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Higher education and economic development: The importance of building technological capabilities☆

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ABSTRACT

Higher education and development has not been a priority of global policy or research funding in recent decades. Yet, since the millennium, Southern governments have become believers in the global knowledge economy and higher education enrolment growth has been phenomenal. In this paper we offer an original account of how higher education institutions contribute to economic development by drawing on evolutionary economics and the national innovation systems approach. This offers distinct advantages in conceptualising higher education's developmental role, through its stress on the importance of education, skills, work, innovation and production for economic development. Using these concepts, we examine how well South African higher education is positioned to contribute to economic development through a consideration of two case studies from astronomy and automotives. These highlight the importance of the intersection between global, national, sectoral and spatial dimensions of the education—economic development relationship. We suggest that dynamics at multiple scalar levels work in complex ways to shape possibilities for development. We argue that such an approach offers a way forward for international education and development thinking about the relationship between education, technological innovation, production and development.

1. Introduction

Higher education slipped down the international development agenda in the past 25 years as first the education for all goals and then the millennium development goals focused on primary education, at the same time as the overall global development discourse put little emphasis on issues of industry-led growth, technological progress and innovation. Yet since the millennium, governments and populations in the South have largely accepted the discourse of the global knowledge economy and higher education enrolment growth has been phenomenal, with some national systems in Africa expanding more than ten-fold since 2000.

Nonetheless, the absence of external support to higher education had a major negative effect on research capacity on education for development in Africa, whilst Northern scholars also largely evacuated the field due to parallel declines in funding. Slowly, research activity on higher education and development is beginning to rebuild internationally. However, there is a paucity of work theorising the relationship between higher education and development, as Oketch et al. (2014) show in their systematic review of the literature.

What robust evidence there is, shows consistently high rates of return to higher education and points to non-market as well as market benefits (e.g., McMahon, 1999). However, the human capital claim that this must reflect productivity gains appears problematic in the face of the highly imperfect labour markets that exist in Southern countries, affected as they are by large public and informal sectors and high levels of patronage (McCowan and Schendel, 2015). Whilst there are studies that point to correlations between higher education and innovation (e.g., Pillay, 2011), there are counter arguments that point to limited interactions between the key variables of higher education expansion, growth, productivity and technological change (e.g., Ca, 2006).In this paper we want to offer an alternative account of how higher education contributes to economic development. Whilst we

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acknowledge that there is more to higher education's developmental impact than economic development alone (see Walker, 2015; for instance), we will restrict our argument to the economic sphere. This alternative account can be developed by drawing on the evolutionary economics tradition (Nelson and Winter, 1982; Freeman, 2002; Lundvall, 2011), which is being revisited by a number of development economists (e.g., Chang, 2014; Salazar-Xirinachs et al., 2014). We suggest that evolutionary economics, and, specifically, the national innovation systems approach strongly associated with it, offers distinct benefits in conceptualising higher education's developmental role, due to its stress on the importance of education, skills, work, innovation and production for economic development. Moreover, the focus on the level of the organisation (typically the firm, but the university by analogy) and network offers a new scalar level and methodological purchase on the higher education— economic development relationship. Together, these theoretical and methodological lenses offer very different policy implications and possibilities when compared to more conventional neoclassical approaches. Such alternatives may be of value for consideration alongside or in competition with orthodox policy options.In this paper, we locate our research in this broad approach, but our focus is on the explanatory potential of mid-level theories of technological capabilities (Lall, 1992, 2001), sectoral systems of innovation (Malerba, 1999, 2002, 2005) and interactive capabilities (Von Tunzelmann and Wang, 2007; Von Tunzelmann, 2010). Using these concepts, we examine the complex ways in which South African higher education is positioned to contribute to economic development. We do so through a consideration of two case studies: the high skills case of the astronomy sector – particularly the Square Kilometre Array (SKA project) – and the automotive sector – specifically the "Tier 1" component supplier sub-sector in the Eastern Cape.

Given that much of this literature may be unfamiliar to education audiences, we will proceed to a relatively lengthy discussion of key concepts and approaches before reporting on the methodological approach taken. We will then examine two sectoral case studies separately through the lenses of our conceptual framework before drawing them together in a conclusion that considers the theoretical, practical and policy significance of such an approach to thinking about higher education and economic development.

2. Literature review: evolutionary economics and innovation systems

Following the perceived failure of efforts to understand variations in country development and growth patterns through conventional neoclassical approaches, a series of alternative approaches emerged emphasising the role of innovation in economic development, underpinned by evolutionary economics (Lundvall, 1992; Nelson, 1993; Freeman, 1995). Nelson and Winter (1982) pioneered the argument that productive transformation is central to economic development. Contrary to linear models of technological development that privilege the knowledge frontier as the locus of economic growth, these scholars argued that innovation is a non-linear and non-sequential process. Moreover, drawing on the institutional tradition, they stressed that technical change and growth depends as much on social as on technical innovations. That is to say, it requires multiple processes occurring simultaneously in production, which in turn requires not just research and development capacity but a variety of skills at all levels of the firm, and processes and systems for harnessing these in order to ensure effective diffusion and adoption of technology (Freeman, 1995; Dosi, 1988; Lundvall et al., 2002).

2.1. Technological capabilities

Within development economics, this approach was taken up most prominently by (Lall 1992, 2001,1). He stressed that technology cannot simply be imported without investing in the technological effort to master, acquire, adapt and improve upon existing technologies (Lall and Kramer-Mbula, 2005). This is crucial, for it goes against core assumptions of the neoclassical theory of trade by highlighting the difficulties that developing countries actually face in making technological and industrial progress. Lall's work stresses that it is through building capabilities to learn that a country grow its ability to catch up. Capability building involves effort at all levels of a firm, as well as new skills and knowledge that are required to master tacit elements of new technology. Lall's "capabilities" approach not only proposes that learning requires organisational capabilities, but also highlights the national level, stressing that countries also need to learn to be technologically capable, an important contribution to the notion of the developmental state.

This implies an important role for networks as the means of bridging between the firm and national economy levels. Thus, the approach focuses on linkage capabilities between actors in the national system. Science and technology links and knowledge exchange with universities, research organisations and other organisations are critical for technological capability building, but equally so are linkages to those organisations or actors that build the skills required at all occupational levels of the firm.

More recently, Salazar-Xirinachs et al. (2014, p. 2) argue in this tradition that productive capabilities determine the realistic options for economic diversification and the competences to take advantage of potential opportunities: "Learning builds up dynamic capabilities which are key drivers of catching up and economic development". Thus, according to this account, a core role of an aspirant developmental state is to support learning processes to develop dynamic technological capabilities at all levels (Salazar-Xirinachs et al., 2014).

2.2. Sectoral systems of innovation

Arising from an earlier focus on national systems of innovation (e.g., Lundvall, 1992; Nelson, 1993), a literature emerged that focused on sectoral systems of innovation (SSIs), which places the emphasis on economic sectors as potential key agents of economic development. Malerba (1999, p. 4) defined an SSI as:

> A set of heterogeneous agents carrying out market and non-market interactions for the generation, adoption and use of new or established technologies for the creation, production and use of productions that pertain to a sector.

SSIs are dynamic systems shaped by the co-evolution of their components. It is assumed that firms in a sector search around similar knowledge bases to inform their productive activities, face similar technologies (and challenges related to national and global technological development), undertake similar productive activities and are influenced by the same institutional environments (Malerba, 2005). However, firms will also be influenced by their previous learning experiences, competences, organizational routines and culture, and opportunity conditions. Thus, the knowledge base of the firm and accessibility of appropriate technologies may act as both the foundation for and a constraint to innovation and learning. Equally, the nature of sectoral networks may also serve to limit or facilitate the acquisition of knowledge and technologies. Innovation is a networked activity shaped by the agents with which a firm interacts and by the institutions within which they and other actors are embedded. The networks of actors include interaction between firm and non-firm organizations, and