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ABSTRACT

Knowledge transfer is considered essential to the long term health and survival of universities. The strategy outlined in this paper calls for institutions of higher education to develop policies concerning the transfer of knowledge and technology and to tailor such policies to potential users. It discusses types of knowledge to be transferred, potential users of that knowledge, and the role of the university in the procedure. The paper concludes that policy makers should identify the circumstances under which the institution should take a proactive or reactive stance in the transfer of knowledge to potential users. Knowledge transfer strategies that are in accord with institutional policies and that attend to differences in the type of knowledge and in the nature of prospective users can then be designed, tested, and implemented. (Author/LD)

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KNOWLEDGE TRANSFER AND THE DEVELOPMENT OF EDUCATIONAL POLICY

by

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Our symposium today deals with "Educational Policy and Higher Education Institutions." One could discuss knowledge transfer as an internal institutional concern. That is, it is possible to consider the policies that institutions should develop concerning transfer of knowledge between disciplines as well as among subdisciplines. One might, for example, develop in historical perspective the emergence of new disciplines such as microbiology as a result of knowledge generated in previously existing disciplines. Such a discussion might deal with the development of institutional policy concerning the establishment of new academic departments, interdisciplinary research institutes, and the like.

I prefer, however, to discuss knowledge transfer and the development of educational policy from a broader perspective. I shall assume that in no aspect of its organizational existence is the interface between institutions of higher education and other social organizations, particularly governmental organizations, more crucial than in the transfer of knowledge and technology. Knowledge transfer is thus considered essential to the long term health and survival of an institution, for it is through their success in knowledge transfer activities

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that universities are perceived as repaying the investment made in them by society.

In the long run, if any social institution is to survive it must be viewed as useful by the society from which the institution draws its human and material resources, and universities are not exceptions. An institution which is viewed as parasitic, that is, drawing its sustenance from the society and offering nothing in return, will wither and if this perception is not altered will eventually disappear. One way in which institutions may be perceived as useful is by contributing to the solution of the problems that plague society. Since the primary product of educational institutions is knowledge, effective policies for transferring knowledge to potential users are crucial for institutional survival.

Knowledge Transfer and the Roles of the University

There is general agreement that higher educational institutions, particularly large universities, have a three-fold mission--teaching, research and service. Perhaps the most universally accepted role of higher educational institutions is that of teaching, i.e., the transmission of knowledge. A second major role is the discovery of knowledge, an activity primarily associated with research. And third, higher educational institutions typically engage in various types of knowledge and technology transfer functions, activities which are generally associated with their service role. Thus, the transfer of knowledge and technology is that aspect of the higher educational

institution's role that is most closely associated with the application of knowledge to contemporary problems of society or sub-groups within society.

It must be acknowledged that the relative emphasis placed upon each of the three aspects of the institution's mission--teaching, research and service--will differ among higher educational institutions. Many of them define their role as primarily the transmission of knowledge and this is particularly true of four-year colleges. Many colleges and universities pay homage to the importance of research, but relatively few have adopted policies which establish research or knowledge generation as a highly valued activity. In fact, one earmark of the so-called "Great Universities" is the incentives and rewards established to encourage research productivity by the faculty. Knowledge transfer--the service role of the university--is also honored more frequently in admonition than in practice. In discussing educational policy concerning the transfer of knowledge and technology, one must distinguish between the various types of knowledge or technology to be transferred and consider the characteristics of potential clients who might benefit from this activity.

Types of Knowledge to be Transferred

The nature of the knowledge to be transferred has important implications for an institution's approach to this task. One may view knowledge as occupying a continuum which, at the one extreme, consists of facts gained through basic theoretical research and at the other extreme consists of applications of facts to solve complex

technical problems through applied research and development. At the basic facts end of the continuum the transfer of knowledge is accomplished primarily through the traditional teaching function. That is, the knowledge accumulated by humankind over past generations is recorded and transmitted to future generations, a process which might be termed the intergenerational transfer of knowledge. All educational institutions share in this task. In fact, higher education institutions represent only a small segment of the educational systems societies have created to attend to the intergenerational transfer of knowledge.

Higher educational institutions also are expected to add to humankind's stock of knowledge. This function is accomplished primarily through research and development activities. Ideally, the university's research mission will complement its teaching and service missions. Research adds to the store of knowledge as well as applying knowledge to the solution of complex scientific, social, economic and political problems. In its broadest sense, the knowledge transfer role attempts to bring the creative human resources of the university and the accumulated knowledge of humankind to bear upon the unsolved problems of society. Through its knowledge transfer function the university seeks to assist society to deal with its problems. And in dealing with society's problems new knowledge often is gleaned. Thus, a symbiotic relationship exists between knowledge generation and knowledge transfer.

The application of knowledge to solve complex problems typically involves the transfer of technology. We have noted that the

university's research mission includes both highly theoretical basic research and applied research and development activities. Creative applications of technology typically arise from applied research, i.e., applications of basic knowledge to solve current problems. Whereas transfer of the products of theoretical basic research can usually be accomplished adequately through such traditional channels as publication in scientific journals, presentations at symposia and the like, the products of applied research often are of such a nature that technical assistance must be provided to prospective users if the knowledge is to be communicated accurately and efficiently.

Potential Users of Knowledge

It is important to consider the characteristics of potential consumers of knowledge and technology in the development of knowledge transfer policy for colleges and universities. The potential consumers of knowledge generated by highly theoretical basic research usually constitute a rather small and homogeneous group. Individual researchers working in specialized areas generally are acquainted with others working in the same field and share their results through papers presented at specialized professional meetings and articles in scientific journals as well as through less formal communications. The transfer of knowledge produced by highly theoretical basic research is a relatively straightforward task. Potential consumers are easily identified and the channels for communicating knowledge gained from basic research are familiar to those in the field. Policy concerning the transfer of this knowledge should, at the least, actively encourage

dissemination of the results. Policies can be established which use both status and financial incentives to encourage knowledge transfer, for example, subsidizing attendance at professional meetings.

At the applied research end of the continuum, the task of knowledge transfer is far more complicated. The nature and characteristics of potential consumers are important considerations in developing a knowledge transfer strategy. To illustrate, let us assume that the faculty in electrical engineering have developed a significantly more efficient process for generating electricity. There are relatively few organizations engaged in this business. It is an activity which requires large amounts of capital for the construction of generating facilities and transmission and distribution lines. The business is capital-intensive but not labor-intensive. Decision-making tends to be quite centralized. The task in this case is to make decision makers in the industry aware of the existence of the improved technology and perhaps provide some technical assistance, e.g., training, to adapt the new process for use in a business in which a relatively high level of technical expertise already exists. Because the industry is not labor-intensive, relatively little change in human behavior is required. The innovation is one that requires a major change in machinery but not in the behavior of people.

As a second example, let us assume that the faculty in education has developed a system for organizing elementary schools and instructing students that shortens the time needed for them to master basic skills. The "market" for this new technology is quite different than the market for an improved technology for generating electricity.

There are both public and private elementary schools and they differ in their sources of support as well as in their decision making processes. Most elementary schools have at least two organizational levels at which decisions about the technology of instruction are made (classroom and school), and if the school is part of a larger system, the number of decision-making levels proliferates even more. Unlike the capital-intensive electrical generating business, schools are labor-intensive organizations. There are decision makers at each organizational level. A decision at the highest system level to change the technology of instruction does not ensure that the change will actually occur at the classroom level. A change in the technology of instruction will inevitably require changes in human behavior--changes in the way teachers relate to pupils, to professional colleagues, to administrators, and perhaps even to parents. It is much more difficult to change customary, comfortable patterns of action and interaction which have become second nature to teachers than it is to change the machinery used to generate electricity.

The differences between the potential users of improved technology in these two examples suggest that universities, in developing policy with regard to their knowledge transfer activities, must adopt strategies that recognize both the nature of the knowledge to be transferred and the nature and characteristics of potential users of that knowledge.

Issues in Knowledge Transfer

One of the first questions which confronts policy makers is whether the university should assume a rather aggressive role in the

transfer of new knowledge and technology, or whether it should play a more passive role, responding only to requests for information or technical assistance. A related question is the extent to which knowledge transfer activities should be subsidized by the university. The answer to these questions may vary depending upon the potential consumers and the nature of the knowledge or technology to be transferred. Some universities may view knowledge transfer and technical assistance as a potential source of revenue. If this is the case, a proactive role is required with attention paid to marketing the potentially saleable products of research and development. The institution's system of incentives would need to be structured to reward both those who are most successful in the production of knowledge and those who are most successful in the transfer of knowledge or the provision of technical assistance.

A publicly supported university will confront a more complicated set of issues. New knowledge or technology which has potential commercial value, and which has been developed with public funds, may require protection against exploitation by private interests to the detriment of the general public. Our example of improved technology for generating electricity is illustrative of such a situation. Policies are needed with regard to such matters as patent rights, copyright protection, royalty agreements, and licensing arrangements. A cautiously proactive role is indicated, and the policy should ensure that the transfer of knowledge and technology occurs under conditions which protect the university and the public from exploitation. One would expect, at a minimum, that the policy would provide

for recovery of any cost incurred by the university in the transfer of knowledge or technology to organizations which may benefit from it.

A different type of policy may be required, however, when the potential consumers of knowledge or technology are public organizations or institutions. This would often be the situation in our example of an improved technology of instruction. The problem here is to ensure that the public will secure maximum benefit from the university's knowledge-generating activities. A proactive policy with regard to knowledge and technology transfer activities is indicated and a policy which subsidizes such activities may be needed. The establishment of formal or informal linkages with potential users is also indicated. Typically there are few direct linkages between universities and elementary and secondary schools. Even in publicly supported educational systems, different agencies and/or governing boards are responsible for various levels of the educational system. Frequently the systems are not even loosely coupled.

It is ironic to note that knowledge and technology transfer occurs much more rapidly and effectively in such fields as agriculture, business, and medicine than it does in the field of education. At the University of Wisconsin-Madison, for example, a University-Industry Research program operates as an integral component of the university. The function of the program is "to expedite transfer of useful laboratory discoveries to the marketplace." The program provides for a continuing interaction between the university and industry in the state by applying the research competence and facilities of the university to the solution of problems important

to the economic development of the state. Several faculty members from the Colleges of Engineering, Agriculture, and Business who have backgrounds in research and/or industry work in the program on a part-time basis and are responsible for initiating and maintaining contact with industries in the state. The program serves three functions: (1) to marshall the resources of the university to assist Wisconsin companies with research problems; (2) to increase the internal research and development capability of industry in the state; (3) to focus university research on areas of economic importance to the state.

Unfortunately, no formal program exists for linking the resources of the university to the elementary and secondary schools of the state. Yet the elementary and secondary schools of the state have needs which would afford legitimate subjects for both basic and applied research by members of the faculty and often would benefit from applying knowledge or technology developed at the university. Indeed, both in the United States and in other countries, I have been dismayed by lack of adequate communication or linkage between higher education institutions and the elementary/secondary portion of the educational system. This gap exists not only with regard to the transfer of knowledge per se, but also with regard to the placement of professional personnel.

One of the most effective ways of transferring knowledge and technology is through the employment of persons who have been trained at the university. The infusion of freshly trained (or retrained) personnel into a labor-intensive organization such as a school is

often the most effective way to transfer knowledge and speed the adoption of superior technology. Yet too frequently students who complete a bachelor's or master's degree program are unable to find appropriate professional employment. We invest heavily in the training of educational personnel but fail to pay sufficient attention to job placements which make effective use of the knowledge and skill of trained personnel in developing policies concerning the transfer of knowledge and technology.

As an example of a strategy which has been reasonably effective in transferring knowledge and technology in the field of education, I will briefly outline the procedures the Wisconsin Research and Development Center followed to implement Individually Guided Education (IGE). IGE is a comprehensive system for organizing and operating elementary schools developed at the Wisconsin R & D Center between 1965 and 1970. It is a complex innovation that requires significant changes in both instructional practice and interpersonal relationships. It was evident that schools which chose to implement IGE would require a great deal of technical assistance because major changes in the roles and relationships of teachers and principals, i.e., changes in their behavior, would be required. It also was evident that it would be impossible for the Center to provide the necessary technical assistance to schools throughout the United States. The task was to develop an effective strategy for successfully transferring this new technology to potential consumers.*

*It should be noted that the University of Wisconsin has had a proactive policy with regard to the transfer of knowledge for over 100 years.

The strategy selected was to create a network composed of existing institutions and organizations which could link prospective users with sources of technical assistance. It was decided to concentrate first on state education agencies that were interested in IGE and to establish a state-level coordinating committee composed of teachers, principals and teacher educators under the leadership of a person from the state education agency's staff. The Center, with support from the United States Office of Education, and later the National Institute of Education, provided technical training to the members of the state coordinating committees so that they could, in turn, provide technical assistance to local schools who wanted to adopt IGE. Later, as the number of IGE schools expanded, regional coordinating committees were formed within states to provide easier access to technical assistance and support. The Kettering Foundation's Institute for the Development of Educational Activities (/I/D/E/A/) was actively involved in the implementation of IGE and the Sears-Roebuck Foundation also provided support for the development and strengthening of state networks.

In 1973, an independent association of individuals interested or involved with IGE, the Association for Individually Guided Education (AIGE), was formed with support from the R & D Center and from /I/D/E/A/. It was hoped that this new organization would eventually become strong enough to assume responsibility for the implementation of IGE throughout the country. That expectation was realized in November, 1979 and the R & D Center is now devoting its energy and resources to further research and development in the area of individualized schooling.

The strategy outlined above was not presented as a generic model for the transfer of knowledge in education. Rather, it was presented to illustrate the importance of developing a policy concerning the transfer of knowledge and technology, and of tailoring strategies and procedures which pay attention to the nature of the knowledge to be transferred and the characteristics of potential users.

Summary

I have suggested that knowledge transfer is an important function of institutions of higher education; indeed, it is one of the three primary reasons for their existence. The fact that knowledge and technology vary in form and substance must be considered in developing policies concerning their transfer. The characteristics of potential users of knowledge, both individuals and groups, must also be considered in choosing the strategy which is most likely to accomplish the transfer of knowledge or technology. It is important that policy makers identify the circumstances under which the institution should take a proactive (or reactive) stance in the transfer of knowledge to potential users. Knowledge transfer strategies that accord with institutional policies, and that attend to differences in the type of knowledge and in the nature of prospective users can then be designed, tested and implemented. Appropriate policies concerning the transfer of knowledge and technology will benefit both the institution and the society in which it is embedded.