Governance of Science, Technology and Innovation for Food Security in Africa: A Conceptual Framework for Developing Indicators

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Introduction

This paper lays out the conceptual framework for developing indicators for assessing the governance of science, technology and innovation (STI) in Africa. It is erected on the premise that the subject of 'governance of science, technology and innovation' is increasingly becoming part of academic inquiry and public policy discourse in Africa and internationally, yet there are no conceptual tools as well as empirically tested indicators for demonstrating what constitutes it. There is indeed increasing usage of the phrase or concept of governance of STI in both academic and policy circles. This is due to the growing realization that orthodox approaches of measuring scientific research and technological activities of nations and supranational entities such as regions do not adequately deal with the growing complexity of science-technology-society interactions. Secondly, the democratization and opening up of political systems as well as public policy-making processes in Africa have made it necessary to rethink the modes of organizing science and innovation enterprises and the role of non-state (non-governmental and private sector) actors in science and technology policy formulation and implementation. For example, it is now widely accepted that lay citizens have rights to participate in the choice of science and technology and in decision-making on how technological innovations are regulated. Food is also a basic human right in most African countries and thus states have constitutional obligations to invest in STI that generate food and food security.

The conceptual framework developed in this paper is guided by the view that governance is a complex concept encompassing many issues and is based on at least three key principles: participation, accountability and transparency. Its application to the management and assessment of STI systems (and their activities) must, as of necessity, focus on designing and using quantitative and qualitative indicators beyond those that can be constructed using the Franscati and Oslo manuals that are currently being used in many countries particularly those of the Organization for Economic Cooperation and Development (OECD) and nowadays in the African context under the auspices of the African Science, Technology and Innovation Indicators Initiative (ASTII).

The paper is organized as follows. First, we define governance because though widely used the concept is not well understood. It is subject to misuse and abuse. It is not uncommon to confuse governance with government. We also discuss why governance is an important concept in the management of public affairs. Secondly, we focus on what is 'governance of science, technology and innovation'. We also

Commissioned by: Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA)

outline key features of STI policy-making and discuss the management of policy processes as part of the governance

The rest of the paper focuses on the three principles of governance of STI. These are: (a) public participation by Partner States, national and regional think tanks, individual citizens, private sector and other actors in STI policy processes; (b) accountability of the AU and of individual Partner States as well as national and regional institutions in ensuring effective implementation of STI provisions of the AU Treaty and related protocols, including accountability of the state actors in ensuring adequate allocation and efficient use of resources for the promotion of scientific research and technological innovation in the AU and in individual Partner States; and (c) transparency of the AU and the individual Partner States in the management of STI activities, including aspects such as making available to the public information on specific STI policies and activities in order to enable public participation in the choice and regulation of specific technologies and related innovations, and transparency in making decisions pertaining to the choice and/or establishment of agencies for STI in the AU.

On the whole, our goal is to construct a framework for studying (or assessing) the 'governance of science, technology and innovation' in the African context. The framework will be used to develop specific indicators of 'good' governance of STI for food security.

Governance and Why It Matters

The concept of 'governance' is now in the lexicon of politicians, scholars, donor agencies, development practitioners, civil society and many different groups around the world. Hardly a day goes without a report or statement on governance being issued by some entities of the United Nations system, the World Bank, national governments and non-governmental groups. There is also so much proliferation of academic papers on governance and its relationship with development. Indeed there are thousands and thousands of documents on governance. According to Hyden (2011), there is "a whole industry of governance assessors and advisors trying to measure as best they can the way individual countries are governed and how close they come to the liberal ideal."[1] Yet, the precise meaning of the concept of governance tends to be left open to various different definitions and interpretations. In a recent paper Fukuyama (2013) asserts that there is confusion in current discussions on governance. He calls for better conceptualization of governance and the design of better ways of measuring it.[2]

To address the gap or challenge of defining what governance means, various agencies and academics have proposed various definitions and interpretations. Our understanding of the concept has evolved considerably in the past three decades or so. According to Goran Hyden "there has been a considerable change in how the international policy community understands the concept and translates it into specific assessments and practices."[3] We do not intend to and, indeed, cannot pretend to review the relatively huge corpus of literature on governance. As stated earlier, we are more concerned with key features and principles of governance and not with a mere articulation of what it is.

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[1] Hyden, G. (2011), 'How Do Africa's New Engagements Affect Governance?' Paper prepared for the panel titled "Finally Untamed? Africa's New Engagements with the North and South" at the 4th European Conference on African Studies held in Uppsala June 15-18, 2011.

[2] See Fukuyama, F. (2013), 'What Is Governance?' Working Paper 314, Center for Global Development, www.cgdev.org

[3] http://www.ilo.org/wcmsp5/groups/public/-ed_emp/emp_policy/documents/meetingdocument/wcms_162982.pdf

The International Fund for Agricultural Development (IFAD) and Gisselquist (2012) provide succinct reviews of various definitions of governance.[4] Most definitions of governance put emphasis on the existence and role of state institutions that are accountable to citizens and citizens participate in public policy-making within the framework of the rule of law.[5] To achieve a state's accountability to citizens and ensure their participation in policy-making, transparency is mandatory. Most of the definitions consider rule of law, accountability, participation and transparency as key facets or principles of governance. We treat the rule of law as an enabler of good governance. It is a key ingredient of the institutional infrastructure

Table 1: Three core principles of governance

" (a) Accountability. At the macro level this includes financial accountability, in terms of an effective, transparent and publicly accountable system for expenditure control and cash management, and an external audit system. It encompasses sound fiscal choices, made in a transparent manner, that give priority to productive social programmes – such as basic health services and primary education vital to improving the living standards of the poor and promoting economic development – over non-productive expenditures, such as military spending. At the micro level it requires that managers of implementing and parastatal agencies be accountable for operational efficiency. Auditing systems should meet international standards and be open to public scrutiny.

(b) Transparency. Private-sector investment decisions depend on public knowledge of the government's policies and confidence in its intentions, as well as in the information provided by the government on economic and market conditions. Transparency of decision-making, particularly in budget, regulatory and procurement processes, is also critical to the effectiveness of resource use and the reduction of corruption and waste.

(c) Participation. Good governance requires that civil society has the opportunity to participate during the formulation of development strategies and that directly affected communities and groups should be able to participate in the design and implementation of programmes and projects. Even where projects have a secondary impact on particular localities or population groups, there should be a consultation process that takes their views into account. This aspect of governance is an essential element in securing commitment and support for projects and enhancing the quality of their implementation."

Source: http://www.ifad.org/gbdocs/eb/67/e/EB-99-67-INF-4.pdf

In general, there is a large measure of consensus that the three interrelated principles are important in the articulation of good governance—whether political or economic—at all levels, from local to international. The principles are used and sometimes interpreted differently by different groups but are generally acknowledged as the foundation of good governance.

A recent report of the United Nations Task Team on the Post-2015 UN Development Agenda defines governance as "the exercise of political and administrative authority at all levels to manage a country's affairs. It comprises the

[4] See http://www.ifad.org/gbdocs/eb/67/e/EB-99-67-INF-4.pdf and Gisselquist, R. (2012), 'Good Governance as a Concept, and Why This Matters for Development Policy'. Working Paper No. 2012/30, UNU-WIDER 2012.

[5] Gisselquist, R. (2012), 'Good Governance as a Concept, and Why This Matters for Development Policy'. Working Paper No. 2012/30, UNU-WIDER 2012.

mechanisms, processes and institutions, through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences."[6] According to the Team there are two key issues at the core of governance: institutions and the rule of law. Implicit in the definition is citizens' rights to participation in public affairs, including decision-making. For example, citizens articulate their interests by participating in public policy processes.

Participation, Accountability and Transparency (PAT) are entrenched in many national, regional and international instruments of governance. At the national level, constitutions and related legislation on issues such as protection of the environment, enhancement of food security, public health and budgeting contain provisions on PAT. For example, national constitutions of Kenya, Uganda, South Africa, Tanzania, Rwanda and other African countries have very explicit requirements for public participation in such processes as national budgeting and the exercise of other public activities.

Many regional treaties also contain provisions on PAT. For example the Treaty Establishing the East African Community (EAC) has several explicit provisions on PAT. Articles 6 and 7 of the Treaty clearly articulate PAT as important principles of good governance. Article 6 (Fundamental Principles of the Community) of the EAC outlines principles that guide the Partner States to engage in mutual cooperation. It places emphasis on adherence to accountability, transparency and the rule of law. Article 6(d) states: "The fundamental principles that shall govern the achievement of the objectives of the Community States shall include: …. good governance including adherence to the principles of democracy, the rule of law, accountability, transparency, social justice, equal opportunity, gender equality, as well as the recognition, promotion and protection of human and peoples' rights in accordance with the provisions of the African Charter on Human and Peoples' Rights."

Article 7 of the AU Treaty is about principles that should guide the operationalization of the objectives of the Community. It emphasizes people-centred cooperation and people's participation in political and economic integration of the Partner States. Article 7 (1d) states that Partner States shall be guided by "the principle of subsidiarity with emphasis on multi-level participation and the involvement of a wide range of stake-holders in the process of integration." Article 7(2) requires the States "to abide by the principles of good governance, including adherence to the principles of democracy, the rule of law, social justice and the maintenance of universally accepted standards of human rights."

The importance of civil society and private sector participation in the integration processes is emphasized in Article 127 (Creation of an Enabling Environment for the Private Sector and the Civil Society). In Article 127(3) Partner States agreed "to promote enabling environment for the participation of civil society in the development activities within the Community."

At the international level PAT principles are contained in many economic, trade, environmental and other sustainable development related agreements. Indeed, there is a wide array of international agreements that contain specific provisions or policy measures for promoting PAT. They include agreements such as the World Trade Organization (WTO) Agreements, the conventions on climate change, biological diversity, land degradation and desertification, and the Aarhus Convention on Access to Information. PAT principles are also deposited in international declarations and plans that have been adopted at various United Nations or related conferences.

For example, the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters adopted in Aarhus Denmark in 1998 aims at promoting environmental justice by ensuring that PAT are

[6] UNDESA, et al. (2012), 'Governance and Development', p.3. Thematic Think Piece Prepared by UNDESA, UNDP and UNESCO.

integral to decision-making. Its preamble recognizes that citizens must have access to information and are entitled to participate in decision-making. Article 6 of the Convention is all about public participation in decision-making. For example, Articles 6, 7 and 8 are dedicated to public participation. Article 6(6) states: "Party shall require the competent public authorities to give the public concerned access for examination, upon request where so required under national law, free of charge and as soon as it becomes available, to all information relevant to the decision-making referred to in this article that is available at the time of the public participation procedure, …"

Other related environmental conventions on biological diversity and climate change also contain PAT provisions. The Convention on Biological Diversity (UN 1992) has PAT provisions explicitly articulated in its preamble and in articles 15 and 25. In the Preamble, the Convention affirms the full participation of women at all levels of policy-making on matters pertaining to the conservation and sustainable use of biological diversity. Article 15 is dedicated to issues of access to genetic resources and the sharing of benefits, including technology, arising from the access and use of the resources. It requires that developing countries Contracting Parties and their local communities must participate in decision-making on access to the resources and the sharing of benefits. The process of determining access to the resources and sharing of benefits must be transparent and developed countries' institutions involved in the access arrangement must transparently disclose the use to which the resources will be put and specific technologies that may be generated.

The entrenchment and application of PAT are the bedrock of good governance and in fact governance in general. Major donors base their financial aid and loans on whether PAT are adhered to in the management of public affairs. There are numerous civic bodies that have been created to promote the articulation of the three pillars of governance in many countries around the world. Some institutions such as the World Bank have developed indicators for assessing or measuring 'good governance' of development in general.[7] There are also efforts to link governance indicators to specific aspects of development such as STI. For example, the European Union (EU) Commission has made efforts to apply the concept of governance to the assessment of national systems of innovation in general and the organization as well as management of science in particular.[8]

What do we mean by 'governance of science, technology and innovation'?

There is increasing usage of the concept of governance in studies of science, technology and innovation (STI). There are studies that focus on the application of the principles of governance to the management of STI in general and the management of innovation systems in particular; and others that are about the relationships of good governance and scientific and technological development. Indeed, governance is a common concept in the literature on STI policy in general[9] and the politics of technology choice in particular.[10]

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[7] http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-4370

[8] See for example EC (2009), *Global Governance of Science*. http://ec.europa.eu/research/science-society/document_library/pdf_06/global-governance-020609_en.pdf

[9] See for example Wagner, C. (2008), *The New Invisible College: Science for Development*, p. 103-120, Brookings Institution Press, Washington, D.C., and van Zwanenberg, P., and Millstone, E., (2005), *BSE: risk, science, and governance*, Oxford University Press.

[10] See for example Paarlberg R.L. (2000), *Governing the Crop Revolution: Policy Choices for Developing Countries*, International Food Policy Research Institute (IFPRI) Washington, D.C., and Mordini, E. (??), 'Global Governance of the Technological Revolution', Centre for Science, Society and Citizenship, Rome Italy.

Governance of STI encompasses, firstly, processes and mechanisms for ensuring participation, accountability and transparency in the formulation and implementation of policies (courses of actions) to promote STI in order to generate public goods and confront public bads such as ecological destruction, diseases, hunger and other forms of impoverishment. Secondly, it is also about participation, accountability and transfer in the choice and use of scientific knowledge and related technological innovations to improve policy-making processes. The two facets of governance of STI are really interrelated. Studies such as van Zwanenberg and Millstone (2005) focus on the latter facet of governance of STI while Mordini is more concerned with the former.

The use of the concept of governance of STI (sometimes referred to as STI governance) is gaining currency in studies of national and supranational systems of innovation for a variety of reasons. First, there is recognition that the traditional or orthodox approaches to measuring STI activities using the old OECD manuals—the Frascati and Oslo manuals—do not tell much about the content, activities and dynamic interactions within and between systems. They do not tell us about the existence and effectiveness of norms and rules as well as how the behaviour of various actors such as science enterprises and the private sector impinge on the innovativeness of the country as a whole or a specific sector of the economy (EC 2009, op. cit.)

Secondly, non-state actors (including non-governmental organizations and private sector) are playing major roles in STI policy management and even in the practical scientific research and technological innovation activities. In fields such as biotechnology and nanotechnology NGOs are actively engaged in policy formulation, monitoring and implementation as well as in the regulation of specific technological products. Private sector is a dominant actor in ICT development and related policy-making activities. The roles and influence of these actors cannot be ignored. They shape national, regional and international STI policy in very profound ways. "The received linear model of science policy, in which investments are turned over to national scientific communities for autonomous utilization and/or market allocation, is no longer adequate."[11]

Thirdly, for a long time STI were treated (particularly by/in economic policy and practice) as exogenous variables in development. STI policy-making and activities did not occupy a central play in the management of public affairs. This is much so in developing countries, African ones in particular. International development policy and practice largely ignored STI. This has changed considerably as STI are now considered critical aspects of development and are receiving growing attention of governments, donors and financial institutions such as the World Bank. In some countries (for example Kenya) the management of STI are constitutional issues, and thus important in political, social and economic governance in general.

Fourthly, the conduct and management of STI are increasingly transcending nation-states. 'Science nationalism' (Wagner, 2008) or 'techno-nationalism' (EC 2009) is no longer the prevailing and only way of managing scientific research and STI in general. STI policy issues and related policy-making processes are becoming more supranational and in fact global in nature. Indeed the arena of STI policy includes such forums as the United Nations, the World Trade Organization (WTO) and continental and regional bodies such as the AU (AU) and the EAC. At these supranational levels STI activities and their management involve a wide range of many different state and non-state actors, making it necessary to have clear norms and rules of engagement and schemes for ensuring that all state parties and their citizens' interests are adequately accommodated. The linear model that focuses on

[11] http://ec.europa.eu/research/science-society/document_library/pdf_06/global-governance 020609_en.pdf

inputs to and outputs from scientific research institutions is incapable of dealing with multilateral STI enterprises and their activities.

Lastly, the STI-society-development nexus has increasingly become complex and require robust policy instruments beyond the traditional science policy that largely focuses on allocation of funds to R&D activities or technology policy that simply deals with the choice of one technology from a few competing choices. There are many issues of ethics, fundamental rights and associated obligations, equity, and sovereignty that have come to the public fore. The 'republic of science' is being rapidly displaced.[12] It is no longer in vogue.

Given the above factors or considerations, 'governance of STI' or 'STI governance' is a better approach or metaphor of managing scientific research and innovation activities and systems of innovation in general. We define governance of STI as norms, rules and agencies that enable society to generate and put to wise use scientific knowledge and technological innovations. The norms and rules determine how STI policies are formulated, monitored and implemented and how well agencies (or organizations) articulate with AU in order to constitute a system of innovation or an innovation system at national and/or supranational levels. It is really about how state and non-state institutions interact in the management of STI based on or guided by the three principles of PAT.

Perhaps one of the most comprehensive attempts at applying the concept of governance to STI issues is the study by Boekholt, P. *et. al* (2002) for the Dutch Ministry of Economic Affairs.[13] Boekholt, P. *et. al* (2002) defined governance of STI as being about the roles that "various actors in the innovation system play, how rules of the game work, how decisions are taken and how changes in the overall innovation system come into being."[14] Their study dealt with issues such as: how research organizations and research funding agencies are held accountable for their activities; ways of increasing transparency in the design and implementation of STI policy; ways in which stakeholders are involved in STI policy processes; and improving coordination mechanisms for STI policy.

In this paper we are also concerned with STI policy processes. The focus is not on the management of STI activities at the organizational or enterprise level but with governance of STI at national and regional levels. We apply the principles of PAT to better understand how STI policy processes are handled at national level (in the EAC of the five Partner States) and the AU level or any other RECs in Africa.

But then what do we mean by policy and STI policy process? Policy is another term that is widely used and is most often confused with politics, plans and strategies. Policy, unlike politics, is based on specific problems, goals and objectives. It is about actions to solve real and/or anticipated societal problems. It is what governments and their citizens choose to do or not to do.

A policy is supposed to be an outcome of a policy process though in some countries policies tend to be derived from administrative pronouncements or even decrees. The policy process is a non-linear cyclic series of interrelated activities that involves defining the real problem and structuring it into a policy problem, setting the agenda, conducting analysis and identifying policy options, choosing options and formulating a specific policy or policies, implementing the policy or policies, and conducting policy monitoring, evaluation and reform. Figure 1 below depicts the policy process.

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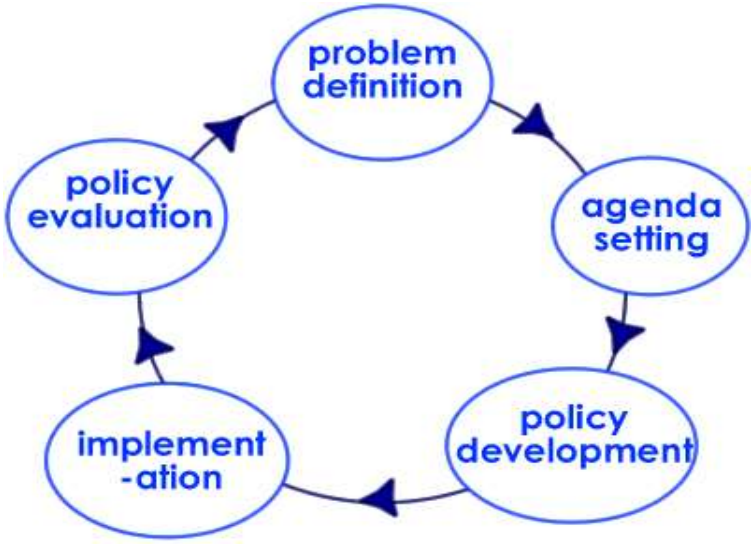
[12] See Rip, A. (1994), 'The republic of science in the 1990s.' *Higher Education* 28:3-23 1994 http://doc.utwente.nl/34304/1/republic_of_science.pdf

[13] Boekholt, P., et. al. (2002), *Governance of Research and Innovation: An International Comparative Study.* Technopolis-Group.

[14] Boekholt, P., et. al. (2002), op. cit. p. i.

Figure 1: Schematic Illustration of the Policy Process



Source: Manyuchi, A. and Mugabe, J. (2014)

STI policy is also supposed to be developed through a non-linear cyclic process (Mugabe 2013).[15] STI policy has two interrelated facets: policy for STI and STI for policy (Pielke Jr, 1990).[16] Policy for STI refers to decision-making about how to fund, structure the systematic pursuit, application, diffusion and adoption of knowledge. STI for policy refers to the use, application and organisation of old and new knowledge to facilitate or improve decision making (Pielke Jr, 1990, ibid.).

The process of designing and managing the implementation of STI policy is often complex as it involves various different actors that have different interpretations of national and local problems that STI are expected to solve, different interpretations of the nature and outcomes of STI and even different opinions on which specific research activities to invest in and which technologies to procure or to develop. STI policy-making is also increasingly more and more knowledge and information intensive as well as a multidisciplinary endeavour. It is influenced by factors that are not necessarily 'scientific' or 'technical' and its outcome is not predictable.

Public Participation in Science, Technology and Innovation Policy Processes

There is a wealth of literature on public participation in the management of STI in general and STI policy processes in particular.[17] The growth of academic inquiry into what constitutes effective public participation in STI policy processes is largely associated with the increasing recognition that STI impact on society or the public in profound ways and the converse is also true: society impacts on STI. As Maat and Waldman (2007) assert:

[15] Mugabe, J.O. (2013): *Science, Technology and Innovation Policy Development in Africa: National Institutions and Experiences*; SADC STI Policy Conference, Cape Town, May 2013.

[16] Pielke Jr, R.A. (1990),*The Honest Broker: Making sense of science in policy and politics*. Cambridge University Press, Cambridge, UK.

[17] See for example Maat, H., and Waldman, L., (2007), *Introduction: How Participation Relates to Science and Technology and How Science and Technology Shapes Participa*tion. IDS Bulletin Volume 38 Number 5 November 2007, Institute of Development Studies (IDS); and Hagendijk, R.P. and Kallerud, E. (2003) *Changing Conceptions and Practices of Governance in Science and Technology in Europe: A Framework for Analysis*, STAGE Discussion Paper 2, Amsterdam: University of Amsterdam

> Science and technology need society. Research and technology have little chance of influencing development if they do not anticipate societal effects and responses. Universities, research centres and technology institutes invest in a good relationship with the public. Engaging citizens creates a wider acceptance of (potentially) controversial scientific and technological developments. Policymakers therefore create platforms and processes for public engagement, as is the case, for example, with nanotechnology. Acceptance may refer to norms or ethical principles but may also be effective from a purely commercial concern. The consultation of potential customers at the early phase of product design often is a major step to success. An example is the Boeing 777 aircraft, developed in close consultation with eight major airlines. Client-oriented technology development and participatory research are global phenomena. The participatory agenda for science and technology is pushed by supra-national networks of companies, governmental bodies and nongovernmental organisations. It is also global in the sense that programmes to support participatory research and technology development can be found in countries across all continents.[18]

There are also now many studies that examine public participation in specific technology policy areas such as biosafety (assessment and management of risks associated with modern biotechnology) and nanotechnology. However, there is insufficient consensus on what really constitutes public participation. The phrase 'public participation' is often used interchangeably with 'public involvement'. Sometimes it is used to refer to 'political mobilization'.[19]

In this paper we define public participation to mean the engagement of non-state actors (mainly civil society) in STI policy-making processes and in the implementation of various STI policies of the AU and of the individual Partner States. The engagement of non-state actors or civil society entails their active contribution to setting the agendas for and/or in both regional and national STI policy-making, their active generation of various policy options, and their active role in the choice of specific policy measures, and then their active presence in all subsequent activities and events of policy implementation, monitoring, evaluation and reform. It is not about getting civil society to be informed of or just sitting in committees or attending national and regional workshops on STI. In this way, non-state actors (civil society) share (with the state actors) the ownership of the processes and related policy outcomes.

Public participation in STI policy processes can be through deliberative forms of participation (such as citizen juries) or through performative participation (Richards, 2005). Performative participation is exercised through avenues such as theatre where citizens articulate issues that affect them and identify solutions for specific problems.[20]

As Sclove (1995) asserts:"[c]urrently, there are few institutions through which citizens can become critically engaged with choosing or designing technologies. Should we commit ourselves to evolving such institutions and to adopting only those

[18] Maat, H., and Waldman, L., (2007), ibid, p. 1.

[19] Maja Horst, Alan Irwin, Peter Healey and Rob Hagendijk (2007) 'European Scientific Governance in a Global Context: Resonances, Implications and Reflections' in Maat, H., and Waldman, L., (2007), op. cit.

[20] Richards, P. (2005), 'How Does Participation Work? Deliberation and Performance in African Food Security'. *IDS Bulletin*, Volume 38, Issue 5. DOI: 10.1111/j.1759-5436.2005.tb00406.x

technologies that are compatible with democracy? Until we do, I shall argue, there can be no democracy worthy of the name."[21]

The surge of interest in and focus on public participation is due to the expansion of political liberties and entrenchment of the right to participate in national constitutions and various regional and international treaties. As stated earlier, public participation in the management of public affairs has acquired legal foundations. However, its realization or enforcement in STI policy processes in Africa and in many parts of the world is yet to take root.

Public participation in STI policy is relatively recent. "Until the end of the twentieth century, the public was allowed little input into decision-making in science and technology (Gregory and Miller, 1998; Ziman, 1992; Wynne, 1991; Nelkin, 1987). For a long time, public involvement in related issues mainly focused on information, public relations, and educational approaches to enhance the public understanding mostly at rather mature stages of technology development."[22]

Since public participation is a constitutional right of citizens and is provided for in the EAC and AU treaties and various protocols, it is important to develop a body of indicators that can be used to monitor and assess its realization or implementation at national (Partner States) and regional levels. The development of indicators should focus on, inter alia, the following:

(a) Identification of specific national and AU and RECs levels STI policy processes, activities and events;
(b) Identification of specific forums and/or institutions for STI policy processes at national and regional levels;
(c) Identification of specific resources e.g. budgets that AU or the Partner States and the AU have allocated to facilitate or support public participation;
(d) Identification of specific obligations (e.g. provision of information) that the States and the AU have to ensure public participation;
(e) Identification of specific organizations (e.g. civic associations and NGOs) that mobilize citizens/public to engage (or represent citizens/public) in STI policy processes, events and activities at national and AU levels; and
(f) Determination of specific public/citizens' inputs into STI policy-making.

Accountability in the Governance of Science, Technology and Innovation

Just like governance and participation, accountability is a widely used concept that is also subject to abuse. According to Jerry Louis Mashaw accountability is a protean and relational concept.[23] It is a protean concept in the sense that it is adaptable to different diverse contexts and uses, and it is relational because it (accountability) exists when there is a relationship involving two or more individuals or organizations. He proposes the notion of "accountability regimes" to emphasize that accountability has multiple meanings in diverse contexts. Bovens (2007) defines accountability as "*a relationship between an actor and a forum, in which the actor has an obligation to explain and to justify his or her conduct*, *the forum can pose questions and pass judgement, and the actor may face consequences."*[24] In this case the actor is either an official or an institution that is politically, legally or even administratively obliged to

[21] Sclove, R., (1995), *Democracy and Technology*, p.9. The Guilford Press, New York and London.

[22] Kurath, M., and Gisler, P. (2009), 'Informing, involving or engaging? Science communication, in the ages of atom-, bio- and nanotechnology'. *Public Understand. Sci*. **18 (5)** (2009) 559–573 www.sagepublications.com

[23] Mashaw, J.L. Accountability and Institutional Design: Some Thoughts on the Grammar of Governance. Research Paper No. 116, Yale Law School. http://papers.ssrn.com/abstract=924879

[24] Bovens, M, (2007), New Forms of Accountability and the EU Governance, p.107, *Journal of Comparative European Politics*, 2007, 5. (104-120)

account while the forum may be such institutional arrangements as courts of law, parliament, citizens' juries or commissions.

Various authors have also identified various forms of accountability. For example, Ackerman (2003) identifies vertical viz horizontal accountability. Vertical accountability is where state institutions are checked by or obliged account to citizens or civil society groups. Horizontal accountability is when state institutions check abuses by other public agencies and branches of government.

Accountability in the governance of STI is defined in this paper as the obligation(s) of Partner States individually and collectively as the AU to account for their activities, actions (as well as inactions) and decisions in the management of STI policy formulation and implementation. Governments of the Partner States as individual actors and as collectives of the AU are obliged by the Treaty establishing the Community and their national legal frameworks to account to their citizens on their actions of the management of public affairs, including STI policy.

There are many issues on which governments of the States are expected to account on to citizens of the AU. These include: (a) the allocation and expenditure of resources to STI (including R&D) activities; (b) choice of specific R&D and innovation activities in which investments are made; (c) progress on the implementation of STI provisions of a Treaty such as the EAC Treaty and related protocols; and (d) progress on implementation of programmes such as those related to the establishment of STI institutions and the pharmaceutical manufacturing programme.[25]

To develop specific indicators, the following inter alia issues or questions should be considered:

(a) What are the different national and regional or supranational frameworks (political, legal and administrative) for accountability in the governance of STI in the AU?
(b) What different accountability actors and forums exist at national and supranational levels in the AU?
(c) What are the different issues on which accountability actors are obliged to report or account on to citizens?
(d) What are specific outcomes of accountability processes?

The above issues or questions are sharply framed for the AU STI programme.

Transparency in STI Policy Processes

Again as observed earlier, transparency is one of the core principles of good governance of STI. It is a fundamental principle in the attainment of good governance in general and the fulfilment of the other two principles of public participation and accountability in STI policy processes. Transparency aids public participation and accountability. It involves providing the public with information about decisions and policy-making procedures.[26]

Transparency is the hallmark of good management of public affairs. It tends to reduce uncertainty in decision-making and stimulates sharing of information as well as policy ideas and options. In the governance of STI, transparency entails aspects such as:

[25] A range of AU STI programmes will be profiled and selected case studies of some of the programmes will be conducted.

[26] Stefanick, L., (2013), 'Transparency, Accountability and Good Governance: Is Alberta Cursed?' Paper Submitted to the Canadian Association of Political Science, Victoria BC.

(a) State actors making public their intentions to launch STI policy processes and programmes, and providing information on the nature of the policy problem(s) as well as agenda of the policy process;
(b) Allowing stakeholders to access information on various decisions leading to specific STI policy processes;
(c) Making public all outcomes of STI policy processes:

Institutional Infrastructure for PAT in STI Policy

Cherchye and Moesen (2003) define the institutional infrastructure as "the set of arrangements that shape the 'rules of the game' and the incentives for the economic agents. …, private individuals and firms figure as agents but also as public servants and politicians."[27] Institutional infrastructure includes existing political leadership, presence of civic engagement, private sector institutions and their resources, existence of executive agencies and their programmes as well as physical and monetary resources that are required to realize PAT in STI policy processes. It is the bedrock of PAT in the management of public affairs and STI policy formulation and implementation. Political leadership is critical in establishing the necessary frameworks and programmes for PAT in STI policy. For example, political parties and legislative assemblies are the main institutions responsible for enacting laws that determine whether or not (and in fact how) the principles of PAT are given expression in such frameworks as national constitutions. These institutions are part and parcel of what Globerman and Shapiro (2002) refer to as a national political infrastructure.[28]

Civil society organizations are another group of agencies that form an important part of the institutional infrastructure for PAT. They include agencies for special interests such as NGOs, farmers' associations, women, youth and the disabled. The AU brings different assets and issues to the goal of ensuring PAT in STI policy.

Conclusion

This paper has defined key concepts and proposed a framework for assessing governance of STI at national and supranational or regional levels in the AU. The paper focused on three core principles—participation, accountability and transparency—of good governance. It has shown that the PAT principles should be entrenched in STI policy processes in the AU. The framework may be tested through specific case studies of STI policy processes and programmes in the region.

Lead Paper presented at: CTA International Forum - Unleashing Science, Technology and Innovation for Food and Nutrition Security With special focus on Africa, Caribbean and the Pacific - Developing a road map - 15-17 October 2014, NH Rijnhotel Arnhem, The Netherlands

Published by CTA, http://knowledge.cta.int/
Edited by J.A. Francis, CTA

Citation: CTA 2015. http://knowledge.cta.int/, "author" accessed on "date."

[27] Cherchye, L. and Moesen, W. (2003), 'Institutional Infrastructure and Economic Performance: Levels versus Catching up and Frontier Shifts', p.3. Center for Economic Studies, Discussions Paper Series (DPS) 03.14 http://www.econ.kuleuven.be/ces/discussionpapers/default.htm

[28] Globerman, S. and Shapiro, D. (2002), 'National political infrastructure and foreign direct investment' Working paper no. 37, https://www.ic.gc.ca/eic/site/eas-aes.nsf/vwapj/wp37e.pdf/$file/wp37e.pdf