

Industry and Academia Networks

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INTRODUCTION

Universities have historically been a source of fundamental knowledge, and the premier source of technologies that have found innumerable applications (in the economy, in the military, in health care, etc.) that have shaped the trajectory, the direction and the nature of social and economic development. The contribution of universities towards the economic fabric of a region, nation or supranational entity is manifold, and is recognised as essential to the creation of wealth. It is because of that recognition that there has been a growing need to understand in what ways knowledge created at the universities is transferred and it impacts upon society at large. Knowledge can take many forms, and the resources devoted to knowledge creation can themselves be allocated to different levels and degrees of activities related to that endeavour. However, resources are scarce and resource allocation to knowledge must be essentially of a long-range perspective. The distribution of resources in terms of short-range and long-range investment in knowledge is inextricably linked to the phenomena of university-industry relations. Many initiatives fostering linkages between universities and industry, with a view to increase or facilitate rates of technology transfer, implemented innovation and economic development. However, the contexts in which these relations occur vary broadly and presently, because resources for investment in knowledge creation are scarce and differentiated there is a need for a comprehensive understanding of the variety of initiatives and relationships that exist, and the need for a deeper conceptualization of the forms, configurations, roles and expectations that shape and define existing relationships.

TRENDS IN UNIVERSITY-INDUSTRY RELATIONS

Relations between university and industry are not new and they have changed with the evolution of the university itself, the evolution of industry and the policy

initiatives and objectives surrounding the university institution. The origins of the modern research university, as we know it today, can be traced back to the second half of the nineteenth century, whereby the main values that described the institution were: 1) the production of knowledge for its own sake; 2) the preparation for professional careers; 3) a structure based on well-defined disciplines and 4) an articulate organisation and a legal status (Geuna, 1999). The university was already seen as a national institution and its mission was related to the development of the nation-state. Explicit orientation to the needs of the local or regional economy was stronger in the United States universities than in the European ones, where research “for its own sake” was the predominant approach. During the 20th century, institutional diversification and expansion gave birth to a set of “higher education” institutions that had a diverse approach as it concerned relations with industry or local economic needs and/or emphasis on “pure” research. After the 2nd world war, the role of science and technology in terms of its direct applicability to economic development was firmly established among the western nations, although a linear perspective of the innovation process persisted. Governments diverted huge resources to research and development (not only to universities but also to other public agents) in the belief that such an investment, through a “pipeline” mechanism, would be transfigured into new processes and products and ultimately in increased wealth. More recently, several factors have transformed the way the university approaches its relations with industry. The perception that the innovation process is not a linear one and that the activities of basic research and development have and need innumerable connections, the increasing complexity of science and technology and the associated uncertainty and risks in the development of new products and processes, and the proliferation of public and private actors that are engaged in research and development activities, has put new demands and pressures on the university system.

Increasing connections between academia and industry are visible in several indicators. Statistics on the percentage of the total expenditure on R&D performed

by the Higher Education sector that is financed by the Business sector (OECD, 2003), including the EU15 countries plus Canada, Japan and USA, show a percentage of 2.2% in 1981 and a percentage of 5.5% in 2001. There is a wide diversity between countries, and the percentages vary from 1% to 13%. The USA is in the middle of the league. During the 1980 decade, there was a very rapid rate of increase (averaging 15% per year) and during the 1990s and 2001, the rising trend persisted but at a slower and declining rate (about 4.5% per year). The pattern of growth during the first period was probably related to the spread of policy initiatives that supported increasing university-industry relations, whereas the pattern of growth during the last period was tentatively related to natural constraints or opportunities that limit the usefulness and growth of UIR. The ensuing discussion will elaborate further on that aspect.

According to recent data (OECD, 2000) both the relative and the absolute number of publications co-authored by industry and university researchers are also increasing.

The number of scientific papers that is cited by patents is also increasing, showing the impact that academic research is having on industrial inventive activity. Technological innovation makes increasing use of academic research output but the intensity and the degree of connection seems subject to considerable variability across fields.

The number of firms that are created based on university research (spin-off firms) is also growing, and varies wildly across countries, both in absolute (number of spin-offs per year) and relative terms (number of spin-offs per research expenditure).

UNIVERSITY-INDUSTRY RELATIONS AND SOCIAL NETWORK THEORIES

The advantages of having relationships with a wide-variety of actors in diverse institutional settings have long attracted the attention of scholars (Freeman, 2004). There are a few sociological concepts that help explain the mechanisms of information diffusion and knowledge exchange within or across networks, one of which is the concept of strong and weak ties (Granovetter, 1973). A strong tie represents a person with whom there is a regular interaction, and a weak tie represents a person with whom there are sporadic or punctual contacts. The source of much of new information that a person receives

comes from weak ties, while strong ties are important in terms of day-to-day social interaction and support. Weak ties are the source of new ideas or new perspectives at looking at old problems. Strong ties are relevant in the exchange of complex information and conducive to the exchange of detailed and thick information (Ahuja, 2000). Applying these concepts to UIR, we can consider that researchers in academia are in a day-by-day basis in contact with their peers, their colleagues, with whom they share and construct complex information, but based on common beliefs and common approaches to solve problems (strong ties). The same can be said of researchers in an industrial setting. Complex and detailed information concerning that setting is shared between colleagues and co-workers, but it is common that a unique problem-solving paradigmatic approach prevails among the group. If a relationship is formed between a member of this group and a member of the academic group (weak tie), there is a high probability that new and fresh insights into old problems may occur, because of the different intellectual trajectories, constructs and perspectives that each individual brings with them. New possible knowledge combinations, otherwise difficult to obtain if the individuals were kept apart, can result from that interaction, and this applies to both sides of the relation.

Another conceptual perspective is the distinction between networks as bridges and networks as structural holes (Burt, 1992). Elements of a network may connect differently and with different persons. If a person knows another person in a network but a third person only knows the second, there is a not-yet-realised potential of connection between this last person and the first one. This configuration was defined by Burt as a structural hole, meaning the connection potential between elements or groups of elements that are not connected. There are elements that are better positioned than other to bridge and broker these gaps in the structure of the network, either to their own advantage or based on mediation and arbitration (Obstfeld, 2005).

This discussion highlights the advantages of university-industry relations (UIR), in terms of opening new avenues of research for members of academia and industry. Researchers in industry and researchers in academia have very different perspectives, experiences, and sensibilities and, in this sense, the two communities have inherent knowledge production advantages by creating communication channels and patterns of cooperation.

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