowerment has been achieved. One

cannot expect that everybody is interested in becoming an information consumer in the way Internet promoters seem to think.

In her work with migrant domestic and sex workers, Augustín sees a potential in the use of information technologies if they could be “wrench[ed] out of its current place in hard plastic boxes and give it a ‘virtual’ reality” (op.cit., p. 155). Her suggestion is mobile cybercenters on trucks, equipped with faxmachines, telephones and computers, where the marginalised people could come on specific times when the truck passed their area.

## Conclusions

I want to summarise the aspects of ICTs in the postcolonial that have been mentioned in the previous, to clarify a few of the important characteristics that need consideration if the emancipatory potential of ICTs is to be addressed. The different themes that I have identified; rupture or continuum, context, individual and national identity, end user agency, modes of communication and pluralism/imperialism are just a few of the strains that will affect postcolonial ICT development.

ICTs share some traits with other technologies and with the debate around technologies and development in general. It is questioned whether the technology in itself is good or bad, or if it is a neutral tool that can be used for different purposes. With reference to feminist technoscience, it is impossible to detach a technology from its application, whether it is intended or not (as in the case Hecht describes). A technology is a force, which has magnitude and direction, leading society towards certain directions rather than others (e.g. Keller, 1992 and Bush, 1983). ICTs, in this sense, support high-speed distant two (or multiple)-way communication; not personal communication (like hearing aid) or (solely) one-way communication (like television). The Internet supports literacy, especially English, rather than oral communication, but ICTs more broadly defined could also be used in flexible ways in this sense. The differentiation between different ICTs, like mobile phones and computers and the Internet is required when these aspects are discussed (see Leonardi, 2003). Note that the different characteristics are not evaluated, but nevertheless important to highlight. The potential ICT users in the Third World may need to redesign the technologies in these aspects, in order to make them useful in contexts where oral and personal communication is the major way of communicating with others.

The directions that ICTs lead towards, for example distant communication as mentioned above, may be interpreted as unifying and networking on a global scale between interest groups to their and society's benefit. ICTs may also lead to an increased spread of American and western ideals and commercial products, increasing the global dominance of US and other western nations. The creation of virtual (non-geographic) communities may also reduce the preparedness for local community engagement, to the detriment of democracy as we are used to see it.

Postcolonial theory relates to a very specific historic moment, when the former colonies in Africa, Latin America and Asia became independent states. This historic moment has often been regarded as a rupture with the past, but many of the current international and global relations share roots with the colonial. This cannot be wished away when negotiations and collaborations are established. Similarly, ICTs are sometimes referred to as revolutionary, but they will also travel on existing technologies, modes of communication and (post)colonial relationships. As

long as ICT developers are from, or are educated in a Western community, the values of this community will likely continue to affect the design and content of the ICTs, wherever they are installed.

The success of a technology or a technology transfer depends on the perspective. The organisation (official or commercial) responsible for the installation may have purposes quite different from the expectations among the intended users. From a commercial or administrative point of view, the introduction of e.g. computer networks may be regarded as a success while the local users are dissatisfied or even negatively affected. On the contrary, another communication technology installation may be regarded as a commercial or administrative failure but an important empowering tool for the local people. The use of the system may therefore differ from the intended use. Depending on the fluidity of the design, the system will be possible to adopt by the users when their needs differ from the intentions.

With reference to the conflict between not yet and now (Chakrabarty, 2000) and to Colby's (2001) argument for end-user access to the production of speech, it is important to design systems that are not built from technologies that were sorted out as oldfashioned and replaced in the western countries. Especially with regard to language requirements and possibly the use of satellite transmission, touch-screen computers and non-literary modes of communication, the equipment needs to be sufficiently advanced and fast.

The different modes of communication will also affect the content and adoption of ICTs. If oral communication is preferred, or if there is reluctance of exposure of information for open access, a computer system may be used more for one-to-one communication over distance than one-to-many, or more for information collection than production.

Similar to Hecht's description of the diverse uses of nuclearity as "dozens of intermediary steps" between "all or nothing" (see p. 21 above), we might want to discuss different ways to jump safely between the tufts of a "digital swamp" rather than a bridge over the digital divide. In fact, the mere reference to a digital divide might hide an attempt to maintain that divide between "haves" and "have-nots".

Users are never passive receivers of a black-box technology, even if this is the producers' intentions. Users will always improvise, and if they find no way to make meaning of a specific technology, it will be abandoned. Arunachalam (2002) has given an example where the users were able to appropriate ICTs in their specific situation. This does not take away any responsibility from the producers and distributors of ICTs in the postcolonial parts of the world. "You've got to start somewhere" is a diametrically different point of view when it is expressed by the unorganised oppressed than when it is expressed by the privileged and those in control in research institutions or companies (Spivak, 2001). "You've got to start somewhere", sending old, outdated computer equipment to Africa is thus not the

same thing as "You've got to start somewhere", when a group of farmers together put up a phone booth.

## Notes

- <sup>1</sup> The search was made in June, 2003 at Linköping University Library.
- <sup>2</sup> The literature references were found during the mentioned literature search, and a "snowball" search via the reference lists in the found papers and books. The focus has been on postcolonial theory, postcolonial technoscience, the digital divide, ICTs in developing countries, communication theory in relation to developing countries.
- <sup>3</sup> According to Deepak Kumar (2000), India paid much effort to showing that rationality and scientism was a universal, not a European asset.
- <sup>4</sup> The given accounts are examples, I would suggest, of the micro-level analysis that postcolonialism could be criticised for, but that nevertheless provide interesting arguments against technological determinism.
- <sup>5</sup> 2001, when aircrafts were hijacked and flown into the Twin Towers in New York City and into Pentagon, USA.
- <sup>6</sup> This might in part reflect the small share of citizens who have access to the Internet in most African countries.
- <sup>7</sup> Zhao and Schiller (2001) reports that some of America's most successful high-tech companies sell software that enables security forces to control the cybernet information flow into and out of China to the Chinese government. The empowering potential is in this case subaltern to the commercial interests.

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## CHAPTER 2

## ICT and Innovation Systems in Developing countries - Rwanda case study

ALBERT NSENGIYUMVA

### Executive summary

The following chapter provides an overview of ICT Sector in Rwanda in general and ICT development in Education with an emphasis on ICT Policy at the National University of Rwanda as the major public higher education institution. This chapter along with other case studies available in this book is part of the research activities undertaken by "Blekinge Institute of Technology" in Sweden and is funded by the Swedish International Development Agency (SIDA). The chapter covers the development of the telecommunication sector in terms of Infrastructure and services taking into account the level of penetration and usage basically for mobile and fixed lines with an emphasis on the development of Internet in the educational sector and take innovation systems as a way forward for leveraging the life of those living in the general context of poverty.

A special attention is made on the issues of policies and access as well as the issue of quality assurance and affordability as many of the Rwandans living in remote areas can neither access nor afford to pay for higher education studies.

Since 1998, the Government of Rwanda (GOR) has worked on elaborating a national framework for the development of an ICT sector. This elaboration has resulted in an ICT Policy for Rwanda, adopted by the Cabinet in the beginning of 2000. The ICT Policy states the visions and strategies for transforming Rwanda's predominantly agricultural economy into a knowledge-based economy through the adoption and development of ICT and its applications.



## Country background

The principal policy instrument for the transformation is the National Information and Communications Infrastructure (NICI), which, by purpose, ranks among the most ambitious initiatives of its kind in Africa. The NICI is supplemented by a comprehensive blueprint with a series of specific initiatives for achieving the policy objectives. The blueprint serves as a strategic vehicle for the transformation in line with Rwanda's Vision 2020. The first quarter of the blueprint covers the period 2001-2005 and is anchored on eight pillars namely human resource, ICT infrastructure, e-government, community access, ICT in education, legal and regulatory provisions, private sector facilitation and foreign direct investment, all which aim at promoting ICT.

For an ICT as enabler strategy and synergies among the components to be achieved, a basic level of institutional capacity is required. Since ICT is cross-cutting all sectors, a comprehensive and holistic approach is the most effective way to benefit from synergies and ensure the impact of ICT deployment is optimized. Rwanda has recognized that national strategies are critical to using ICT effectively for development goals and has already institutionalized these through the establishment of Rwanda Information Technology Authority - RITA whose main responsibility is to catalyze and facilitate the articulation of national and sectoral ICT strategies, their implementation and monitoring processes. In addition, relevant reform has resulted in the establishment of a multi-sector regulatory agency (Rwanda Utilities Regulatory Agency – RURA) and on-going liberalization of the telecommunication sector.

The two major obstacles that Rwanda is facing for ICT to take off include the lack of human resources both on Technical and Policy and Regulation sides and the general context of poverty whereby the basic infrastructure such as electricity and telecommunication facilities are very limited.

Rwanda is a small country in East/Central Africa with 26,363 square km and a population of eight million inhabitants making it the most densely populated country in Africa with over 390 inhabitants per square kilometer. The population is increasing at a rate of 3.6% per annum and 90% live in rural areas. Almost all arable land on the hillsides is under cultivation. Because of the high population density and limited land for cultivation, Rwanda is facing a unique situation whereby arable land scarcity (about 59% of Rwandan farmers cultivate on a piece of land less than 1 square acre) and the declining soil fertility is forcing the country to look for alternative development models to sustain the population.

Rwanda is classified among the poorest countries by the UNDP, World Bank and other institutions assisting developing nations. Poverty is not only persistent but remains widespread, with an estimated 60% of Rwandans living below the poverty line. The 1994 war and genocide not only halted economic development but also destroyed the social fabric, thus deeply exacerbating the pre-war socio-economic crisis. One out of seven Rwandans was massacred during the genocide, and at least 130,000 able bodied persons have been incarcerated on genocide related crimes. Poverty soared after the genocide with as many as 71% living on less than a dollar a day, while the Gross Domestic Product fell by 50%.

While the war and genocide of 1994 aggravated poverty conditions, poverty in Rwanda is rooted in long standing social and economic conditions. The main underlying factors are environmental degradation and decreasing availability and quality of arable land, the low level of human resource development, and bad governance of former regimes characterized by a heavily centralized polity and economy, and a culture of impunity.

### ICTs in Rwanda<sup>1</sup>

#### Telecommunications Sector

The two major obstacles in the ICT sector in Rwanda are the lack of human resources – both in technical matters and in the areas of policy and regulation – and the general context of poverty, whereby basic infrastructure, such as electricity and telecommunications facilities, is very limited.

Since 1998, the government has been working to define the ICT sector and its role in the development of the country. The resulting ICT Policy for Rwanda was adopted by the Cabinet at the beginning of 2000 and states the vision and strategies for transforming Rwanda's predominantly agricultural economy into a knowledge-based economy through the adoption and development of ICTs. Rwanda has established the Rwanda Information Technology Authority (RITA) to facilitate national and sectoral ICT strategies.

In addition, a multi-sector regulatory body, the Rwanda Utilities Regulatory Agency (RURA), was established in January 2003. It has **jurisdiction over several market sectors including** energy, transportation, communications and waste management. This new agency does not yet have the human capacity needed to serve all the sectors it oversees, including the growing ICT market.

The Rwandan government owns the major telecommunications company, Rwandatel, which provides fixed-line telephone services as well as Internet connectivity. The Ministry of Infrastructure oversees the company and, until January 2003, was responsible for issuing new licenses for all telecommunications services. The process of privatizing Rwandatel is underway. A new private-sector player, Artel, is providing fixed telephony over VSAT satellite, mainly in remote areas. Artel is not seen as a competitor to Rwandatel but rather as a complement to the incumbent by providing access to remote areas where lack of infrastructure has been a big handicap for telecommunications facilities roll-out.

## ICT policy

The Rwandan ICT-led Socio-Economic Development Policy and Plan Development Process which is being supported by the Economic Commission for Africa (ECA) within the framework of the Africa Information Society Initiative (AISI) began in 1998. The process is divided into two phases. The first phase concentrated on the development of a comprehensive ICT-led Integrated Socio-Economic Development Framework for Rwanda (known as the Framework Document) and this was followed by the development of an ICT-led Integrated Socio-economic Policy for Rwanda. The Government now has in place a comprehensive set of ICT policies and strategies as detailed in the GOR ICT Policy document adopted by the Cabinet in early 2000. The details of the GOR Policy document can be found at the Gov web site [www.gov.rw](http://www.gov.rw) and at [www.uneca.org/aisi/nici/Rwanda/rwanda.htm](http://www.uneca.org/aisi/nici/Rwanda/rwanda.htm)).

The second phase of the process concentrated on the development of the 1st ICT Plan (2001 –2005) for Rwanda – the *NICI-2005 (NICI: National Information and Communication Infrastructure)* Plan guided by the Government's ICT Policies. This NICI Plan, the first of four to be developed within the framework of the Vision for Rwanda (*VfR*) is to serve as a cornerstone of the Government's socio-economic development plan over the next five year starting 2001.

On the whole the Rwanda process yielded three outputs: a *Policy*, and *Plan* and *Structures*. The Policy was based on the Framework Document, while the Plan was developed to implement Government Policy Commitments. The Structures, namely the proposed National Information Technology Commission (NITC) and its Working Groups and the Rwandan Information Technology Authority (RITA) are designed to serve as national coordinating structures and bodies to support the development and the implementation of the NICI Plans. The three components resulting from the Rwanda process are therefore complimentary entities and part of a whole.

## Institutional arrangements

Since 2001, the Government of Rwanda with the support from international organisations such as the World Bank, ITU (International Telecommunication Union) and USAID has undertaken the process of setting up a Regulatory Body with the objective of promoting a high “quality, efficient, reliable and affordable telecommunication services”.

Looking at the size of both the Market and the Country, the Government has decided to integrate the major social economic development sectors into one Regulatory Agency “Rwanda Utility Regulatory Agency” (RURA). The new Agency started to operate in January 2003. The sectors that are concerned include Energy, Transport, Communications and Waste management. Although, the issue that arises from the beginning for the new agency is the lack of human capacity to be able to serve such new and complex entity. This needs various expertise to be able to serve a growing market as far as the overall ICT market is concerned. In the same time, it is necessary to address the issue of universal access especially in the country like Rwanda where a large number of the population lives in rural areas where basic infrastructure such as water, electricity, telecommunication facilities and roads are still lacking.

## Market structure

The Rwandan market structure can be defined as a mix of Monopoly and Competition. The incumbent Rwandatel is still dominating the fixed telephone and Internet services even if few Telecom players have started to operate. MTN Rwandacell is the only player in the mobile services with a considerable penetration since 1998 when the company launched its services.

Artel is the first private company to provide fixed telephone services via satellite. It is not meant to be a competitor of Rwandatel as such but will complement Rwandatel in providing access to remote areas where access to basic infrastructure has been a big handicap for telecommunication facilities to be deployed. To date, 400 small VSAT are being deployed in those remote areas. It looks like Artel is being mainly funded by Rwandatel as part of its contribution to the Universal Access Funds.

Looking at the development of the major telecommunication services available in Rwanda, the mobile has shown a great success for the past four years. MTN-Rwandacell was able to cover 67% of the country within that period with an annual growth rate of 25% of the market. A second mobile license will be issued to Rwandatel once it is privatized.

As for the Internet services, that's most likely where competition will start to function with a number of new players on the ground and more importantly the variety of technologies available. The various prices scheme depending on technology will definitely provide a big impact on both penetration and usage.

As mentioned earlier, the newly formed regulatory body is not yet fully functional and it will take some time to build the capacity within this entity for a better service delivery but the beauty of the Rwandan context is that the lack of regulation doesn't affect or prevent the Growth of the Market. As an example, the Government has taken a leadership from the higher top level authority to ensure access and usage to the large population starting by education system from the primary to the tertiary education, the Government institutions as well as promoting remote connectivity with the support from various international donors.

## Telecommunications market

The telecommunication market in Rwanda has to be regarded as a set of inputs from both Government, privates and international organizations to address the major constraints that prevent the market to grow. Those include the Network coverage for both fixed and mobile phones and the Internet, the limited financial resources from both Government and privates and the lack of human resources as probably the critical issue that can only be addressed through partnership amongst the stakeholders.

Fixed phone network is still low with almost 2.6% of the households being members and an annual growth rate of 10%. The mobile phone network has risen dramatically for the past four years. The current rate is 13% of the households being members and an annual growth rate of 25%. The main reason is that most of the users have been discouraged by the long delay to get a fixed line and have preferred to look for mobile which actually is more convenient for most of people especially youth from 18 to 35 years old.

Internet services are mainly available in the major towns with almost 90% of the market in the capital Kigali. The large public gets access through Cyber cafes that are estimated to be 100 in the whole country with 75% in the capital Kigali. This configuration seems to be similar to most of the sub Saharan African countries, the major cities have always been more attractive since the telecom infrastructure is available and there is a big concentration of potential users that can afford to pay for services.

## ICT and Innovation system at the National University of Rwanda

### **Background of higher education and research in Rwanda**

The NUR falls under the Ministry of Education, Science, Technology and Scientific Research. The NUR is the oldest and the biggest higher learning institution in Rwanda. There are currently 12 higher education institutions in Rwanda including 5 public and 7 private. The national overall enrolment population has passed from about 3,800 students in 1994 to about 15,000 in 2001 and is estimated to be 18,000 in 2004. Despite this tremendous improvement, with only 0.75% higher education enrolment, Rwanda still lags behind the sub-Saharan average of 4%. There is therefore need to increase access to higher education in Rwanda if we want to prepare for the new knowledge based society. For the last four years there has been an increase in number of higher learning institutions and student enrolment in Rwanda. The increase in enrolment was also noted in NUR. The student population has grown fast due to the increased demand for higher education in the country and currently it has a population of 7,300 students compared to 3,200 in 1993.

With this need to increase the access to higher education, there is a budget constraint. The budget of NUR has not been increased accordingly. It is clear that NUR will have to cut down the yearly intake in order to cope with the existing resources (classrooms, laboratory etc.). Rather, with the improvement of human resource supply (ICT, Library, Research capacity building), the NUR shall concentrate in Master's training and later on PhD training.

As for research, apart from the NUR, there are mainly two more research institutions, the ISAR, an agricultural research institute under the Ministry of Agriculture, Livestock and Forestry and the IRST, the institute for scientific research under the Ministry of Education as well. Plans are under way in the Ministry of Education to set up a national structure to promote and co-ordinate research in the country.

This increase of higher institutions in the country needs a strong co-ordination. This is why the GoR through the Ministry of Education has undertaken changes related to high institutional policy to be capable to respond to ongoing Government priorities. The new high education policy provides the Commission for High Education with the task of harmonisation of higher education institution policies. The commission will also be charged with quality assurance.

Harmonisation of research priorities will also be entrusted with the national Academy for Research in sciences and technology. NUR, being fully associated in development of these structures, is institutionally being associated with the National body mentioned above. This will ensure that national priorities are taken care of.

NUR within the overall National Education Research framework is putting emphasis on sciences and technology as important issues in the country and is prepared to embark in innovative technologies that can support our population to overcome poverty. However, sciences such as environment, education, conflict management through good governance, ICT cannot be left aside as they are also pertaining issues to the country as it is indicated in the document Poverty Reduction Policy. This is why NUR is initiating research under themes so that all these issues are being approached in a holistic manner.

### **The University context**

The National University of Rwanda (NUR) is a state University, which was created in November 1963. It is located in the southern town of Butare, 150 km from the capital city Kigali. It is a “traditional” comprehensive university largely subject oriented in which the 3 main areas of university education: humanities, social sciences, basic and applied sciences were unequally represented with a bias towards humanities and social sciences. Before the 1994 war and genocide it had 3 campuses (Butare, Kigali, Ruhengeri). Thereafter, because of resource constraints, the 3 campuses merged into one, which is Butare campus.

In spite of its great loss in human resources and the high rate of enrolment, the NUR had to fulfil its mission:

- (i) to provide as soon as possible qualified university trained manpower that the country badly needed in the aftermath of war and genocide with special emphasis on science and technology, training and management of teachers;
- (ii) to promote the culture of human rights and good governance;
- (iii) to promote development oriented research;
- (iv) to provide services to the community.

For the accomplishment of the above mission, the NUR needed to build on a new vision and set of values:

- (i) technological transformation of the society;
- (ii) clear community orientation of our education and research;
- (iii) promotion of women education;
- (iv) promotion of positive values, critical thinking and patriotism;
- (v) promotion of equity and accessibility.

To achieve this goal, the NUR will also have to orient its educational policy suitable to that new orientation in order to contribute fully to the future of this country.

From its creation up to now, the NUR has been guided by a document called “*Textes légaux et réglementaires de l’Université Nationale du Rwanda*” (Legal and regulations texts of the National University of Rwanda). This document contains legal texts that stipulate the creation of the NUR and how it has to be operated.

This university guide is outdated and does not fit with the current national socio-economic situation.

In 1993, a student guidebook was elaborated. However, since then, the situation has changed: the number of students has increased, campuses have been merged, the bilingualism policy has been instituted in the country due to the post-genocide context. The massacres and genocide that happened in Rwanda in 1994 broke down the fragile economy and left the country in the extreme poverty. The government policy geared towards poverty reduction and off-farm economy is based on human resource development. It is within that context that a national seminar was organised in July 1997 in Kigali by the NUR in collaboration with the MINEDUC to give new orientation to the NUR according to the existing situation. The conclusions of that seminar enabled the NUR to reshape its curricula in the student guidebook in order to respond to the realities and demands of the society.

The NUR also has elaborated an ICT master plan drawn from the national ICT policy for ICT development in administration and education as a long term development and capacity building strategy. Though it has not been adopted officially, it is being used.

In 2000, a document known as “Strategic Development Framework 2000-2005” was elaborated with the purpose of boosting the university capacity in human resource development and to achieve an annual rate of increase in student population of 17.31. However, this document did not adopt a holistic approach to show what had been done and the gaps in order to set up appropriate strategic planning. The new strategic plan will have to take this into account.

### **Gender and empowerment**

Traditionally in Rwanda, the education system favoured discrimination of girl children and reinforced the existing inequalities in opportunities with regard to employment and participation in national decision-making. Women constitute a significant number of the population (53.7%) and are substantially involved in economic activities. In 1999, it was estimated that 34% of households were headed by women and most of them were minors.

In line with the situation mentioned above, the GoR, responsible of policy initiatives, is ensuring that all GoR policy development takes into consideration gender concerns.

Although an official policy is yet to be set, the University has demonstrated a particular interest in women empowerment activities and measure. The NUR’s leadership has been instrumental in the creation of a University Women Students Association (UWSA) as well as the creation of a Commission of Gender in the official structure of the Student’s Association Federation. To strengthen this policy,



the Center for Conflict Management has been mandated to create a gender desk within the University.

In 2001, a counselling unit within students services office was created at the NUR with the purpose of helping female students, mainly those entering University that are more exposed to sexually transmissible diseases (STD). In collaboration with the Faculty of Medicine, the unit also offers counselling services to women with all types of problems which can hamper their education. For the last few years, it was noted that more female students dropped out compared to their male counterparts, due to unwanted pregnancy. The unit gives advice on sexuality and other issues regarding women empowerment.

In addition, the NUR in accordance with the national policy, is also involved in gender equality promotion with emphasis on encouraging women in continuing with higher education. Though figures of number of girls entering the University had been stagnant. Female students constitute 22 % of the student population. As far as admission of University is concerned, there is need to continue putting emphasis on mobilizing female students as there is empirical evidence to show that the drop out in schooling system occurs at high school because of traditional beliefs to encourage more boys than girls for further studies.

Courses on gender issues have also been introduced in different faculties to raise awareness on gender equality, human rights and democracy.

The NUR has also tried to increase the number of women in academic and administrative staff. For example, from the time the University reopened its door female to male ratio among the academic staff has gone from 1/10 in 1995, to 1/4 in 2001 (17.3 %) though the number still needs to be increased. Recruitment policy will continue to emphasise the Gender Balance in the Academic staff and Senior University Management.

#### **HIV/AIDS status**

HIV/AIDs have become a severe problem in the world. More than 40 million live with HIV and Sub-Saharan Africa is one of the most severely affected region. According to a report of UNAIDs (1998), 70 % of the total number of the new cases observed in the world live in sub-Saharan Africa. The causes and consequences of the HIV/AIDS crisis are closely linked to wider development issues including poverty, malnutrition and illiteracy.

The NUR, as a leading higher education institution in the country, could not ignore the plight of HIV/AIDS in Rwanda, Rwanda being among the most affected countries. According to the study carried out by the National Program for the Control of AIDS (PNLS), the prevalence of HIV/AIDS was estimated at 11.1% in 1998 in the country.

Given that the University community has an important role in the control and fight against this disease, it was felt that higher education is a long investment

for any country. Beyond the need to contribute to research work on HIV/AIDS, the NUR has the responsibility to ensure sustainability of that heavy investment by ensuring an effective prevention programme and management of the disease in and outside the University community. This is why the University League for AIDS Control (LUCS) was created on November 27th, 1999.

This is a permanent organ of the University in the Rector's office and has two permanent staff under the supervision of a board drawn from all stakeholders within and outside the University including administrators, professors, administrative staff, strong representation from students' leaders and associations. The LUCS activities focus on prevention and counselling as well as promotion of research on behavioural change. Current research information shows that prevalence rate among students is lower (2,5%) than the national average (11%) and knowledge is satisfactory (95%) while behavioural change is still low (46% use of condoms and 16% abstain).

#### **Human resources development programme**

Currently the Rwandan academic staff is not able to cover the whole range of courses. There are 335 teachers including 48 expatriates. There are about 80 with a first degree who require advanced qualifications. As the University can only offer a postgraduate training in 6 disciplines, most of our junior lecturers have to go abroad for their further studies. The main challenge lies therefore in the lack of teachers in some key and specialized disciplines. This is why we still rely very much on full time expatriate staff. A sizeable number of visiting lecturers from both within the country and outside still teach at our University. We intend to discourage this scheme as much as possible because it is not very cost effective. The teachers stay 7 to 10 days and are forced to give a crash program to students with no real time for discussion and feedback. Ideally this should be phased out with the increased number of expatriates.

#### **Teaching and Research in the National University of Rwanda**

The NUR, with an enrolment of 7,300 students, is organised in 7 faculties and 3 schools:

- Economics, Social Sciences and Management (economics, management, social sciences, public administration and political sciences);
- Science and Technology (biology with a new programme on biotechnology, chemistry, physics, mathematics, civil engineering, electricity and electronics and computer science).
- Education (mathematics and sciences, humanities, education foundation, school psychology, clinical psychology, distance education);
- Law
- Medicine

- Agriculture (soil science, plant science, and animal production and soon agribusiness, rural engineering, and food science)
- Humanities (geography, history, French, English, African languages)
- School of Public Health
- School of Journalism and Communication
- School of Modern Languages: transitional language program at pre-university level.

Though most programmes at NUR are still predominantly at undergraduate level, a lot of efforts are being put in initiating post-graduate programmes where possible. There are currently 6 master's programmes going on in partnership with foreign universities in internal medicine, paediatrics, gynaecology and obstetrics, general surgery and MBA and the new ICT Master Degree Programme in partnership with the Blekinge Institute of Technology in Sweden and supported by the Swedish International Development Cooperation Agency. Additionally, we hope to develop soon a joint Ph.D. programme in public health.

In 1997, a consultation process with stakeholders, including the Government, was initiated aiming at determining the new orientation of the NUR as well as providing guidelines for future strategic objectives. The focus was clearly put on priority areas:

- Academic and administration support units in order to enhance the quality and the capacity of the Faculties of Science & Technology, Education, Medicine, Agriculture, and Management by availing qualified professors, didactic materials, classrooms and laboratory equipment;
- Increase in accessibility by widening classrooms, library, and laboratories both in Butare and Kigali particularly for Medicine and Agriculture;
- Improvement of quality in education by focusing on postgraduate training of the staff, access to library materials and ICT and on methods of teaching and learning as well;
- Improvement and reform of the curricula contents so that the new programmes are more field oriented with ICT covering all the disciplines. This will make the education more relevant and suitable to the needs of the country and the communities;
- Development of ICT by installing the campus network, increasing access to computer and internet services and promoting distance education;
- Institutional management support and reform by carrying out a University strategic planning exercise with the aim of decentralising management to the department level and by modernising the management of information (ICT);
- Enhancement of research by promoting inter-disciplinary approach and by focusing on real needs of the society such as poverty reduction, rural development, conflict management, and environment.

When the University reopened its doors in April 1995, the immediate challenge was to resume teaching and all efforts were focused on this for about two years. It was not until 1998 that the University set up a Research Commission with the view to promote research at the University. Until then, research was done mostly in the context of undergraduate theses under the supervision of lecturers.

With the creation of the Research Commission, the University endeavours to promote research that is geared towards responding to issues that affect primarily the Rwandan society while acknowledging the necessity for international partnership. It is with this view that efforts have been concentrated on themes like poverty reduction, peace and conflict, justice, food security and environment.

Within its limited resources, the University allocates to research activities an amount varying between sixty and one hundred million francs every year (approximately hundred and thirty to two hundred thousand US dollars). With this allocation, the research commission has been able to finance 39 projects, to organize a national workshop on the status of research in Rwanda, to resume the publication of the University journal (*Etudes Rwandaises*) and to fund the participation of some researchers in international conferences and colloquia.

Beside the research commission that looks mostly at research projects presented by the research/academic staff through their departments and faculties, the University has also encouraged the set up of autonomous or faculty-based research centres that focus on specific issues with a multidisciplinary approach. It is in this context that we have established research centres like the Centre for Conflict Management (CCM) where research embraces historical, psycho-social, judicial and socio-economic dimensions of the Rwandan conflict, the Centre for Geographical Information Systems (CGIS), the Centre for Community Mental Health (CUNISAM) and the Centre for Contemporary Studies and Research in Human Sciences (CERCOSH), Project for Enhancement of Agriculture in Rwanda Through Linkages (PEARL) (with collaboration of Michigan State University and Texas A&M University) together with the Socio-economics Centre in the Faculty of Agriculture and the Centre for Research on Environment and Development that is being set up. Other partners in research development comprise bilateral and multilateral institutions often coming in through inter-university co-operation (UNDP, USAID, Belgium and SIDA/SAREC).

The University is very much aware that it will not be able to develop research at a respectable level on its own limited resources. It is for this reason that efforts are being made in staff development, strengthening the University capacity in grant writing, research methods and to develop international partnerships so that university researchers can have access to international funding and expertise and bring our research to maturity.

It is currently the view of the University that, while improving on the teaching mission of the University will remain a substantive target, a strong emphasis will be put on research so as to make NUR a reference research institution in Rwanda, the region and an attractive research partner for international scholars.

In the near future, the University would like to embody this focus in its working structure by creating a new senior position of a vice-rector for research, development and information technology to strengthen its research and innovation mission.

## ICT vision and policy at NUR

The National University of Rwanda ICT vision is informed by the Government of Rwanda's strategic vision for 2020. The National University of Rwanda and specifically the National University of Rwanda Computing Centre (NURCC) as the ICT support unit is expected to be the major contributor of the 2020 vision framework. To this end, the NURCC has prepared a strategic plan to provide innovative leadership and support in ICT for the University and surrounding communities. The goal is to create an empowering and dynamic technological environment for academic, administrative and community users that will contribute to a sustainable income-generating, physical and managerial infrastructure for ICT at the National University of Rwanda.

Established in 1997 and fully operational since 1999, the National University of Rwanda's Computing Centre is the ICT Command Unit within the NUR responsible for training of both end-users and technicians, maintenance of computer labs, computers reparation, electricity issues, database and application software management and connectivity both inside and outside the University (Internet connectivity). In order to become a national centre of excellence in ICT training and services, the Computing Centre must be able to serve a growing population of students, faculty, staff and external clients, currently estimated to number around 12,000 in total with increasingly diverse needs. To achieve the necessary goals in infrastructure, access and training, the NURCC has identified a series of measurable objectives in three distinct but linked core program areas: academic computing, administrative management and information systems, and income generation. It has identified a range of short, medium, and longer-term strategies to meet these objectives, while also paying special attention to the needs of under served rural communities and women.

However, the National University continues to face some major obstacles in the area of ICT infrastructure and curriculum delivery. Most pressing are the lack of qualified ICT lecturers and trained technicians, and inadequate infrastructure and equipment. Without these, it will be difficult for the University to produce a technologically sophisticated and informed pool workforce as envisioned by the national Government. The Computing Center also currently has limited capacity to keep up with technological innovation in order to provide enhanced service to the University's faculties, schools and to the surrounding community. For example, the current ratio of personal computers (PCs) to students at the NUR is approximately 1:16 and thus lies far below the general average for a higher educational institution of 1:4.

Nevertheless, the NURCC is positioned to take on the tasks outlined in the strategic plan with some additional support. A fiber-optic backbone connects the local area networks within the main campus, and has been extended to the two remote campus sites in Butare, the Rectorate and the Medical School, that currently was connected via wireless links thanks to emergency support from

SIDA/SAREC. Internet access is available through a VSAT system supported also by SIDA/SAREC. It provides connectivity of 1.5Mbps down link and 512kbps up link.

Over the course of the next three years, beginning in 2004, the National University of Rwanda will focus on three different areas of activity:

- 1) the integration of ICT and Instructional technology into the curriculum delivery;
- 2) increased access to computers and the Internet for students, professors and researchers;
- 3) and capacity building and advancement of the Computing Center.

Other ICT major programmes that the NUR is involved are:

- (i) ICT MSc Programme supported by SIDA/SAREC;
- (ii) Rwanda Development Gateway supporting ICT Development for the community;
- (iii) Distance Learning programmes to enhance teaching and access to online material;
- (iv) ICT Professional training in support to the National ICT Policy to build capacity in system administration and network management and maintenance.



## Conclusions

The National University of Rwanda as the major public higher educational institution of Rwanda has already embarked in a number of internal and necessary reforms to cope with the current trends of societal technological requirement taking into account the major constraints that prevent the social and economical growth of our country.

In line with the poverty reduction policy and the Vision 2020, Rwanda needs a strengthened capacity in science and technology. In order to overcome the overall poverty context and bridge the gap between the rural and urban areas, applied research is a key to empower our local community which represents more than 80% of the entire population. The National University of Rwanda with its key partners including local and international organisations such as funding partners, universities and research institutions, can create potential expertise in terms of developing technological innovations to enhance productivity and make sure that Rwanda products can be more competitive in the international markets. The Maraba Coffee as one of the best coffee in the World is a good example showing what is possible to achieve through partnership with associations of local coffee producers, international organisations and university researchers.

Finally, the role of the University to spread out knowledge and skills within the society especially in the country like Rwanda where access to higher education is still very low is a key. ICT can be taken as a way forward on one hand to enhance the teaching, learning and administration of our institution and on the other hand the University can use this tool to create resources that can be used for those left behind for them to acquire knowledge and skills that can help them to get jobs and be competitive in the market place.

## CHAPTER 3

## Notes

<sup>1</sup> For more information on the state of Telecommunications in Rwanda in general and the government's policy goals for the ICT sector, see Rwanda ICT Sector Performance Review, April 2004, by Albert Nsengiyumva. Much of the information in this section was taken from the aforementioned document.

## ICT and the Role of Universities - a Technopolitical and Postcolonial Challenge

LENA TROJER

### Introduction

When ICT (information and communication technology) development issues are situated in the context of knowledge- and technology co-development between low and high income countries, the need for understandings and praxis of postcolonial ICT emerge and the challenges for the academy and its technical faculties increase. Relevance seems to be the multiple stemmed core concept and the change of position from merely transfer to co-development is strongly in demand.

This chapter elaborates how ICT can be involved in local and national innovation systems in developing countries with special attention to the role of the university as one of several driving forces for local and national development.

Academic ICT and its applications in society and every day life force our attention towards the relation between dominating actors, of which the university is one. It stresses not only the development of innovation systems but also relevant knowledge about its prerequisites resulting in transformation challenges for the traditional universities. One model explored for these processes has been the triple helix model stating that the three institutional spheres university, industry and Government are increasingly working together (Uhlin and Johansen, 2001; Trojer and Henningsson, 2004).

We can furthermore realize ICT as one of the technological science fields most evidently provoking the borders between academic research and political sector

(Gulbrandsen, 2000) and experience how the 'negotiations' (Aas, 1999) about the character of academic research take place in society. This is evident also in a European context.

In this chapter, the challenges involved in ICT development and the role of universities are commented by means of a study in a Tanzanian context. It is a piece of situated knowledge at a specific time, namely the experiences and understanding of Tanzanians engaged in national ICT working in Dar es Salaam in September 2003. The study is based on 8 semi structured interviews with professionals at University of Dar es Salaam (UDSM), Civil Service Department of the President's Office, Tanzania Telecoms Co Ltd (TTCL) and Tanzania Commission for Science and Technology (COSTECH). It is also based on own experience as well as material from Sida SAREC and from UDSM.

## The national ICT policy of Tanzania

In March 2003, a policy proposal was approved by the Cabinet and since then, Tanzania has a national information and communications technologies policy<sup>1</sup>. The process for working out this policy started in the beginning of the year 2000 with an informal group sharing interests and visions of ICT to be successfully applied for Tanzania's development. This informal group became the so called eThinkTank. In April 2001 the Cabinet designated the Ministry of Communications and Transport as the national focal point for ICT. In September the same year a national ICT Task Force was formed as a public / private - that is a multi stakeholder - partnership to advise the Government on an ICT policy using the eThinkTank's inputs and Sida's funding. The ICT Task Force had 15 members and was headed by the Vice Chancellor of the University of Dar es Salaam (UDSM). The ICT policy process was open in order to have as many inputs as possible from persons with very different interests and perspectives. Drafts were circulated to the Government, Members of Parliament, private sector, academics and other stakeholders and even outside Tanzania. Drafts were also put on web pages for comments. The process incorporated regional and local political levels in Tanzania. In the stage of preparing the final draft a large meeting was held with 400 participants including persons from outside Tanzania like Sweden and Ethiopia.

The University of Dar es Salaam played a key role in the ICT policy process. The ICT Task Force was, as just mentioned, chaired by the Vice Chancellor of UDSM not only because of his official position but also because of his expert knowledge and engagement. Two skilled persons from the university staff were brought into the secretariat in order to formulate and write the drafts. The draft was developed in a very broad and open anchoring process and thus moderating the preferential right of interpretation of the academy. This role of UDSM furthermore can be viewed as an advanced technopolitical "negotiation" between the University and the Government. We have to keep in mind that the knowledge experts of ICT in Tanzania were and are mostly located at UDSM or trained at the same place as the only institution having a technical faculty in the country<sup>2</sup>.

The national ICT policy gives a substantial understanding of the status of ICT in Tanzania as well as emphasizing 10 strategic areas for ICT and development and is a very well formulated document from my point of view. One of the central statements concerns the needs for Tanzania to move from being mere consumers of technology to the processes of being designers and manufacturers of ICT<sup>3</sup>, which will be commented below.

The ICT policy stopped at chapter 4. Longer texts in earlier drafts were addressing more of implementation strategies. It is important to note that from the very beginning the Task Force agreed not to locate the organ to deal with the implementation of the ICT policy within the Government. The Task Force also

wanted it to have enough authority to coordinate and oversee ICT issues in the 10 focus areas in both the public and private sectors. Designing such an organization proved to be a daunting task. The Task Force tried the following measures to accomplish the job:

- (i) assigning Task Force members to visit some countries to see if there are examples to learn from. Sweden was one country visited.
- (ii) engaging an expert on Organizational Design from UDSM to come up with a design from first principles.
- (iii) asking stakeholders at all meetings convened by the Task Force to provide ideas on a way forward. Meetings, where this plea was made, included one made to all MPs in Dodoma and the large one, where about 400 attended.

All these measures were taken because the Task Force was convinced that Chapter 4 was a very weak chapter. Unfortunately this remained the case up to the time the final report was submitted to Government. The understanding was that the task of coming up with an implementation mechanism would be taken up by the Task Force to deal with the implementation of the ICT policy. Hence the decision by Cabinet to shorten this Chapter and defer it until later did not come as a surprise but reflected the thinking of the Chairman and that of the majority in the Task Force.

The implementation strategies are developed by a new Task Force, again chaired by the Vice Chancellor of UDSM and with about half of the members of the former ICT Task Force. The Task Force on implementation of the ICT policy has given priority one to the issue of defining and agreeing on an implementation mechanism. An expert from Sweden was brought in to work with some members of the Task Force and a general implementation mechanism has been designed and agreed on. It will be refined after full details of implementation of the ICT policy are completed.

## The role of the University

### Background

The University of Dar es Salaam was born out of a decision taken on March 25th, 1970, by the East African Authority, to split the then University of East Africa into three independent universities for Kenya, Uganda and Tanzania. The University of Dar es Salaam consists of six faculties and prospective College of Engineering and Technology including three engineering faculties (see below), five institutes and two university colleges: Faculty of Aquatic Science and Technology, Faculty of Arts and Social Sciences, Faculty of Commerce and Management, Faculty of Education, Faculty of Law, Faculty of Science; Institute of Development Studies, Institute of Kiswahili Research, Institute of Marine Sciences, Institute of Resource Assessment, Institute of Mass Communication and Journalism; the University College of Lands and Architectural Studies (UCLAS) and the Muhimbili University College of Health Sciences (MUCHS). The University also operates a Library, University Computing Centre Ltd, Dar es Salaam University Press (DUP) Ltd and two centres; Centre for Continuing Education, Centre for Entrepreneurship Development as well as consultancy activities within Economic Research Bureau and University Consultancy Bureau (UCB)<sup>4</sup>. Other centres are the African Virtual University Learning Centre (AVU-LC) offering degree, diploma and certificate courses in computer science using open and distance education platforms and the Technology Development Transfer Centre at pCET, the Instructional Technology Resources Unit (ITRU), which imparts skills to academic staff to enable them to conduct online instruction. UCB handles consultancy at University level. There are other units at College, Faculty or Institute level e.g., the Bureau for Industrial Cooperation (BICO) in pCET on the Bureau for Education Research and Extension (BERE) in the Faculty of Education etc. all coordinated by UCB.

The context of the universities in post-colonial Africa must be considered with great care in order to understand the relations particularly between the university and the government. Luhanga et al. (2003a) give an elucidative insight into the processes of transforming the colonial African universities to national universities. The situation was particularly precarious in a political situation characterized by single party states including Tanzania. The threat of increasing state repression to institutional autonomy became a reality for a number of universities. "State presidents became chancellors of public universities to ensure increased powers to curtail any opposition to their student enrolment expansion programmes or to handle any other politically motivated moves by African universities."<sup>5</sup> The appointment of the former Secretary General of the then ruling party TANU, as the first Vice Chancellor of the University of Dar es Salaam has been associated with the desire of the Party to entrench itself in university affairs in order to safeguard the interests of the peasants and workers of Tanzania (Luhanga et al., 2003b). This

historical and political background implies a specific connotation of university autonomy. UDSM has been and is involved in a complex and delicate situation quite different from what is describing for universities in Europe (Nybom, 2001). This Tanzanian context additionally contributes sharpening and multifaceted knowledge about the role of universities in societal development.

In the background presentation of the ICT cooperation between UDSM and Sida-SAREC the following is stated<sup>6</sup>: “As part of the on going transformation programme, the UDSM has initiated a number of reforms aimed at improving its main outputs (teaching, research and services to the society) through ICT. The improvement of ICT aims to suit the needs of the students and staff, the working environment and establish linkages with both industry and Government. The new ICT developments are also expected to contribute to income generation in order to complement Government and other funding sources to ensure sustainable academic programmes.”

### **Relevance**

The Vice Chancellor emphasizes that within the larger transformation activities of the University the issue of relevance becomes central to the mission of teaching, research and service to the communities. As far as possible, a public university in a very poor country must aim to be able to be relevant to the developmental aspiration of the people. Addressing development concerns means that the University must have impact on whatever area.

The transformation should go deeper in the academic culture, the Vice Chancellor argues. Out of the 16 objectives in the strategic plan of UDSM, one concerns the change of the organisation culture within the University. “I must say it is not easy. If you want to bend a fish you bend it while it is still alive, before it is dry. If dry you crack it. We have come to learn that it is a bit difficult. We are still struggling with it.”<sup>7</sup>

At Tanzania Commission for Science and Technology (COSTECH), which is a Governmental body, certain reflections upon the role of the university can be found. A high level representative for COSTECH does not want technology to be an academic exercise. He thinks the universities of Tanzania have not transformed themselves 100% to be more directed towards the users need of society. The question of relevance seems to be sensitive for COSTECH, which wants to own that question. “We think that university should produce people who are relevant for us in the field, people who can challenge us in what we are doing, be catalytic in their activity, can conceptualize reality of things.... Many universities solve academic problems not practical problems.” Examples of preferred projects for students are databases of the villagers, repacking local knowledge and multimedia tool on cd. The Tanzanian perspectives are stressed.

COSTECH used to be a research council with a lot of assistance from Sida

SAREC. The balance between research for the sake of research and research for development was difficult to handle. Certain circumstances contributed to a change of mission for COSTECH to now have a much broader mandate. COSTECH is seen more as an umbrella institution connecting and transferring knowledge, science and technology with and to society.

### **UDSM as a national resource for ICT infrastructure**

The experience of approving ICT at the University started in 1993 with the establishment of a university email system<sup>8</sup>.

Transfer of technology needs a special organization, like marketing intelligence in private sector, but nobody thought about that at the University. The beginning of the 90s was the time of the Internet entrance. What happened was that UDSM brought Internet to the Tanzania telephone company (TTCL) and not the other way around. In many countries the telephone company gives access to the Internet to the University<sup>9</sup>. Internet powered the head quarter of the telephone company. However, in this period there was a lack of knowledge about Internet. Both the university staff and management clearly saw the benefits of Internet. A VSAT link was installed at the main campus of UDSM. In order to provide Internet services to the University campuses outside the main campus, a radio link at 2 MBps was installed as well. TTCL Headquarters was connected to the University network via the radio link. Now ten years later Tanzania has Internet backbone in every region. The present challenge for the University is to look out on how to transfer the technology to the industry. As a result of the actual process and the role of the University, expert people from UDSM are now managers at TTCL.

The role of the University in supporting access to Internet and digital interconnections did not stop with TTCL. The University tried to extend the Internet service to Government departments. The Government could at the time of the introduction not pay the telephone bill. When TTCL started disconnecting the Government, the University decided to take the eight ministries out of the telephone network for Internet access and connect them with the wireless line at UDSM. They had to find alternative solutions.

Gradually, the prices for Internet access came down and several ISPs<sup>10</sup> entered the scene. When the University started to raise money for the services there was no licence system. Now there is and the University compete with the other ISPs. There are still about 13 Governmental bodies connected through the university link. The impact of the initiative coming from the University was an enhancement of the motivation for the university staff to keep on with ICT development. This technology was appreciated as exciting and they were the only people who knew. A somewhat parallel process of integrating the then Faculty of Engineering (FoE) with the then Institute of Production Innovation (IPI) to form the Prospective College of Engineering and Technology (pCET) with three new engineering faculties,



was probably boosted by the initiatives. The university staff engaged was eager to see Tanzania on the map, as they knew how to build the systems. For the content development for the Government (eGov) the process is both way. The Government as well as the University is trying to find the easiest way to implement the Government's own processes and demands, which are monitoring, evaluation and easy communication. UDSM is trying to provide that kind of solutions.

The technology transfer role of UDSM is explicitly defined. The University started the development by investing heavily in ICT in the University in terms of human resources, infrastructure and software. It was made possible by donor funding and own efforts. After less than 4 years of implementation, UDSM recognized the ICT development not to be sustainable. They had to find ways and mechanisms to bring in more resources than the Government and donor funding could provide. The ICT services include 24 hours network, with all the systems depending on it. The Computing Centre of UDSM started to use the extra capacity to tap private resources back to the University. The Computing Centre is now a registered company owned by the University. This arrangement is also established as a result of critique from private companies, which thought the Centre was not paying taxes neither being legal. Because the Centre is a company the University can transfer all the technologies and expertise they have. They have some of the best people in network and hold the biggest network in the country – wireless, fibre, databases etc. An example of services provided by the Computing Centre is a network for the whole airport system in the country, a contract obtained in open competition. They are designing the system and somebody else is constructing. The Centre is also just finishing a project of developing a system for socio economic databases for the local authorities for the whole country. The same data is used by the regional administration and imported at ministry level.

It has been stressed (Mutagahywa, 2003) that two factors are dominant for the development of ICT at UDSM. The first one is the existence of a University ICT policy and master plan widely accepted. The ICT policy was approved by UDSM in 1995 and implementations started in 1996. The second important factor is the championship of and support by the top management of UDSM.

#### **pCET at UDSM**

The Faculty of Engineering (whose integration with the Institute of Production Innovation in 2001 resulted in the establishment of the Prospective College of Engineering and Technology - pCET) was established in 1973. The faculties within pCET are Civil Engineering and the Built Environment, Electrical and Computer Systems Engineering, Mechanical Engineering and Chemical Engineering. In September 2003, the number of undergraduate students was about 1350, while the number of postgraduate students was 171. At the same time there were 36 PhD students including 4 female. The aim is to have at least 10% of undergraduates

continuing to postgraduate studies. The number of staff was 110, of whom almost 80% held a PhD degree. Consultancy work is favoured by the staff and is coordinated by the College's Bureau for Industrial Cooperation (BICO)<sup>11</sup> as an organ of pCET and thus part of UDSM.

An approval by the Tanzanian Parliament is still required for ratification of the College's status. Operationally, pCET is in full activity. The main motive for pCET is to fulfil one step of the university strategy of reducing a lot of duplication and pooling of the resources in order to become strong in the technology area. Presently pCET can be seen as leading the process of gathering resources at UDSM.

The basic objectives of pCET are:

- to supply the country with sufficient middle and high level engineering human-power as agents of development and change, thus contributing to the domestic development of infrastructure, industry and trade,
- to perform research in the interest of suitable exploitation and local processing of natural resources in Tanzania, ultimately leading to the innovation of technical products and production processes for the local industry, and
- to provide expert professional services in the form of consultancy to industry as well as public and private organisations and institutions.

The core issues for ICT implementation from the perspectives of pCET are

- 1) technical staff, educate technicians
- 2) reach the remote areas
- 3) content, what do you do after technical infrastructure
- 4) long term agenda for UDSM is to increase the output. In campus to get distant students and distant education also within the campus.

ICT literacy is very much in demand, which means respective graduates from pCET are absorbed very fast by the industry after receiving their bachelor degree. The demand is expected to be even higher, when reaching also the rural areas. There is a big problem, the biggest headache for pCET, to keep good students for research and academic career in order to build the capacity needed at the faculties. Professors find themselves lucky to remain with those students who really want to stay at the university, about 1 of 10. The students concerned, find jobs that are better paying than staying at the university. The motive to have a PhD in ICT is further decreased by the lack of interest from the private sector to appreciate staff with a PhD degree.



## University Government relations

As indicated above, the relation between UDSM and Government has shown some complications. The present political situation in Tanzania with introduction of global market economy and multi party system is changing this relation. Not the least the national ICT policy process in Tanzania showed other kinds of links between the University and the Government, both on a knowledge sharing level and on a personal level as mentioned above. In addition, the present Minister of Communication and Transport is a professor from UDSM. You find professionals that in the same person hold competences as ICT experts trained at the University, as former employed experts at ministries and as managers in ICT related companies partly privatized. That person is in her/himself an innovation system. In a country of scarce resources and with knowledge and technical skills concentrated in one institution - that is the University - this situation is not unique and holds certain potentials.

### **Governmental support to higher education and research**

Only undergraduate studies at universities in Tanzania have been supported by the Government including allowance for transports, books etc. Postgraduate studies are managed by the universities on their own. There have been no fees for higher education. The system is now in a transformation stage. The Government decreases the number of grants as well as allowances, hoping people will take over. The conflicts arising are somewhat met by introducing higher education on loan basis for people who cannot afford a fee and living expenses during studies. The university assisted the Government in drafting an umbrella bill for this purpose.

Tanzania has 5 public universities with a student population of about 30,000 out of a population of 34.5 million people. There are over 14 private universities regulated by a Government agency to operate in Tanzania. UDSM realizes that there is a problem. Already in 1994 a program to increase the number of students was launched. Activities to inform the Government on all kinds of occasions like consulting meetings and in review strategies have taken place. Everyone seems to agree with the analysis. But the reaction from the Government is less resources to the University – sponsorships for students decreasing by 600 in 2002 and with yet another 1100 in 2003. The reduction in Government sponsored students joining UDSM has however not affected the student enrolment expansion strategic objective. Thus, for example, the Government reduced the number it would sponsor from 3,500 to 2,500 in the academic year 2003/04. The University made these vacancies open to qualifying students who could pay fees on their own. Slightly over 1,200 students joined the UDSM this way. UDSM is of course disturbed by reduced resources from the Government. The responsible ministry seems to be passive, and waits too long in the budget process. The argument of the Government

is that there is no money. The counter argument at UDSM is that it is a question of priority and a question of investment; not a cost.

As indicated above Tanzania has no national research funds. For development of research there is no money from the Government, which is only sponsoring undergraduate (bachelor) – on a decreasing level. The Committee of Vice Chancellors has put forward proposals to the Government in this matter. Institutions in various Ministries exist purely to conduct research (e.g. Ministry of Agriculture, Ministry of Industry and Trade, Ministry of Health, etc.). The Ministry responsible for the Universities allocates some funds to them. Funds are also available from the National Fund for the Advancement of Science and Technology and the Tanzania Education Authority, the latter focusing support to infrastructure. Sida SAREC firmly states<sup>12</sup> that support will be continued only if the Government through relevant Ministries is willing to engage in a dialogue on the role of research and knowledge for Tanzanian development, and if this dialogue is reflected in strategic interventions from the Government. At pCET they are looking at the evolving research financing system in South Africa. An East Africa regional cooperation in research financing has though to come on a later stage.

### **The ICT infrastructure issue**

From the Governmental side it is stressed that a lot has to be exploited concerning ICT infrastructure. For instance, how to link up the very important institutions in the country like the major hospital.

In 2001, a conference was held at UDSM concerning networks between the University and the Government itself and other training institutions as well as telecom companies. The question was, if the University took a leading role, would the others follow? There is a potential with an institutional arrangement linking to universities and other institutions and thus helping to develop their own capacity. At the same time, it is cheaper to run and develop from the old networks.

For ICT implementation processes in society, University computing centres are distributed to different places. Pilot centres for distant education, mostly short courses, are already in place in for instance Arusha, Mwanza and Dodoma.

## University industry relations

The engineering education and the results of university activities are vital for the Tanzanian industry. At the same time, it is important to learn about the needs of the industry, to have relevant feedback from the stakeholders and from the students. pCET at UDSM decided to work that out, regularly every 5 years, in order to find out whether they moved in the right direction or not and look at research and other activities for relevance. UDSM has invited the Government and the industry for discussions. It means a revised curriculum every 5 year. However, Tanzanian industry is young and there is a lack of response. The industry is often recognized to be unable to interact with the university. The situation is connected to the change from socialist to market economy system. In the private sector, few companies have been able to stabilize. “We need close cooperation. If we play a too dominant role they will run away from us. We have to calm down. When they are doing their own things, we should establish contact and accommodate. Then they will appreciate us. Though, it is rather uncomplicated with the industry compared to the Government.”<sup>13</sup>

The University is in different ways connected to innovative production at the industry. For SMEs it has a double effect with employment of graduates. Industry is recognized to be changing to more sophisticated activities and open for more interaction. Some researchers and faculties are directly assisting different industry sectors like mining, agriculture, fishing and manufacturing. UDSM has an Entrepreneurship Centre. As thoroughly presented by Mwamila and Katalambula (2004) and briefly commented by Diyamett (2004), pCET has two major outlets for technology development and innovation – Bureau for Industrial Cooperation (BICO)<sup>14</sup> and Technology Development and Transfer Centre (TDTC)<sup>15</sup>. BICO is focusing consultancy and services while TDTC focuses technology development and transfer with the important role of technology brokerage.

When raising the questions about consuming and producing ICT in Tanzania, situated experiences from mixed perspectives are bringing alternative strategies. “In order to be active on the production side, the easiest way is to make ourselves credible as big consumers.”<sup>16</sup> This strategy has somewhat started in the Government finding retail levels like the present reduction of taxes on computer equipments. Bringing down the prices means support to the local second hand market. When the big manufactures get an order on for instance 50 000 computers, they will be sniffing around to find out how to improve computers design for the Tanzanian environment (dust proof, water proof). A disadvantage can be turned into an advantage. One experience is that there is no lack of interest among manufacturers in this respect.

Another line concerns the problems in the education system. The students do not have the skills the market need. One company person states that you have to

go finding the right skills in Kenya. If ICT and education are not driven by the demand side, there has to be a rethinking in the education system. The transformation of teacher training is crucial as well.

For science there is a major problem. It is neglected in secondary schools. The resources are scarce. The Faculty of Science has started producing B.Sc. (Ed) graduates one of whose major subject is computer science. These are earmarked to be teachers of computer science in secondary schools.

Under the Secondary Education Development Plan (SEDP) the Government has already made a decision to convert two Teachers’ Training Colleges into Constituent College of the University of Dar es Salaam. Plans on affecting this are underway.

## ICT innovation systems

It is not self evident to use a concept like innovation system in a Tanzanian context, first of all because it is originally a western formulation and experience. Secondly because the situated relevance of the concept is still to be evolved as the ICT discourse is extremely western dominated with very few if any cracks in favour of African situated interpretations and experiences.

As a starting point for discussions in the empirical work of this study, an understanding of ICT innovation system as a function or process of close cooperation between the government (national or local), the university and private sector made some sense.

The ICT Task Force is interpreted as unique concerning partnership. The three main stakeholders mentioned above met in the Task Force and produced a joint policy supporting this kind of cooperative thinking. Persons active in the Task Force emphasized the need to educate the private sector to be patient. The impatience of private sector is a true challenge as the Government is a very slow moving machine. Initiatives from private sector are more likely to be reshaped by the Ministry. Harmonizing the different interests not the least the ones of keeping status quo in order to defend old privileges is not easy. Adding the interests of the university makes the situation even more complicated.

In the statements in the empirical study, the University is regarded if not as the major stakeholder in this system so at least, in the present situation of a severe shortage of trained professionals, one of the most important. "The institutions of higher learning, such as universities, have a major role to play in generation of knowledge that enables smooth functioning of national technological capacity." This was a statement at an opening address by the Minister for Science, Technology and Higher Education, Hon. Dr Pius Y. Ng'wandu (MP) on the occasion of the Regional Conference on Innovation Systems and Innovative Clusters in Africa hosted by UDSM, at Bagamoyo<sup>17</sup>.

A very practical example of an ICT innovation system in Tanzania is what is happening at the Tanzanian Telecommunication Company Limited (TTCL). TTCL was a state-owned company. After privatization the Tanzanian state is still the major owner. Although the monopoly of TTCL is expected by TTCL to disappear within a year or two, it presently has a lead of operating the national network. The interests of the Government and of the appurtenant private sector are connected to the University in the following way at TTCL. TTCL is and can be used for research and training as well as connectivity for the University. Some master students are funded by TTCL. The project work of the students constitutes pilots, which means that both the student and TTCL are learning a lot of valuable things. They mutually capture important knowledge. The University and TTCL can join hands in being employers – a number of students work at TTCL.

It is also the case that TTCL is paying a chair at UDSM. The need for mutual development is recognized and supported by having University research trained people as managers at TTCL.

A number of University professors consider the private sector to be very unfair. They do not want to invest in research for mutual development. The companies are only looking for graduates sponsored by someone else, leaving the entire burden to the Government. They gave an example of one firm with an opposite attitude. The firm is a mobile phone operator, which means that down the road the firm is sure to need graduates to take up some jobs. They are prepared but still planning to take over the support for these students for 2 years up to bachelor. Contacts between the company and students have been established. This is a kind of new model that the company wants to keep secret in order to have a competition advantage compared to other companies wanting the same students.

Another aspect is that the private sector could have teamed up with the University. Instead they are cooperating with foreign consultants. The question about why they go for foreign consultants, when they have local consultants is raised. There is still a gap between industry and the University. The private sector argues the taxes should provide resources for education and research.

Many can agree with the professor at UDSM stating that the Tanzania university heritage to a large extent rests on a western world way of knowing things. The same is for the industry and the Government in particular. The changes in Tanzania are not yet stabilized. The Government is unable to comprehend things and cope with the open trends. Generally, the University and the engineering sector had a strong relationship with the Government from the beginning. The sector depends on the Government and appreciates the role of the Government recognizing training of students as an input to the development of the country. It is important that the University is involved in the policies and the strategies.

One of the major problems is the diversity of the development patterns you find in Tanzania. Certain sections of the Tanzanian society are first world. However, there are others in a stage similar to the European 16th or 17th century. This situation indicates the (digital) divide within the Tanzanian society. One important question is how to cater for the areas where ICT development is almost of the first world nature but also not dragging these areas down by completely forgetting about them and just addressing the larger needs, where the majority of the people are - that is, how do you balance?

## ICT implementation in a postcolonial situation

Acute issues for ICT implementation can be identified in the fact that there is no real owner at high political level. The Ministry of Communications and Transport is coordinating the efforts to find the appropriate owner, who can channel all the efforts. A Governmental voice says the issue is not whether you have a ministry as an owner or not. ICT is a matter for many ministries. Everybody participates. What is needed is a matrix function for integration of ICT. People running the matrix should be innovative and not bosses. Another example is funding. Government as the largest employer should be the largest provider in order to reduce the uneven distribution of connections. A content issue concerns going from documentation in manual form to e-form. This does not require infrastructure in the sense of interconnection in the first place. It requires equipment and skills.

What should the Government do concerning ICT infrastructure and a capacity to provide all the services needed? One idea suggested is to utilize other sectors to build networks like combining with railways construction and maintenance work in order to avoid waste due to duplication.

The University has done a lot more in terms of infrastructure and hardware development. Very little priority has been put on the content area. Very little has been done in local content even in educational institutions. A lot more needs to be done in software and content. Situated development in these areas is suggested to be pushed by organisations like East Africa Community, Southern Africa Development Community (SADC) and the African Union. These are such new areas and you might not have the critical mass in one country to address the issues. You can do it more efficiently on a regional level. Addressing the content development should be a major regional issue. Presently this development is just dominated by the west and there are no cracks where you can get in. A suggestion raised was that Sida could play a major role, mainly facilitating by sending an expert looking at what the needs are on a regional level and how this can be addressed.

When integrating ICT in development programs, low income countries like Tanzania are necessarily disadvantaged. The partnerships Tanzania goes into now are not necessarily going to be in its favour. Tanzanians will agree to things that they have no institutional memories of, like knowing how to shape the contracts, the deals, etc. From being truly peripheral during the colonialism, over the period of cold war conditions being pawns and not one's own master, Tanzanians are now supposed to be partners in a globalization era. This progression from powerlessness to potentials has impacts in many areas. Most of the legacies come from the cold war period with impact of Marxism. This means that the local market has not been able to acquire the ingredients to understand the concepts the market process requires.

One of the persons interviewed stressed that

it is very unfortunate that computers came to Africa as prestigious tools, as elite, sophisticated tools and not as non rocket signs. This is a myth that came with them. Computers are just ordinary technology, much easier than automobile and more powerful than automobiles, because they are all knowledge based. Knowledge based technologies transform individuals. Many have a lot of interest in them. The West pushed computers as tools for private sector. That this is not true was not understood by the Government ...It all depends on how you look at things within your own country... This element of articulation is what we need to do. We have to do a lot of trying around, pilots, a lot of talking with people.

The expansive force in the wireless telecom sector shows how high an ICT potential can be in Tanzania. We face an almost technical revolution experienced in Tanzania by the implementation and use of cellular phones with prepay function. Such a technology for direct communication between people seems to be appreciated as appropriate, relevant and affordable by a larger group of people than the income strong elite. The technology of cellular phones with prepay function has trickled out to more income weak masses. In its turn this implies a further elaboration of situated use and socio-technical development. The possibility to reach the very person you need to reach is higher with a mobile phone, especially in a country where the fixed line exchange capacity is 234 640 on a population of 34.5 million people, teledensity (lines per 100 people) is 1.22 and mobile subscribers are 700 000<sup>18</sup>. The possibility of self control is higher by the prepay function. A 55-year-old Tanzanian woman living in a poorer suburb of Dar es Salaam said in an interview September 2003 that she and her family could not afford a fixed line telephone. But having a second hand cellular phone for prepayment recharge makes it possible for her to develop her businesses, a necessary complement to her scarcely paid teacher job, as well as to communicate in different ways for the safety of her children, grandchildren and extended family members. Two motivations for this technology are brought out. The possibility to reach the very person you need to reach is higher with a mobile phone, especially in a country, where the number of mobile phone connections is three times the fixed line connections. The woman in question also emphasized the possibility of self control by the prepay function instead of a "salted" bill for the fixed line telephone use. The latter is a sign of very low trust in public (and private) institutions in Tanzania – an understandable attitude under earlier and present circumstances. The mobile phone market in Africa has expanded more than in any other region in the world during the last seven years. In average the market has grown with 78 % a year<sup>19</sup>.

At UDSM, the issue of how to achieve the dreams like poverty reduction, more education, etc was brought up in the discussions. Nothing new is stated, but here Tanzania has a tool plus a competitive component. How much is really Tanzanian? "We have a kind of technology where we can provide significant content of products, more than 60% as equal partners in the provision of products and services. This is mainly knowledge based. We have an opportunity to do that (provision)



much more than in nuclear physics for example.” For rural development, running newspapers etc. even 75% is estimated to be able to be provided locally, when it comes to ICT content and services.

## Concluding comments

In order to develop relevant and multi-faceted ICT practices in a postcolonial situation we have to acknowledge ICT as producing reality (Haraway, 1997) and as integrated in predominant transformations.

ICT is a strong driving force for a number of transformation processes in societal development. In this chapter I have tried to focus on ICT as a trigger for making the role of the university in a postcolonial context crucial and for the university to be understood as an equal partner in economic, technical, cultural and political transformation in society. Focusing ICT also enables us to realize potentials in building innovation systems – a capacity building, which must be done with a context sensitive approach. More specifically I have tried to elaborate the role of the technical faculties and other ICT related bodies at UDSM, as they are in the core of the whole ICT process.

A number of stakeholders are involved in making things happen. This indicates that the issue of ICT is much more than a question of technical infrastructure and technical systems, particularly when entrenched in innovation systems. Experiences from Tanzania show how the introduction of ICT for instance in the form of Internet communication is a delicate process of technopolitical as well as more general political dimensions. Technical faculties and top management at the universities have been active and initiative taking partners. However, in the complex web of material, cultural, social and economic actors<sup>20</sup> within ICT development, one of the current key issues is accessibility for low income countries and poor women and men. Opening up for and increasing access to information, knowledge and communication via ICT is a non-linear process.

A postcolonial situation emphasizes the concern of relevance. The Vice Chancellor of UDSM is explicit about relevance as the central mission for the assignments of the University – research, teaching and services to the communities. To be relevant in a bigger context than the traditional “ivory tower” context of universities means a number of challenging impacts on the university and its transformation ambitions. This huge issue is fully recognized by international researchers showing thorough insights like Michael Gibbons, Helga Nowotny, Peter Scott and others. The recognition is met with forceful resistance by the university establishment in the West - as expected. However, our increasingly complex realities in a globalized world are there and cannot be denied. A postcolonial country like Tanzania has advanced potentials to meet the challenges of relevance and be in the forefront when it comes to the transformation assignments all universities face in a knowledge and technology dependent society.

If we use the triple helix model<sup>21</sup> just as a simple way of recognizing the co-operating practices, where the university has one of the active roles, the relation between the university and the government becomes a complicated balance act.

This balance act is different in many but not all aspects from the situation in for instance Sweden and is due to the history of universities in former colonized countries. The situated knowledge about UDSM is carried by Luhanga et al. (2003a, b) and is an imperative reminder for me and others of the vital importance of context dependence of every effort of ICT development and knowledge system transformation.

A fourth actor, beside the three main actors, university, industry and government, in the triple helix model for technology development, has been recognized in “technology-related intermediary institutions”<sup>22</sup>. This fourth actor points to the importance of a broker function. The broker role including knowledge management is often overlooked in the processes of cooperation between industry, university and government, not the least in a north European context. It is interesting that this function is identified in a Tanzanian context and strengthened by the account that the institutions of higher learning, such as universities, have a major role to play in generation of knowledge that enables smooth functioning of the actual cooperation processes. We find the vital broker and the linked transforming functions also within the main actors and as noticed at pCET and other parts of UDSM.

The ambitions of UDSM and the Government of Tanzania (in the National ICT Policy) to foster ICT for poverty alleviation and societal development are serious and have a recognized steerage-way. Acknowledging the postcolonial context holds vital potentials for innovative advantages as well as turning the western ICT expert discourse upside down.

## Notes

<sup>1</sup> The document can be found at [www.ethinktanz.org/eseecretariat/DocArchive/](http://www.ethinktanz.org/eseecretariat/DocArchive/)

<sup>2</sup> As far as hardware and software skills are concerned, skills for the training of professionals in both these skill areas are available only at UDSM. Training of hardware sub-professionals is being done at the Dar es Salaam Institute of Technology and at several other institutions offering Cisco approved courses, for which the University Computing Centre Limited (UCC Ltd) serves as the Regional Academy for the local “Cisco Academics” spread all over Tanzania imparting skills in hardware and software. As far as acquiring skills in software applications is concerned, many institutions, both public and private, are active and they are regulated by the National Council for Technical Education (NACTE).

<sup>3</sup> See chapter 3.3.1 in the National ICT Policy document.

<sup>4</sup> [www.udsm.ac.tz](http://www.udsm.ac.tz) 2004 04 06.

<sup>5</sup> Luhanga et al., 2003a, p. 8.

<sup>6</sup> [www.sida-sarec.udsm.ac.tz](http://www.sida-sarec.udsm.ac.tz)

<sup>7</sup> in interview 2003 09 12

<sup>8</sup> The UDSM started e-mail services using a Low Earth Orbit Satellite (Health net) before starting the dial up services. Then as presented by Mutagahywa (2003, p. 474) GreenNet routed the messages through London. Given the high cost of international calls, the UDSM hub called once a day to London to download and upload messages. The email messages were the printed out for the recipients, who paid about 0,10 US\$ for the service. The demand for the service grew rapidly. More modems were added to the system to service not only internal clients but people outside the University as well. This email service was provided by the Computing Centre.

<sup>9</sup> In Sweden, Internet was introduced in the 80s. Like in Tanzania, initiatives grew from a University, namely Royal Institute of Technology (KTH). The centre for Internet supply (KTHNOC) at KTH became the hub for development of the Swedish Internet. The net had its core at KTHNOC and was linked up to the Swedish universities under the name SUNET, Swedish University Computer Network (<http://basun.sunet.se>). The success of the Swedish Internet development depends on a high degree on personal and trustful relations with Internet pioneers in USA (Hamngren and Odhnoff, 2003).

<sup>10</sup> Internet Service Providers, also known as Internet Access Providers. It is a company that provides infrastructure for access to the Internet or for interconnecting other ISP and content based or application based services on the Internet.

<sup>11</sup> PM Sida SAREC 2003 04 28 to the research board of SAREC.

<sup>12</sup> PM 2003 09 22 to research board of SAREC.

<sup>13</sup> Interview at pCET 2003 09 15.

<sup>14</sup> Over 4 000 participants from the industry and other organizations including participants from all 25 regions in Tanzania have attended professional development courses aimed at enabling them to keep close with technical development. (Mwamila and Katalambula, 2004, p. 8).

<sup>15</sup> All technology development by the pCET staff, technology brokerage as well as the subsequent transfer to industry is coordinated by TDTC (Mwamila and Katalambula, 2004, p. 11).



<sup>16</sup> Interview at Civil Service Department of the President's Office 2003 09 11.

<sup>17</sup> 18 February 2004.

<sup>18</sup> All numbers refer to the year 2002, presented in the National ICT policy of Tanzania.

<sup>19</sup> Statistics from ITU commented in Ny Teknik (New Technology) 2003 11 28.

<sup>20</sup> For a discussion of diverse actors in ICT contexts, see Elovaara, 2004.

<sup>21</sup> The triple helix model focuses mainly on the outer frame of the processes (see page 1 above). The actual knowledge and development processes are more explicitly discussed within the concept of mode 2 (Gibbons et al., 1994, Nowotny et al., 2001). Some characteristics of mode 2 knowledge productions are "situated in the context of application", "distributed knowledge processes" and "development of socially robust knowledge". The mode 1 is described as carrying the ivory tower tradition of the academy.

<sup>22</sup> Emphasized by the Minister for Science, Technology and Higher Education of Tanzania 2004 02 18 at the Regional Conference on Innovation Systems and Innovative Clusters in Africa, Bagamoyo, Tanzania.

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## CHAPTER 4

## How can Universities become more active Partners in Innovation Systems? Lessons from the Nordic Countries?

ELISABETH GULBRANDSEN

... innovation is about adapting to changing circumstances and making new things in new ways. New ways to do things always emerge locally (Reijo Miettinen, National Innovation System, 2002)

### Significant question marks

The title of this intervention contains two significant question marks, and my ambition is to help them proliferate. One of the most pressing interrogations for science policymakers the last 20-30 years has centred on output; how to secure an output from research that complies with economic, social, cultural and ethical concerns. Or reformulated to suit our more immediate concern: How can universities assure that choices made by scientists<sup>1</sup> and engineers on campus contribute to responsible innovation? This challenge has by no means been satisfactory answered; hence the first question mark remains important. In the paper possible lessons are drawn with reference to Finnish ventures with National Innovation System (NIS) in the 1980-90s, Swedish universities' experiments with the so-called "third task" or mission from 1996 onwards as well as Nordic women's research contributions to social and cultural innovation.

The second question mark ought perhaps to be doubled as it relates to the possibility of developing 'situated knowledges'. The concept was introduced by Donna

Haraway as part of an epistemological and political struggle to create alternatives to "... developing at home that voice of entitlement, the voice of control, that accompanies the conquest of empires far from home" as Sharon Traweek depicts the conventional voice of science (Traweek, 1992). As an approach to knowledge-making, 'situated knowledges' endeavours to dilute the "two indivisible foundations of imperial authority – knowledge and power" (Aschcroft et al., 2002).

Texts produced with an ambition to qualify as situated knowledges, can be read as instances of sense making striving to "holds things together well enough so that people can share in that account powerfully".<sup>2</sup> As regards this intervention, I therefore find it appropriate to underline that the contexts for my engagements hitherto mainly have been Nordic. This makes sense making in a postcolonial context a rather risky task. So my second question mark may double while asking: Does this make sense?

## Challenges for research and policymaking

Not aspiring to promote a free and unfettered science capable of "speaking truth to power", 'situated knowledges' foregrounds science as deeply embedded, entangled and implicated in world-making processes. It works against various forms of unlocatable and hence, irresponsible, knowledge claims. It strives for partial, critical knowledges capable of sustaining webs of connections called "solidarity in politics and shared conversations in epistemology" (Haraway, 1992, p. 190). 'Situated knowledges' is an argument for a more open and democratic scientific literacy, for a new doctrine of objectivity struggling to become accountable to the claims research make on people's lives. 'Situated knowledges' was put forward as a challenge for all the sciences/academic fields, though later developed in relation to technoscience (Haraway, 1997).

Sheila Jasanoff directs an echoing challenge to policymakers in a recent article commenting the growing insistence on co-evolutionary and interactive images in models relating to science and technology policy (Jasanoff, 2003). Co-evolution of science and society has led to increased complexity, unpredictability and irregularity in both spheres.<sup>3</sup> Jasanoff expands this discussion by contending that policymakers need to develop a set of 'technologies of humility' for assessing the unknown, unspecified and uncontrollable, the ambiguous and indeterminate aspects of scientific and technological development. 'Technologies of humility' call for different capabilities and different forms of engagement between scientists, experts, decision-makers and the public, than the regulatory and predictive 'technologies of hubris' on which policymakers presently lavish much of their attention. Jasanoff is not alone in addressing issues of complexity and uncertainty in relation to science and policymaking these days. Brian Wynne and Jerry Ravetz recently, in very interesting and provocative proposals, place 'ignorance' on part of the sciences at the heart of the discussion about how to understand, differentiate, express and communicate complexity and uncertainty.<sup>4</sup>

Sheila Jasanoff's article can be read as enhancing policy questions into political questions. Policy questions are often represented as questions concerning merely strategy or tactics.<sup>5</sup> Jasanoff insists that we also see them as constitutional:

There is growing awareness that even technical policy-making needs to get more political – or, more accurately, to be seen more explicitly in terms of its political foundations. Across a widening range of policy choices, technological cultures must learn to supplement the expert's preoccupation with measuring the costs and benefits of innovation with greater attentiveness to the politics of science and technology. (op. cit., p. 225)

## What is at stake

I find Jasanoff's explication of the challenges for policymaking valuable and her concept of 'technologies of humility' suggestive. She is not very optimistic, however, concerning the necessary changes that have to follow to assure that the research and innovation activities of institutions like universities, will reflect responsible concern for the public good: "The problem, of course, is how to institutionalize polycentric, interactive, and multipartite processes of knowledge-making within institutions that have worked for decades at keeping expert knowledge away from the vagaries of populism and politics" (op. cit., p. 235). What is at stake here? What does it take to enhance our transformative capabilities adequate to this challenge?

The linear model that was dominant in science and technology policy from the 2nd World War until the late 70s, might be declared in trouble and even dead, but it will not lie down that easily. So, what is stopping us from pulling ourselves and our institutions out of line(arity)? Although it is recognized that interactive knowledge-making with "up-stream" participation from stakeholders foster more socially robust knowledge, improve accountability and lead to more credible assessments of science and technology, modern institutions still operate with conceptual models that seek to separate science from normative and political questions, and that emphasize prediction, mastery and control at the expense of reflexivity and learning. New policy models based on interactive conceptions have a hard time, being subjected to hash criticism by leading (as well as aspiring) scholars.<sup>6</sup>

It is important not to underestimate the changes required to initiate and sustain transformative processes in research systems. It may require quite fundamental shifts: "I think something is going on in the world vastly different from the constitutional arrangements that established the separations of nature and society proper to 'modernity', as early modern Europeans and their offspring understood that historical configuration; and recent technoscience is at the heart of the difference" (Haraway, 1997, p. 43). The breakdown of the linear model leave little or no intermediary time and no place to develop science's relations with society "... after all the serious epistemological action is over" (Haraway, 1997, p. 68). The transformative challenge doubles as accountability is placed on the agenda. Our scientific struggles are deeply embedded in world-making processes and in order to develop a knowledge base and competencies more adequate to such diffractive endeavours, we may have to question received conceptions of research, of policy and of politics as well as discuss and develop new figurations of these rather basic concepts and their relations.

These are stiff demands, and it is therefore important to make sense both of the institutional and scholarly resistance, as well as exercise our imagination in developing new questions and discussing new figurations, like 'situated knowledge'

and 'technologies of humility', that can guide our efforts towards more intimate, immediate and responsible interactions between research, policymaking and politics. Otherwise the critique of the linear model might end up as impotent as the critique of positivism in the 70s.<sup>7</sup> An outcome I fear we cannot afford.

## A very short story of science policy

The conventional short story of science policy in Europe starts with “science push” following the 2nd World War, shifting to “societal pull” in the 70s.<sup>8</sup> This narrative can also be interpreted as a dichotomous science policy situation; on the one hand, at one place and time we have a focus on “policy for science” that is input centred, on the other hand we have “science in/for policy” that is focused on securing output from research. As Wenneberg (1999 & 2000) as well as Sarewitz (2000) have demonstrated, the outcome-oriented approaches are still poorly developed: “So we fall back on what we know how to do best: talk about inputs to the system, and assume that we will get the outputs we need and desire” (Sarewitz, 2000, p. 13). The input that is focused most is money, and science policy is consequently preoccupied by asking how to use money on research, by discussing what financial measures to develop. According to Sarewitz, science policy as currently practiced in the US: “... operates largely as struggle over allocation of resources” (op. cit., p. 14). If policy/politics in this way disintegrate into fights over budget, the “success” of the policy endeavours in science is not measurable in terms of increasing quality of life/contributions to particular societal outcomes, only in terms of the size of research budgets. It has been suggested that the introduction of New Public Management in research systems contribute to the decline. It is puzzling that in so called knowledge societies, inspiration for developing the system of governance is taken from business and/or bureaucracy, not from universities.<sup>9</sup>

In Sweden, the system of funding and research was institutionalized in a bifurcated way. Research directed to societal needs, was taken care of and funded through the development of separate sectorial agencies that was put up aside the traditional, discipline oriented research councils. Hence, two different conceptual models of research existed side-by-side, never having to interact. The presumably clean, objective, basic research was catered for through policy for science-institutions, while the presumably socially related and relevant research was handled by sectorial research agencies. Such a consistent dichotomous research system has some rather grave consequences, as suggested by Aant Elzinga (Elzinga, 1994). The societal/political dimensions of research remain invisible to university researchers in their everyday lives, Elzinga contends, and more complex understandings of science’s internal dynamics interacting with societal drivers never become an issue, neither for university-based researcher nor for researchers catered for by sectorial agencies.<sup>10</sup> Questions concerning the research system as a central societal stakeholder and political actor were not addressed. As a result, research communities may draw on obsolete and simplistic ideas about the relations between science and society, Elzinga warns, undermining their ability to deal with science as embedded and entangled in world-making processes. An evaluation of Risø National Laboratory in Denmark, seems to confirm that policy questions, in this case represented

as “strategic questions”, is absent and of little or no interest to the researcher in her everyday activities (International Evaluation of Risø National Laboratories, 1997). In 1994, Elzinga put his hopes for the development of more integrated and complex conceptual models in the proposed concept of “strategic research”. A range of other suggestive figures, triggered by anxiety concerning the linear model and dichotomous policy situation, followed suit; e.g. triple helix, innovation system, post-normal science, technoscience, mode 2 and agora.

The anxiety has increased the last 10 years, manifesting itself in the focus on public participation and governance, on prediction and regulatory mechanisms, as well as in the proliferation of ethics committees and ELSA-research; that is research on the ethical, legal and social aspects of emerging technologies. If we follow Haraway’s suggestion and consider technoscience paradigmatic for the predicament, the new production of knowledge empowers society to intervene more directly and on a massive scale into the “nature of nature”, both on micro level (biotech to nanotech) and on the macro level (global climate and biodiversity). The transformational potency to what we are creating today is unprecedented in history. “The only possible analogue we have to today’s emerging technologies is nuclear weapons”, Sarewitz contends, reminding us that we were “... a hair’s breath of cataclysmic nuclear war during the Cuban missile crises. We were lucky, not smart.” (Sarewitz, 2000). The advent of the knowledge society, calls for real-time technology assessment, for identifying choices and making evaluations part and parcel of (techno)scientific processes.<sup>11</sup>

The linear model still holds sway in Europe, if judged by the recent discussions concerning the establishment of a European Research Council (ERC) and conferences this spring focusing the future of European universities, together with invitations from the European Commission to discussions about the Seventh Framework Programme (FP7). European universities are expected to contribute to innovation, work in partnership with stakeholders in networks “... to ensure better dissemination and exploitation of new knowledge ... be it for commercial applications, to take part in public debates or advise governments at policy level”.<sup>12</sup> Implying that first we have knowledge-making, then dissemination, exploitation and/or application. Quite far from dreams of securing socially robust knowledge through “polycentric, interactive, and multipartite processes of knowledge-making” as proposed by Jasanoff or through different forms of “collaborative assurance” (Guston, 2000). The Commission recently proposed to discuss the setting up of a European “agency” for allocating EU-funds for research also to “basic research”. While characterizing the FP-side in terms compatible with sectorial research, “basic research” is advocated as based on scientific excellence, peer review, not “political agendas”. The only community that will have something to do with setting the research agenda in basic science will be the scientific one.<sup>13</sup>



## Authority in transformation<sup>14</sup>

At times it seems to me that we are trudging in fine programmes for change, with little or no transformative power. Why is that? Again; what is stopping us from pulling ourselves and our institutions out of line(arity)? How to account for the continuing appeal of the linear model and a bifurcated policy system? Enhanced understanding both of the resistance against as well as possibilities for transformation is emerging as a competence much sought after. Continuities between the critical programmes of the 50s, 60s and 70s, critical hermeneutics, women's research as well as the relatively new field of science studies can easily be traced.<sup>15</sup> In the 50s this ideal was formulated as 'critical theory'. A theory was critical in proportion to its ability to specify its own (pre)conditions. What could be struggled for was a relative objectivity; an objectivity that could specify its own limitations, which at the same time also indicates possibilities – even if this point was seldom emphasized. In 1985, Evelyn Keller summed up the struggles for more complex models: "Yet, while our sensitivity to the influence of social and political forces has certainly grown, our understanding of their actual impact on the production of scientific theory has not" (Keller, 1985, p. 5).

As already indicated, this lack of mediation between so-called external perspectives and more internally based analyses has grave consequences regarding our possibility to develop a transformative competence as researchers and as policymakers. As a result of this lack, we cannot but regard science's products as being impelled solely by science's own internal logic. In the everyday life of doing research, we are left without possibilities to understand how macro powers are at play; we are left without the possibility of transforming research in a direction of identified concerns. In a Nordic context, concessions are made that the ambitions from the 60s and 70s have as yet to be realized.<sup>16</sup> We are left with judging only the consequences of what we partake in creating; science and technological development. The linear model may be only five decades, but grafted on an older and more ingrained tradition, it will not step down when told to. Does this mean that we are stuck between those "old and tired words"<sup>17</sup>, between external and internal stories of science and technological development?

Impacts of our knowledge constructions are independent of whether our results are judged to be true or false, valid or invalid. Following this realization we can trace a shift in focus from what in the philosophy of science is called the 'context of justification' to an interest in developing more complex and integrated understandings of knowledge processes in the modern research complex. In order to handle the political and ethical implications and responsibilities involved in the new production of knowledge, we need understandings and concepts of knowledge that help us become aware of these dimensions. It no longer suffices just to claim our scientific products as "true" or valid or that "it works". Following Keller from

1985 onwards, we must also ask what it works at (Keller, 1992). If we consider complementing the context of application of research with the context of implication as recommended by Nowotny et al. (2001), we have yet another interesting convergence between research questions and science policy questions.

During graduate studies and postdoctoral work we learn to pass as researchers with authority in the academic world. Internalizing the rules and norms that constitute the chosen discipline also implies the assimilation of a complex of tacit or informal knowledges. As Gerholm and Gerholm put it: "... the things you learn by acquiring a discipline is by no means only knowledge of a certain kind and technical skill but also a 'cultural framework' that may come to define a big part of one's life" (Gerholm and Gerholm, 1992, p. 14, my translation). One important aspect of informal knowledge is the notion of authority or lack of authority in a text. The ability to recognize such authority is hard to make explicit and thus difficult to achieve. "Very few scientists can answer questions about why certain texts give an impression of 'competence' while other texts don't" (op. cit., p. 25, my translation). Gerholm and Gerholm describe this ability as a feeling for how authority is created in a text or a lecture, for what counts as an argument, for the common attitude towards the surrounding world and for the personal style accepted by colleagues. What we want to leave behind as outdated conceptual models may live on as cultural frameworks, showing itself spontaneously in practice as a "theory-in-use".<sup>18</sup>

This is not a call for any old or new liberalism, but I think Wendy Hollway makes a point by stating that: "Science as we know it could only become dominant because it was preferred" (Hollway, 1989, p. 11). Struggles to become aware of and change such preferences will be a central part of research transformatory projects. What I miss in most of the European approaches, is application of and reference to "(techno)science as culture" as developed in science studies in the US. Processes of knowledge and learning hinges, in rather constitutive ways, on capacities for reading, writing, interpreting and translating. Language and communication are cultural products and attending to and developing our cultural and scientific literacy, may also help in mediating between external and internal stories of science and technological development, paving the way for what we may figure as a "politicoscientific competence".<sup>19</sup> Provided that we observe and let us be inspired by the elegant turn of the concept 'scientific illiteracy' as performed by Sandra Harding (1998), and manage to keep our justificatory efforts apart from our transformative struggles. The latter will include considering whether a developed transformative competence can turn out to be what renders legitimacy and accordingly authority, to our work in the longer run.<sup>20</sup>

## Situated futures

'Innovation system' was one of the first concepts employed to figure interactive alternatives to the linear model. It has been extensively used in the Nordic countries while pointing to Finland as the paradigmatic case of applying the concept of 'national innovation system' (NIS). Reijo Miettinen's analysis of how the notion of NIS was developed in Finland, may also qualify as paradigmatic I think, focusing NIS' role as a mobilizing metaphor, discussing its development as it doubles as both a scientific and a policy concept (Miettinen, 2002). He introduces and develops: "...an epistemology of transdiscursive terms that are simultaneously and interactively used both by scientific communities and in policymaking". This turns out to be a useful perspective for discussing the changing relations between policy questions and research questions that I focus in this intervention. Examining other suggested figures like mode 2, agora, technoscience, post-normal science, as transdiscursive terms, may further our understanding of the convergence between research questions and policy questions.

Miettinen's text is rich and may serve to induce the much warranted reflexivity both on the part of researchers and policymakers. He manages to bring forth awareness concerning the technocratic and scientific temptations lurking in NIS, well suited to the tradition of rationalistic policymaking and planning. Miettinen discusses whether Nordic socialdemocratic political cultures may predispose both policymakers and researchers for technocratic and scientific interpretations of the concept, making them eager to exploit its holistic possibilities thereby connecting NIS to technologies of hubris, or to stick with Haraway; the god-trick<sup>21</sup>. But not necessarily so, Miettinen argues convincingly for a more modest approach, emphasizing reflexivity, learning and context dependent knowledge-making. Thus echoing both figures like situated knowledges and technologies of humility, not seeking "mastery and control", but focusing interaction with ambitions to induce modulations in the diminishing gaps between variation and selection or promotion and control.<sup>22</sup>

What fascinates is Miettinen's analysis of policy questions as related to research questions. I find the transdiscursive perspective valuable, representing possibilities for judging the new suggestive science policy models like mode 2, agora, triple-helix and post-normal science, against another background or project than the conventional scientific one. What bothers me about his approach, is what I find is a subscription, after all, to a concept of science, that accepts that science cannot cater for anything associated with the future. Miettinen promotes such an understanding by e.g. referring to Marx Wartofsky's distinction between models that serve as explanations of present practices and state of affairs, and models that are used in orienting ourselves to the future. Explanatory models of science mostly belong to the first category, Miettinen contends. Policymaking is conditioned on

making sense of the future. Since 'the future' is not a sort of thing one can put under microscope, or even test by a knowledge of exactly equivalent conditions in the past, we are involved in decisions that necessarily lie beyond the strictly scientific vocabularies of description. I have positioned myself throughout this paper in relation to a project of blurring the boundaries between science and policy/politics, not in relation to the intentional separation advocated by Miettinen. I find that blurring the boundaries is unavoidable to a certain extent, as well as productive on both policymaking and research. This approach entails dangers, of course, but if we avoid references to the future, we also avoid references to the desired outcomes and identified concerns, and hence, accountability in other than cost-benefit terms, becomes difficult, if not impossible.

A clear-cut separation also invites a division of labour between scientists and policymakers, reinforcing a social contract thinking that has been called the "Nordic way of governance".<sup>23</sup> In my attempts to double as an advisor to the policymakers, in a so-called intermediary institution (Guston, 2001), The Research Council of Norway, I have come to doubt whether my commitment as a researcher to systematic, causal explanations may serve our transformative ambitions as well as we want to believe. It is not enough to focus on improving the statistical data and on improving the explanations. These are of course necessary elements in the knowledge base, but must be supplemented in ways that allow researchers and policymakers to engage in polycentric, interactive and multipartite processes about future solutions and implications of knowledge claims.<sup>24</sup> My suggestion is that we complement 'situated knowledges' with a new figuration of 'situated futures'.

## In dreams begin responsibility

There seems to be quite a lot of imaginative futures around these days, suffice to mention different foresight exercises swarming the European countries. In a recent article Catherine Lyall and Joyce Tait (2004) discuss these endeavours and concludes that the linear model still reins, in spite of all good intentions to break with it. Lyall and Tait also points out a tendency to narrow the scope again to technological foresight, leaving behind the ambitions to develop and relate to broader societal concerns. I will not, however, end this intervention on a discouraging note, having just advocated a stronger solution orientation. It is important to remember that in every representation of a problem lies a frustrated dream or solution inviting articulation and discussion. Yet again, how do we invite such opening discussions in practice and as culture?

Maybe it is time to change metaphor. In an inspiring account James Moore turns up a lot of suggestions about how to induce quite fundamental transformative processes by developing a new figuration; 'business ecosystem'. The problem with the traditional industry paradigm was that it ignored the context - the environment - within which the business lies, and it ignored the need for co-evolution with others in that environment, a process that involves cooperation as well as conflict.<sup>25</sup> The new metaphor's positive functioning was, however, dependent on the establishment of the institution of a "kitchen cabinet". A generous, open, inviting, allowing arena had to be created for the construction and development of new questions and new dreams adequate to the fundamental shift denoted by the shift in figuration. Holding both analysts and strategists back, while new questions and visions for future solutions were allowed to mature, was another important prerequisite.

We need a lot of "kitchen cabinets" on our Nordic campuses to cater for the polycentric, interactive and multipartite processes of knowledge-making we may dream of. But first we must figure out what our different, specific, local kitchen cabinets may look, feel and smell like, aiming to turn on transformative processes, changing research cultures and "teaching smart people how to learn".<sup>26</sup> Such transformations cannot be brought about by the kind of measures that universities traditionally have at their disposal. This lesson comes out of Swedish universities' experiments with the so-called "third task" or mission<sup>27</sup>, presented as a challenge to blur the borders between science and society or research and politics, by Carl Tham, minister for Research from 1994 to 1998. Wisely enough, he created new universities where experiments inspired by figurations like triple helix, post-normal science, technoscience, mode 2 and agora, proliferate.

## Notes

<sup>1</sup> By "scientist" and "science" I refer not only to the natural sciences, but the social sciences as well as the arts and humanities.

<sup>2</sup> As Haraway herself puts it in an interview with Thyza Nichols Goodeve in *How Like a Leaf* (1999).

<sup>3</sup> As developed e.g. by Nowotny, Scott and Gibbons in *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty* (2001).

<sup>4</sup> Jerry Ravetz asks in "Reflections on of the Future of Science": Can we afford, any longer, to maintain ignorance of ignorance at the centre of our scientific culture?" (<http://www.others.com/reflect.htm>) Bryan Wynne contended at EuroNanoForum in Trieste, December 2003, that "Public ignorance is not the cause of mistrust and scepticism, this has been proved by Eurobarometer surveys. The cause is what as seen as a denial by scientists of scientific ignorance."

<sup>5</sup> See Bo Dahlbom "Vem styr tekniken?" (in my translation: Who governs technology?) and Carol Bacchi *Women, Policy and Politics: The Construction of Policy Problems* (1999).

<sup>6</sup> The new models are criticized for being unscientific, not empirically based, of no analytic value, just empty rhetoric, dangerously misleading, mere propaganda from Brussels and so on. As Nowotny et al. also point out in an article revisiting "mode 2"; such reactions are predictable (Nowotny, Scott and Gibbons, 2003).

<sup>7</sup> For a discussion of the impotent critique, see *The Reality of our Fictions: Notes towards accountability in (techno)science* (Gulbrandsen, 1995). Reference also to Alfred Nordmann, rapporteur of the European Commission's High Level Expert Group on converging technologies, expressing worries about what he points to as a swift return of positivism (at a seminar in Oslo, 5 May 2004).

<sup>8</sup> For excellent reviews and discussions of the policy literature, see Egil Kallerud, 1992 and 1998.

<sup>9</sup> Reference made to Johan P Olsen's paper; "Organisering og styring av universiteter: En kommentar til Mjøs-utvalgets reformforslag" (my translation: Organisation and governance of universities: A comment to the proposals for reform from the Mjøs-committee), ARENA Working Papers, 00/20.

<sup>10</sup> As a result of a lack of more complex understandings of the interrelatedness between the sciences' internal and external workings, Sweden may be subjected to rather unfruitful (reactionary) shifts at the policy/politics level; see e.g. Ben Martin (2001, p. 12).

<sup>11</sup> See e.g. Guston & Sarewitz (2002) proposal developing what they call "real-time technology assessment" in *Technology in Society* as well as Ari Rip et al. (1995) work on "constructive technology assessment".

<sup>12</sup> Invitation to the conference in Liege, April 2004, on the future of European universities.

<sup>13</sup> Science and technology, the key to Europe's future, strategy document from the

Commission, 20040616, and statements made by Research Commissioner Busquin and Director-General of Research Mitsos, see e.g. “Signs of change in EU science”, *The Scientist*, 2004 02 18 and “EU proposes science shake-up”, *The Scientist*, 2004 06 16. I understand the work of the Commission’s High Level Group on converging technologies as a serious attempt to counter the setting up of such a bifurcated system, by suggesting and struggling to promote agenda-setting policy processes as arenas for stimulating more creative and imaginative research processes (*Converging Technologies – Shaping the Future of European Societies*, Report 2004). This interpretation was supported, I think, by the rapporteur’s exclamation directed at his fellow scientists at a meeting in Brussels, 15 September 2004: “Politics is good, and can even be fun!”

<sup>14</sup> The discussion of authority is developed in a paper with the same title in *The European Journal of Women’s Studies* (Trojer and Gulbrandsen 1996).

<sup>15</sup> Reference made to Lundstøl (1978), Bärmark (1984), Elzinga (1988), Rosenbeck (1992) and Lundgren (1993).

<sup>16</sup> See Gregersen and Køppe (1985), Håkanson (1988), Kjølrup (1985), Lundgren (1993) and Rosenbeck (1992).

<sup>17</sup> Ian Hacking’s expression in “The Self-Vindication of Laboratory Sciences”, in Pickering (ed., 1992, p. 51).

<sup>18</sup> See Chris Argyris (1991) for a discussion of espoused theory contra theory-in-use.

<sup>19</sup> Reference made to Michael Flower’s figure of “politicoscific communities” as presented in Haraway (1997).

<sup>20</sup> This argument is developed in my licentiate thesis, especially the article “The Reality of Our Fictions: Notes towards accountability in (techno)science” (Gulbrandsen, 1995).

<sup>21</sup> The god-trick, according to Haraway; “...to see everything from nowhere” (Haraway, 1991, p. 189).

<sup>22</sup> See Arie Rip’s expert review for the Bundesministerium; *Co-Evolution of Science, Technology and Society* (Enschede, 7 June 2002) for an excellent elaboration on the co-evolutionary perspective on science and technology with society, as well as a brief review of the literature on co-evolution: <http://www.sciencepolicystudies.de/expertise/download.htm>

<sup>23</sup> As developed in Kjell Eide “Hvem skal informere politikken?” (my translation: Who is informing the politicians) in *Nytt Norsk Tidsskrift* 3-4/94.

<sup>24</sup> Reference to my engagement in Nordic women’s research. Some lessons are developed in “The New Politics of Knowledge; making (sustained) Change Happen” unpublished paper prepared for an AIOFE workshop 2002 10 25 in Antwerpen: *Integration of Gender Research in EU’s FP6*, distributed by the author on request. See also Gulbrandsen (2002) for an earlier version of the paper, as well as Gulbrandsen (2000).

<sup>25</sup> I hope Moore’s initial borrowing from the sciences, will excuse my borrowing from business when models of governance are concerned.

<sup>26</sup> See Argyris (1991) and Nowotny et al. (2001).

<sup>27</sup> See Brulin et al. (2003) as well as conference reports from the Nordic R and D conferences on university and society cooperation.



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## EPILOGUE



## Epilogue

We have discussed the theme of the book – ICT, Innovation Systems and the Role of Universities in Societal Development, a (post)colonial strain? – from perspectives not yet much elaborated in international research. We find that these perspectives carry strong potentials for creative and innovative understandings and practices. The perspectives in focus are an integrated view of postcolonial contexts and ICT, complex understandings of innovation and figures of situated and socially robust knowledge and technology development. The discussion is based on field experiences in Rwanda, Tanzania, Sweden and Norway.

In the introduction, some questions were presented concerning ICT development in relation to the postcolonial situation, the societal progress in developing countries and the role of the universities in the development of innovation systems in these contexts. In the following we bring up some threads as summarised comments on these questions.

In the complex web of material, cultural, social and economic actors within cyberspace<sup>1</sup> and ICT development, one of the current key issues is accessibility for economically weak countries and poor women and men. To open up for and increase access to cyberspace is a non-linear process and certainly not only a technical issue. The contemporary accessibility debate pivots on telecommunication.

We have seen how the G8 and other transnational bodies gather around the telecommunication sector and more or less explicitly demand deregulation of that market. In contrast with that view, we argue with many others that the telecom market, left to itself, will not address the inequality of women's and men's access to communications. Positive political intervention will be required and national telecom sectors must be reformed and restructured. Open, unfettered competition will never ensure that telecommunications are provided globally. However, it may

be possible to achieve the goal of global service through regulation and by placing conditions on the companies licensed to provide telecommunication services. For example, the ITU (International Telecommunication Union) promotes 'universal access obligations' for ICT operators in order to address this issue.

The consequences of the colonial experiences place very specific requirements on ICTs in the postcolonial parts of the world. There, new technologies have often been introduced as novel, while reproducing the existing hierarchical order between the industrialised "donors" and the (post)colonial "receivers". Considering the quote from a Tanzanian interview person in Trojer's paper (see page 99.), ICTs risk walking the same path instead of utilising the potential of postcolonialism. Powerful international institutions are putting great efforts to introduce and spread ICTs with the argument that ICT will be a driving force for economic progress within the dominating global economic system and with leapfrogging potentials.

If ICTs are going to be a serious attempt to change the global relations, room for local, contextualised technological development, experimentation, decision making and use is needed. As well as contextual requirements on the environment in which the technology is put in use, there are contextual requirements on the specific technologies to be used. Collective identities, preference for oral over literal communication and language diversity are but a few examples which need thorough consideration.

Experiences from the Nordic countries in the field of feminist technoscience and ICT development form the base for the argument for widening the concept of knowledge and technology production. The triple helix model introduces the potential for collaboration between the university, the government and industry in ICT development. In the traditional university model, such collaboration has been discouraged in the efforts to produce "clean" knowledge. As feminist theorists have shown, this has never been possible. The universities in Rwanda and Tanzania, as described in this book, are examples of a new openness, of the necessity of relations between the university and organisations outside. These universities, shaped in the postcolonial nation building, have a very straight-forward mission to contribute to the development of society. As the two examples show, the universities have also taken on a leading role to develop internal expertise in the ICT field, and develop ICT networks and systems in collaboration with the government as well as local organisations and companies.

We find this outspoken collaboration strategies balancing bravely between accountability/appropriate research and an unhealthy dependence, especially since the number of research institutions is so low, and university staff and government staff or politicians have close relations.

Another balancing act is that between basing all activities in the local society and making the best use of technologies provided from outside. Developing domestic expertise in the field of ICT is highly relevant and urgent, with the goal to make

use of ICTs in the knowledge production and spread in all sectors in society. ICTs per se are in this sense not the primary goal, as the rhetoric often suggests.

The role of the universities as active partners in innovation systems has become increasingly visible and explicit. In order to have functional innovation systems contextually anchored and embedded in accountable politics, the understanding of this partnership is situated in non-linear thinking. As innovation is about adapting to changing circumstances and making new things in new ways, it is reasonable to draw attention from "the utilization of the results of science" to the interactions between various institutions and activities and focus dialogue/multilogues, interaction and real-time evaluation and learning. In this way, ICTs and innovation systems may have the potential to contribute to poverty alleviation and the evolution of democracy and freedom in the developing world.

The international discussion about present and future knowledge- and innovation processes has made us focus the changing relationships between knowledge, freedom, (techno)politics and society. Some of the most central themes acknowledging these transforming relationships concerns situated knowledges and accountability. We find the understanding and practice of these concepts of utmost importance for ICT development in postcolonial situations struggling with an often too dominating discourse of western technological determinism.

As is stated in Gulbrandsen's chapter, new and innovative ways of doing and developing things always emerge locally and thus foster the development of situated knowledges. And situated knowledges may guide us out of a colonial situation.

## Notes

<sup>1</sup> Cyberspace is understood as the space, which world-wide computer networks create and which is accessible through Internet.

The aim of this book is to develop knowledge and understanding about how ICT can be involved in local and national innovation systems in developing countries. Special attention is paid to the role of the university as an important stakeholder in local and national development processes.

For this purpose, an interdisciplinary group of researchers has made the study carrying the question about the prerequisites for postcolonial identities to make their mark on a nationally situated ICT development and implementation.

The study addresses the emerging implosion of postcolonial situations and ICT development.

The theory frame of feminist technoscience is included in the analysis as a special resource.



NATIONAL UNIVERSITY OF RWANDA PRESS  
IN COOPERATION WITH BLEKINGE INSTITUTE OF TECHNOLOGY AND  
SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY