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SCIENCE POLICY FOR DEVELOPMENT

Prof. Dr. Solvay Gerke

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ABSTRACT

SCIENCE POLICY FOR DEVELOPMENT

Science is central to development, providing the knowledge inputs for social, institutional and technological innovations which are key drivers of economic and social development. The role that science and knowledge governance can play for development is, however, not fully valued. Sound policy and strategies are needed for domestic and international science policy, especially in emerging economies and in institutions who aim to support their development. Of increasing importance are knowledge-based innovations. To assess science policy requires interdisciplinary research efforts to link questions of innovation and implementation with research endeavors regarding institutional support systems for science production and the identification of the respective, locally grounded science policy for sustainable growth. Science policy is understood here as the design of science landscapes, institutional arrangements for science funding and partnerships, and the setting of goals and allocation of resources to science priorities. [1]

KEYWORDS: Science, technology and Innovation, Knowledge Infrastructure, Malaysia

Dr. Solvay Gerke
Visiting Professor
Centre for Policy Research & International Studies (CenPRIS)
Universiti Sains Malaysia
11800 USM, Penang, Malaysia
solvay.gerke@uni-bonn.de
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1. INTRODUCTION

Science is central to development and knowledge increasingly explains the gap between developed and underdeveloped, between poor and rich countries. Many countries have thus planned and carried out strategies to develop a national science policy to produce and utilize knowledge for economic and social development (Evers 2003a,b). The idea is, indeed, fascinating. If natural resources are scarce, if FDI does not flow into the country as expected, if land is not fertile or scarce, or if vital resources of a countries wealth are running ou,t knowledge can be put to effective use (Evers 2004).

Knowledge intensive growth is no longer solely dependent on national policy-making nor is it a privilege of highly developed nations. Nowadays, knowledge intensive growth and value creation are equally determined by a better use of knowledge as well as new combinations and re-uses of available knowledge, whatever the development state of a nation is. But still a significantly uneven distribution of innovation and research persists on the global, national and regional level (UNESCO 2010a).

The global environment in which national STI (Science, Technology and Innovation) policies are embedded has considerably changed during the last decade. Due to globalization new possibilities have opened up for faster knowledge accumulation and diffusion. But this development has not yet facilitated to narrow the gaps in R&D capabilities across nations and regions. Moreover, knowledge and innovation is emerging on highly differentiated paces within regions and within countries (UNESCO 2010a).

Not only does governance influence the making and use of knowledge, but knowledge-making is also incorporated into governance (Chilvers & Evans 2009). At present, science and higher education governance is characterized by several challenges for policy-makers, such as the management of complexity and uncertainty, balancing public and private funding, assuring knowledge exchange, integrating future oriented, non-linear thinking in decision-making and the creation of participatory processes (UNESCO 2010b). The main issue of science policy is or should be to consider how science and technology can best serve the public.

2. SCIENCE POLICY

In the past decades, science policy was widely discussed under the notion of 'knowledge' and 'knowledge governance'. It has increasingly shaped development discourses worldwide and is perceived as a crucial driver for the economic development of nation-states and as a key element for successful measures of international development cooperation (Stehr 2004). Packaged under the terms 'knowledge society' and 'information society', the increasing importance of different types of knowledge for the further development of economies and societies was originally assessed and conceptualised mainly by researchers from Europe, the US and Japan. International organisations such as the OECD (1996a, 1996b) closely followed, by sharpening the economic focus of the on going debate and arguing for the development of 'knowledge-based economies'.[2] Knowledge has been identified as one of the major factors of production, driving economies and societies towards a post-industrial stage of development. Countries around the globe, including several ASEAN nations, have adopted policies to encourage the growth of a knowledge-based economy. Building an ICT (information and communication technology) infrastructure has usually been one of the leading policy measures, in addition to developing universities and research institutes. Malaysia embarked on these policies and appears to be on the way to building a knowledge-based economy.

The European Commission developed an international strategy for science and technology in its related Communication in 2008 (EC 2008). Its main objective is, to establish a strategic framework that contributes to global sustainable development and to foster European science and technology excellence (see: Bucar 2010).

Building a knowledge infrastructure means initially creating knowledge-producing and -disseminating organizations such as R&D divisions of companies, research institutes, universities and colleges. To be effective, these have to be located closely to make use of common types of infrastructure such as laboratories, libraries and

[2] The following scholars can be mentioned: Machlup (1962); Umesao (1963); Lane (1966); Drucker (1969, 1993); Touraine (1969); Bell (1973, 1987); Porat (1976); Nora and Minc (1979); Minc (1987); Böhme and Stehr (1986); Castells (1989, 1996, 1997, 1998); Gibbons et al (1994); Stehr (1994); and Willke (1998). They were later scrutinised and their concepts of knowledge society developed further by Kumar (1978); Collins (1981); Lyon (1988, 1996); Dordick and Wang (1993); Stehr (1994, 2001); Webster (1995); Willke (1998, 1999); Maasen (1999); Dunning (2000); Evers (2003); Evers et al (2000); Steinbicker (2001); David and Foray (2002); Evers and Menkhoff (2003); Mattelart (2003); Evers and Gerke (2005); Knoblauch (2004, 2005); Kübler (2005); Tänzler, Knoblauch and Soeffner (2006), Hornidge (2007, 2007a) to name a few.

computing facilities. The industrial and knowledge clustering theory assumes that proximity increases an organization's innovative capacity when employees – especially researchers – can share ideas, products and services. The European Cluster Observatory, an initiative of the European Commission has produced data and maps on various industrial clusters in the European Union. The purpose is to aid industries in their decisions to invest in areas where transaction costs can be minimised and access to knowledge resources in terms of manpower and facilities is guaranteed. In a growing post-industrial economy access to knowledge has become a vital factor for economic success.

But international efforts to strengthen science policy will only be effective if national science policies are strengthened. Some governments worldwide adopted the general idea of knowledge society as well as the manifold terminology originating from the scientific community, which resulted in an increased emphasis on science policy-making (Simon et al. 2010). In many countries this led to a re-evaluation of applied versus basic research and development, as well as a widening of the portfolio of scientific disciplines ranging from natural sciences and engineering to economics as well as social sciences and the arts (Hornidge 2007, 2008).

In the field of development, the idea of knowledge being a key element of successful activities in the field of development cooperation and poverty alleviation culminated in 1998 in the publishing of the World Bank development report with the title 'Knowledge for Development'. Envisioning a future saturated with knowledge and knowledge application, the report states "Knowledge is like light. Weightless and tangible, it can easily travel the world, enlighten the lives of people everywhere" (World Bank 1999, 1). The report builds on a wide range of earlier research on the actual and potential role of different types of knowledge (indigenous, local, expert and global, explicit and tangible knowledge, and systems of not-knowing) for development and poverty alleviation. The report adopted ideas that had been discussed in the development research community. At the same time, it significantly contributed to the further spread of the notion of 'knowledge' and connected themes, such as innovation development and diffusion processes, information and communication technologies, and science and technology research, as drivers for development (Torero and von Braun 2006). Similarly to the concepts of 'knowledge society' and 'information society', 'knowledge' as driver of development entered the global development discourse and was linked by many state governments to ongoing national attempts of strengthening the respective innovation systems through a stronger emphasis on science policy formulation.

Science policy is inseparable from the notions of knowledge creation and knowledge management and closely associated with the need to improve human well-being to support sustainable development and economic growth. To research science policy requires interdisciplinary efforts of social sciences and economics for the assessment and further development of institutional support systems conducive for development enhancing science production. In particular, science policy for development should focus on:

- The linkages between science, technology, innovation, and poverty reduction, including the identification of respective science policy impact pathways;
- The investment in building the science systems of developing countries to take advantage of the opportunities that are arising;
- The provision of access to basic science conducted in developed countries in order to connect with international science and knowledge-sharing systems.

Following the examples of the EU, USA, and Japan, countries such as China, India, and several Southeast Asian and African countries adopted a focus on knowledge production and dissemination in their economic development agendas and resulting science policies. Amongst the specifically addressed areas of knowledge productions are:

- Information and communication technologies (ICTs)
- New media
- Bio- and life sciences,
- Health,
- Nano- and biotechnologies, and
- Creative industries including.

The identification of new economic focal areas is in many cases significantly influenced by the internationally debated areas for high expected economic growth, sectors also identified by current ‘knowledge society’ indicators and prognoses, and thus by a global science discourse. Consequently, there is a concentration of science policy and investment in a few economic sectors, which are often characterised by high-external inputs as well as particular technical, educational, social, political, legal and financial infrastructure requirements as basis for their flourishing development.

Despite this and instead of identifying country- and society-specific knowledge intensive sectors, based on the respective country's comparative advantage, governments worldwide identify a similar and rather narrow set of knowledge producing and knowledge intensive sectors, with those mentioned above taking the lead, for the further development of their economies. Malaysia, for example identified information and communication technology research as an area to focus on in the late 1990s and substantial government funds were invested into building a multi-media super corridor with Cyber- and Putrajaya as the new Malaysian Silicon Valley (Nordin, forthcoming).

The arising gap between current science policy-making and the existing local landscapes results in neglecting the existing comparative advantages of countries while instead investing into areas of knowledge production, in which international competitors are often far more advanced. The longed for 'leap-frogging' effect consequently turns into the negative, often with the 'knowledge trap' phenomenon arising, namely the transfer of knowledge without the corresponding unknowns and without adapting it to the local context (Menkhoff 2007; Evers et al. 2006).

Experts are advocating the creation of knowledge clusters as incubators of future economic development. The Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) launched a programme in 2003 to set up knowledge clusters throughout Japan. Knowledge clusters are described as follows: "A "Knowledge Cluster" is a local innovation system organized around universities, research institutions and firms which have unique R&D themes and potentialities"[3].

In 2006 the Asian Development Bank announced a programme to develop knowledge hubs in selected developing countries throughout the Asia and Pacific region to support and strengthen research and disseminate new development concepts and technologies (ADB 2005). ADB is, for example, supporting Tsinghua University in Beijing since 2006, in establishing a regional knowledge hub on climate change. The knowledge hub is to be established under an ADB grant and expertise, setting up centres of excellence in the region to support and strengthen research and disseminate new and emerging concepts and technologies. Other centres are planned in Thailand and India, strengthening and supplementing the already existing knowledge hubs. "These knowledge hubs should aim to mainstream new concepts in innovation, science, technology, management development, and related fields for the region. They should

[3] See http://www.mext.go.jp/a_menu/kagaku/chiiki/cluster/h16_pamphlet_e/01.pdf

also promote improved exchange of data, information, and knowledge; and increase the capabilities of institutions and organizations in the region. Singapore and Malaysia have also embarked on a similar science policy of designating specific areas to house knowledge clusters and identifying special areas of research and development to set up knowledge hubs.

3. SOUTHEAST ASIA

Science policy-making in Southeast Asia has – in the past two decades – been characterised by a focused integration of science and technology (S&T) policies with innovation and industry policies, particularly in terms of patent registration (see: Gerke and Evers 2006:2-3; Gerke, Evers, Schweisshelm 2005). This resulted in significant increases in science output production. In the years 1998 to 2008, the number of scientific publications in Malaysia quadrupled, being, in 2008, four times higher than that of Indonesia which nevertheless had also doubled. Furthermore, Malaysia is the fastest growing patent producer in the region with an increase of USTPO registered patents of almost 240% from 2000 to 2007. In contrast, patent registration in Indonesia, as only country in the region, decreased by nearly 20% during the same period of time (UNESCO, 2010).

Although absolute numbers of national investments have increased in both countries during the last decade, in Indonesia these investments have not kept pace with the growth in GDP. Instead the GERD/GDP ratio had decreased to 0.05% in 2005 (resulting in Indonesia being ranked second last on the World Bank Knowledge Index), followed by renewed government interest in science production and the establishment of seven national R&D agencies under the direct authority of the Ministry of Research and Technology. Furthermore, the ministry in 2005 identified R&D, diffusion and utilization of S&T, institutional and industrial capacity-building of S&T as new focal areas. For making this future research output production possible, increased emphasis is placed on qualifying research personnel in national S&T institutions. Higher education was provided by 2600 institutions in 2009. Since the mid-2000s effort emerged to build up the number of research personnel in national S&T institutions. In future the quality and quantity of researchers engaged in international research shall be increased. Nevertheless, as the availability of human resources for high-level research is likely to remain a challenge, international research networking with positive synergies for local research is to be enhanced and forms an explicitly voiced interest of the Indonesian government. As outlined here it is obvious that Indonesia actively aims at the advancement of the country's research and development system. Consequently, mutual exchange with Malaysia regarding scientific innovation and knowledge production systems might be a good opportunity to implement new R&D strategies.

Malaysia is characterised by remarkable progress in science, technology and economic development, going in hand with an increase in R&D expenditure as proportion of GERD from 0.49% in 2000 to 0.64% in 2006. On the World Bank Knowledge Index, Malaysia ranks relatively high, and this in particular with regard to the ICT and innovation variables. In 2000, Malaysia's number of USTPO registered patents was around six times higher than that of Indonesia, and 23.5 times higher in 2007 (UNESCO, 2010). Not only has the number of patents and publication output continued to increase but also the numbers of S&T personnel. In 2003, the Ministry of Science, Technology and Innovation published Malaysia's second National Plan for Science and Technology Policy 2002-2010, focusing on ICTs and multimedia, biotechnology, micro-electronics, energy, aerospace, nanotechnology, photonics, pharmaceuticals, and advanced manufacturing and materials, all sectors thought to significantly contribute to Malaysia's economy in the future. Nevertheless, and similar to other countries in the region, the availability of highly qualified human resources for science production remains a challenge. Malaysia has registered a net loss of scientific personnel in most of the research fields except agricultural science and chemistry. Within the range of conducted R&D, a clear shift towards demand-driven R&D has been observed (Evers et al., 2010).

4. CONCLUSION

Science policy research increasingly underlines the cultural and systemic specifics of national innovation systems, each made up of complex institutional arrangements between the science system and a diverse range of societal sub sectors (Weingart 2010:119, Nelson 1993, Skolnikoff 2004). Consequently substantial insight into the inner workings of each innovation system is precondition to effective science policy-making; science policy that aims at influencing, guiding and steering the national scientific research and development.

It should be noted that the emergence of knowledge clusters and knowledge hubs has to be embedded into a wider epistemic landscape (see: Knorr-Cetina 1999, chap1,2). Knowledge capital can be created by supporting colleges, universities, research institutes and centres of applied research and development and tacit knowledge can be imported through immigration of foreign talents and overseas training schemes. By this an important principle of knowledge management will be used, namely that knowledge is needed to use and create more knowledge. This also entails deleting barriers to knowledge flows, building an ICT backbone, increasing knowledge assets and closing knowledge gaps and developing a legal infrastructure that allows and encourages creative and diverse knowledge production. Without the thorough creation of an epistemic landscape, a successful science policy of a knowledge-based economy and society will hardly be possible. Besides the external and systemic characteristics defining the inner workings of the science system, i. the financing and expected outcomes, channels of communication between politics, economy and science and the legal position of science producing bodies, the internal characteristics and institutions governing each national innovation system are of relevance (Weingart 2010).

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