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Building an innovation hub: A case study of the transformation of university roles in regional technological and economic development

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ABSTRACT

Universities have assumed an expanded role in science and technology-based economic development that has become of interest to catch-up regions as well as to leading innovation locales. This paper examines how the role of the university has evolved from performing conventional research and education functions to serving as an innovation-promoting knowledge hub though the case of Georgia Institute of Technology (Georgia Tech). This case is discussed in the context of state efforts to shift the region from an agricultural to an industrial to an innovation-driven economy. Central to the transformation of Georgia Tech as a knowledge hub is the emergence of new institutional leadership, programs, organizational forms and boundary-spanning roles that meditate among academic, educational, entrepreneurial, venture capital, industrial, and public spheres. Comparisons between Georgia Tech's experiences and those of university roles in selected other catch-up regions in the southern United States highlight the importance to the case of networked approaches, capacity building, technology-based entrepreneurial development, and local innovation system leadership. Insights on the transformation of universities and the challenges of fostering a similar transformation in regional economies are offered.

1. Introduction

Albeit often gradually, the roles that universities undertake in society change and evolve over time. "The medieval university looked backwards; it professed to be a storehouse of old knowledge... The modern university looks forward, and is a factory of new knowledge." So wrote the English biologist Thomas Henry Huxley in 1892 (Huxley, 1892), remarking on the transformation that industrial society had stimulated in long-established functions of universities.

In this paper, we examine the case of one university and how it has undergone a further transformation, from that of a knowledge factory to a knowledge hub, to advance technological innovation and economic development in its region. One of the hallmarks of a knowledge hub is that it serves as a boundary-spanning organization that accumulates mediating functions for the exchange of tacit as well as codified knowledge between academia and local business and financial communities. The case of Georgia Tech illustrates how one university has benefited from university leadership and the accumulation of boundary-spanning programs. These programs seek to develop new technology-oriented business capabilities among academic faculty, startup ventures, mature companies, and industry clusters. Evaluations of these programs suggest that their explicit elements are most likely to be measured

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and reported, even though tacit knowledge sharing is what is most valued by participants and stakeholders. After comparing the approaches to leveraging universities in other rising innovation regions in the US South, we then explore the implications for university transformation in stimulating an innovation-based regional economy.

2. Role of intermediaries in the innovation process

The earliest models of universities highlighted their roles as "accumulators" of knowledge—a function that was largely separated from the rest of society. This was signified, for example, in medieval universities (such as Oxford and Cambridge), where scholars and students housed in residential colleges lived and learned apart from the public at large, leading at times to "town v. gown" clashes (Brockliss, 2000).

Beginning in the nineteenth century, the rise of a more active role was heralded for universities. The pursuit of scientific research based on rational inquiry and experimentation grew, as seen in the formation of Berlin's Humboldt University, which then became a model for other universities. Universities also assumed roles in conducting research and training in technical disciplines (as well as purely academic ones) and in educating students to meet the needs of industry (Graham and Diamond, 1997; Noll, 1998; Mowery et al., 2004). Examples here include the development of "red brick" universities and local technical institutions in the industrial cities of Britain, and state land-grant universities and private technological institutes in the US, all of which stressed the value of practical subjects and the application of research.[1]

University institutions continued to expand on both sides of the Atlantic in the twentieth century. Following World War II, government and industry funding for university research was greatly expanded, with support (particularly from government) provided both for basic science and applied technology development. In the 25-year period, 1954–1979, US university R&D expenditures grew at an average rate of 8.1% per year in real terms, significantly higher than the annual rate of growth of 5.3% for the economy as a whole. In the subsequent 25-year period through to 2004, the average rate of growth of university R&D in the US slowed to 5.0% annually in real terms, although this was still a higher rate than for the overall US economy (3.9%). In 2004, US academic R&D totaled $42 billion or about 14% of all US R&D, up from about 10% in the 1970s.[2] Enrollment in all types of higher education in the US increased from 6.9 million students in 1967 to 15.7 million in 2001.[3] Moreover, the decades immediately following World War II have been viewed as an era in which industrial mass production was preeminent in the US and other advanced economies (Piore and Sabel, 1984). The features of linear organization, scale economies, and dedicated systems that characterize mass production have at least some analogies in the growth and orientation of universities in the mid-to-late twentieth century, particularly for high-enrollment campus institutions. In rudimentary terms, such "knowledge factories" developed inputs (e.g., students and research funding) into outputs (prospective employees and research papers) in batches, with set methods, raising comparisons with assembly-line production.

Training students and conducting research to produce new knowledge remains the "bread and butter" of the modern university. However, we suggest (see Fig. 1) that a third model of the university has emerged in recent decades—one in which the university functions as a "knowledge hub" that seeks to animate indigenous development, new capabilities, and innovation, especially within its region (Shapira and Youtie, 2004; see also Newlands, 2003). In this model, universities become even more deeply embedded in innovation systems, seeking to actively foster interactions and spillovers to link research with application and commercialization, and taking on roles of catalyzing and animating economic and social development. Processes of the creation, acquisition, diffusion, and deployment of knowledge are at the core of these functions, hence the terminology of knowledge hub. The university, of course, always has been an institution of knowledge, but in this third mode, the institution seeks actively to use knowledge to promote indigenous development and new capabilities in its region and beyond.

There are multiple forces influencing this transition and evolution in university roles. They include the underlying shifts in advanced economies away from traditional mass production and linear transfer relationships to post-industrial, knowledge-driven, open, and more interactive innovation systems (Florida, 1995; OECD, 1996; Chesbrough, 2003). These shifts challenge universities to reorganize research (for example, to address new developments in technology which require interdisciplinarity and collaboration), to evolve educational missions and methods (to meet demands for new qualities in human capital development), and to reconsider the ways in which they develop and exchange knowledge (including their knowledge-based interactions and networks with industries and communities). Related to these shifts are new expectations by government about the performance and contribution of universities. In the US, state governments (which operate large public university systems and fund teaching) increasingly request that their institutions foster economic development and innovation within their localities. Federal policy encourages university technology transfer (including through the Bayh-Dole or University and Small Business Patent Procedures Act of 1980 and other legislation), while federal agencies, which fund most university research, also increasingly look for economic and

[1] A prominent example is the incorporation of the Massachusetts Institute of Technology by the Massachusetts legislature in 1861, as a "... a school of industrial science [aiding] the advancement, development and practical application of science in connection with arts, agriculture, manufactures, and commerce" (Acts of General Court of The Commonwealth of Massachusetts, 1861, Chapter 183, Section 1, available at http://web.mit.edu/corporation/charter.html).

[2] *Source*: National Science Foundation (2006). Authors' calculations of constant dollar compound annual growth rates in R&D spending based on data in Appendix Table 4-4.

[3] National Science Foundation (2006), Appendix Table 2-3.