

## **Introduction**

In view of the prominence played by universities in the papers that make up this book, it seems appropriate to provide some of the background conditions that have shaped institutions of higher education in the course of American history. Indeed, this recourse to history is inevitable, not only in understanding the introduction of new forms of educational institutions or new academic disciplines. Innovations are hardly ever subjects that can be well-illuminated with only the assistance of sweeping generalizations or abstract theories.

The different trajectories taken by American universities, as compared to those in Europe, owed a great deal to the political systems in which they were developed. After the Napoleonic Wars, higher education in much of continental Europe became public institutions. In effect, they were nationalized, with extensive centralized control as the inevitable accompaniment of centralized funding. University faculties in Europe became, essentially, civil servants.

The status of higher education in the United States was shaped by a very different set of political forces, the most distinguishing feature of which was an aversion to the centralization of power. The federation of the country in the last two decades of the eighteenth century translated into the localization of decision making as well as financial support of the educational system. This hostility to centralization has had its reflection in the fact that, to the present day, there is no major research university located in the nation's capital, in spite of numerous proposals over the years as well as the availability of superb library and archival collections. Support for establishing a national university in Washington, D.C. goes back to Hamiltonian proposals that were advanced almost immediately after the American Revolution, but they were rejected out of a fear of the possibility of concentrating excessive power in a centralized authority. Perhaps even more pertinent is the fact that the US has never had a ministry of education!

In the absence of a reliable source of revenue, a prerequisite for the success of an American university has always been its ability to raise funds, and the leadership of universities has therefore required a critical entrepreneurial skill: fund raising. In a small number of cases, some of America's most eminent universities were founded with substantial endowments by entrepreneurs who had already acquired considerable wealth. Johns Hopkins University, Cornell University, Vanderbilt University, Stanford University, Carnegie-Mellon University and the University of Chicago. The University of Chicago was, of course, founded with abundant Rockefeller money, but it was thought to be unwise at the time (1891) to prejudice the future of a newly born university with the name of a "robber baron". But, for the vast majority of private institutions, and even for institutions that started life with sizeable benefactions, a university president has had to be a skillful and determined fundraiser.

In this context, the older, elite American universities paid little attention to more "practical" concerns, such as science and engineering, until the incentive of a private endowment was eventually forthcoming, which led to the establishment of the Lawrence Scientific School as a branch of Harvard in 1847. Yale created the Sheffield Scientific School in response to a gift by a private entrepreneur in 1858. MIT was established on April 10th 1861, through the leadership of a group of Boston industrialists (two days before Fort Sumter was bombarded and the Civil War begun).<sup>1</sup>

State universities might, on first consideration, appear to have been exempted from the need for entrepreneurial leadership, but this has not been the case. The Morrill Act, passed by the US Congress in 1862, was the enabling "land grant" legislation that gave rise to a national network of state universities, with decentralized control and the subsequent financing of these universities left in the hands of each state. Since there were many states, it was never obvious why a public institution of higher

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<sup>1</sup> UNIDO (2005). *Capability Building for Catching-up*. UNIDO, Vienna, p. 46. See also Karl Wildes and Nilo Lindgren, *A Century of Electrical Engineering and Computer Science at MIT, 1882-1982*, pp. 378-379.

education was necessary in each state, to be supported by revenues raised by the taxpayers of each state. Thus, in order to persuade state legislators to appropriate the necessary tax revenues, it was essential to demonstrate that the state university was providing uniquely valuable services to the business, agricultural and industrial interests of each state. And this required considerable entrepreneurial skills of a political and perhaps rhetorical sort.

State universities therefore came to specialize both their teaching curricula and their research activities in ways that would accommodate the changing needs of local industry and business. The Merrill Act referred to the need for these new institutions to advance the interests of “agriculture and the mechanic arts.” The subsequent Hatch Act, passed by Congress in 1887, established state agricultural experiment stations that have subsequently played a crucial role in the development of improved agricultural technologies. As the country expanded westward and underwent industrialization, university teaching and research programs expanded in terms of their diversity and their extent of specialization. Indeed, the ease with which these activities could be altered became, and has remained, an essential feature that distinguished American universities from their European counterparts.

Thus, after the first World War, a college of engineering might offer undergraduate degrees in a bewildering variety of highly specialized engineering subjects, specializations of somewhat doubtful social benefit. In Illinois, a state heavily dependent on railroads, an engineering student at the University of Illinois found that he might take an undergraduate degree in architectural engineering, ceramic engineering, mining engineering, municipal and sanitary engineering, railway electrical engineering, and railway mechanical engineering. As one observer wryly observed at the time, “Nearly every industry and government agency in Illinois had its own department at the state university in Urbana-Champaign.”<sup>2</sup>

American universities, especially state universities, have been a cornucopia of useful technologies for local industry. The Babcock test,

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<sup>2</sup> David Levine. *The American College and the Culture of Aspiration, 1915–1940*, 1986.

developed by an agricultural research chemist at the University of Wisconsin and introduced in 1890, provided a cheap and simple method for measuring the butterfat content of milk, an easy way to determine the adulteration of milk, a matter of no small consequence in a state dominated by dairy farmers. In Ohio, the University of Akron, a public urban university, supplied skilled personnel for the local rubber industry and later came to excel in research on rubber processing; and, even later, it “graduated” into a much more sophisticated research center in polymer chemistry.

The University of Minnesota developed, at its own Mines Experiment Station, a processing technique for the efficient exploitation of low grade iron ores, after the rich hematite deposits of the Mesabi Range had been largely exhausted. Similarly, for many years, the University of Oklahoma distinguished itself for its research in the field of petroleum, and the universities of Kentucky and North Carolina have worked intensively on devising technologies that have been employed in the post-harvest processing of tobacco. In the early 1980s, there were no fewer than 37 universities in the United States that were performing research for local and regional forest products industries. The main focal points of such local research were “...wood moisture relations, wood chemistry including pulp and paper, mechanical properties, reconstituted products, and wood anatomy microscopy.”<sup>3</sup> Localization indeed!

But American universities in the twentieth century also moved gradually, yet decisively, beyond these highly specialized research projects for the benefits of local industry. In the first half of the twentieth century, American universities began to focus more substantially, both in research and teaching, on new disciplines in several fields of engineering and applied sciences — and, early on in the 1950s, on the realm of medical research and teaching at the graduate level. A striking feature here was that these subjects were institutionalized (i.e., acquired department status) very early and very quickly at American universities, even when the related scientific discipline had been developed earlier in Europe, and even when European contributions to the science remained

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<sup>3</sup> *Wood and Fiber Science*, 1985, p. 584.

far more advanced than the contributions coming from America. This was conspicuously the case with respect to the engineering disciplines that had been built upon electricity, chemistry, and aerodynamics (fluid mechanics).<sup>4</sup>

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<sup>4</sup> In one important dimension, public universities in recent years are becoming more like private universities. “Public universities in general, which used to cover most of their budgets from state money, now get only 15–20 percent from that source. Their costs are rising rapidly, especially where new technology and health-care expenses are concerned. To fill the gap, many of them are looking to the private sector for help. But can they do this and still stay loyal to their old public responsibilities?” *The Economist*, June 2, 2001.