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Three frames for innovation policy: R&D, systems of innovation and transformative change

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ABSTRACT

Science, technology and innovation (STI) policy is shaped by persistent framings that arise from historical context. Two established frames are identified as co-existing and dominant in contemporary innovation policy discussions. The first frame is identified as beginning with a Post-World War II institutionalisation of government support for science and R&D with the presumption that this would contribute to growth and address market failure in private provision of new knowledge. The second frame emerged in the 1980s globalising world and its emphasis on competitiveness which is shaped by the national systems of innovation for knowledge creation and commercialisation. STI policy focuses on building links, clusters and networks, and on stimulating learning between elements in the systems, and enabling entrepreneurship. A third frame linked to contemporary social and environmental challenges such as the Sustainable Development Goals and calling for transformative change is identified and distinguished from the two earlier frames. Transformation refers to socio-technical system change as conceptualised in the sustainability transitions literature. The nature of this third framing is examined with the aim of identifying its key features and its potential for provoking a re-examination of the earlier two frames. One key feature is its focus on experimentation, and the argument that the Global South does not need to play catch-up to follow the transformation model of the Global North. It is argued that all three frames are relevant for policymaking, but exploring options for transformative innovation policy should be a priority.

1. Introduction

Public policies, including those directed at science and technology, arise from understandings of past experience with actions, reflections on contemporary challenges and perceptions of future potentials for action. The past, present and future are interpretively connected by policy scholars and practitioners as well as many others as a guide to analysis and action. These interpretive connections produce forceful framings – interpretations of experience, ordering of present circumstances and imaginations of future potentialities that create the foundations for policy analysis and action and shape expectations concerning potentials and opportunities (Goffman, 1974; Benford and Snow, 2000; Taylor, 2003). Framings evolve over time and change when they are perceived as inadequate to current circumstances. Because they influence peoples' imaginations, they also extend beyond the public policy sphere to influence the mobilisation and activities of non-governmental organisations as well as the private enterprise sector and even families and individuals. Some have argued that frame reflection might hamper action. Following Schön and Reid (1994) we believe the opposite; it is necessary to engage in frame reflection for designing and implementing effective policy solutions for complex policy problems.

Modern economic growth is generated by a collection of socio-technical systems based upon industrial mass production and individualized mass consumption that extensively employ fossil fuels, is resource and energy intensive and produces a massive amount of waste. Despite important improvements in life expectancy and material welfare in many countries, persistent problems of economic crises and rising inequality coincide with a growing realisation that current socio-technical systems for meeting our basic needs – whether in food, energy, mobility, materials, water or resources more generally – are unsustainable. While available framings of science and technology policy that evolved since World II remain relevant, they offer little guidance for managing the substantial negative consequences of the socio-technical system of modern economic growth to which they have contributed and of which they are a part.

Our view is that it is time to articulate more forcefully and to experiment in practice with a framing for science, technology and innovation policy that emphasises socio-technical system change. Three framings related to science and technology policy can be delineated, two of which are available and are systematically employed in policy

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discourse and action. Each of these framings involves a model of innovation which defines the roles of actors and describes actions that may be taken to address goals that are also part of the framings we examine. The third framing, which addresses socio-technical system change, remains under-developed although it has existed in the background of policy discussions for many years; recently it has been acknowledged by the OECD (2015; see also (Steward, 2012; Weber and Rohracher, 2012 and Frenken, 2017).

The first framing focuses on innovation for growth, tapping the potential of science and technology for prosperity and nurturing socio-technical systems directed towards mass production and consumption. It arose as the emphasis on modern economic growth emerged, two central features of which Kuznets (1973) identified as science-based industry and sustained improvement in factor productivity.[1] In terms of science, technology and innovation policy, however, this framing remained tacit or unarticulated until after the Second World War when it was extended to create a new vision for the role of the State in the writings of Vannevar Bush (1945) and others.

The second framing – national systems of innovation - emerged during the 1980s to address some of the consequences for individual nation states of the experience with modern economic growth – the intensification of international competition, globalization, the prospects of being left behind, and the promise of catching up. Similar to the first framing, some of the features of the second framing were present in an unarticulated form in earlier years with greater influence on the practice than on the rationale or theory of science, technology and innovation policy. This paper articulates both rationales more clearly and puts them into historical context.

A third framing – transformative change - is in the making and its outlines have become clearer in recent years. The aspirations for transformative change were captured most recently in the UN Sustainable Development Goals published in 2015. These include ending poverty and reducing inequality in all its forms everywhere, promoting inclusive and sustainable consumption and production systems, and confronting climate change, and many more.[2] This third framing involves a questioning of how to use science and technology policy for meeting social needs and addresses the issues of sustainable and inclusive societies at a more fundamental level than previous framings or their associated ideologies and practices.

The emergence of a new framing does not necessarily replace existing framings. However, framings compete with one another for the imagination of policymakers and, ultimately, citizens. The legitimacy of rationales and arguments for particular policies and the actions that follow from them is influenced by the prevalence and understanding of the framings. Our aim in this paper is to examine the historical development of all three framings, illustrating how each arises as a response to scientific debate, in relation to changing social and economic circumstances. Ultimately, we contend that research, experimentation, and reflection on the third framing should be a priority in any consideration of current science, technology and innovation policy, in short innovation policy, since for us innovation spans the entire process from scientific discovery to utilisation. Yet we do not argue that the first and second framing have become superfluous; they have their own rationale, which is still relevant today and might also be improved. Actual practice will reflect mixtures of frames. A deeper discussion and confrontation of frames and a process of critical frame reflection both by academics as well as policy makers is, however, important, and long overdue, since framings do have pervasive impacts on practice. This discussion paper aims to fuel and contribute to the critical reflection and eventually hopes to inspire new policy practices (Schön and Reid, 1994).[3]

2. Framing 1: innovation for growth

Concerns about the future of the industrially developed economies manifested themselves following World War II. The potential for the re-emergence of unemployment, inflation, and economic instability was feared and the roles of the state in mobilising and conducting the war effort legitimised state intervention that previously had been viewed sceptically, particularly in the British and American context. Substantial variation across countries in the state's support for research and development (R&D) prior to the war existed, but with a few exceptions, such as agricultural research in the US and Europe, these efforts were a direct consequence of the state's role in particular activities such as defence, telecommunications, medical research, geological surveys, and civil engineering works (Tindemans et al., 2009; Mowery and Rosenberg, 1989). Following the war, and because of the ensuing Cold War, there was enthusiasm for an expanded state role in conducting scientific research which was expected to safeguard the peace and to bring industrial benefits. Defence research institutes pushed for the transfer of their research beyond military markets (Galison and Hevly, 1992).

A broad consensus emerged that the state could and should play an active role in financing scientific research on the premise that new scientific discoveries would flow into practice through applied R&D by the private sector. It was also recognised that science was making substantial contributions to the modernisation of industry – replacing craft practices and traditions with a continuation and intensification of scientific management as articulated in Taylorism and Fordism.

Attention to the issues of applied research and technological development and their treatment as an investment by firms suggested shortcomings moving beyond the pre-War focus on invention which emphasised discovery and discoverers. For these investments to be recouped, commercialisation of invention was required. Commercialisation would only happen if an invention were to be purchased by a significant number of customers. In effect, the framing describing the origins and nature of invention inherited from the past was undergoing change. Initially, this involved a focus on R&D as an investment and led to questions about the rate of adoption (or path of diffusion) of new products. To capture these processes and to distinguish invention from the more complex processes of applied research, development and commercialisation, the word innovation began to be employed.[4] The simplest definition of innovation in this context is commercialised invention.[5]

In the late 1950s the popular imagination favouring the economic

[1] Kuznets (1973) identified six characteristics defining modern economic growth. The other four were rapid population growth, structural transformation (primarily urbanisation and the shift from agriculture to manufacturing and then to services), changes in ideology (e.g. secularisation), the increased global reach of developed countries (part of what is now referred to as globalisation), and the persistence of underdevelopment (at the time of Kuznets article, the persistence of non-modern growth experience among three quarters of the world's population).

[2] http://www.un.org/sustainabledevelopment/sustainable-development-goals/ Accessed 28/11/17.

[3] Together with others the authors have developed a new initiative entitled the Transformative Innovation Policy Consortium which aims at stimulating and facilitating policy experimentation – see www.transformative-innovation-policy.net.

[4] For economists, who were developing the theory of production to reflect the contributions of technology, the broader terms technical or technological change were employed in parallel since it allowed discussion of both innovations representing new products and improvements in processes for producing products. Later, the terms process and product innovations began to be used as types of technological change.

[5] This was a particular concern of Chris Freeman due to his interest in the social functions of science (Bernal, 1939) and the need to distinguish between invention and commercialisation of invention. While Freeman was not the first to make this distinction, he was influential in getting this established due to the success of Freeman (1974).