
Editorial: On the importance of university–industry–government cooperation: a global perspective

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In the past decade the field of university–industry relations has witnessed a quiet revolution in thought and in action. Worldwide, the role of cooperation between universities, industry and government has gained increased prominence. Academics, industrial executives and government officials are not only promoting such cooperation, but also rethinking their attitudes and approach to this phenomenon. In this era of increased cooperative effort and strategic alliances among business corporations, the role of universities in such ventures is undoubtedly becoming central to successful interactions. This is particularly true in highly competitive, innovation-driven industries.

Although a definitive metrics of the benefits accrued from this cooperation is yet to be developed, there are numerous cases of successful interactions between universities and industry. In the past decade many such cases have been documented. Several models and approaches have been advanced. Thus we have gained additional insights into why universities, industry and government cooperate, how they cooperate, and why some forms of cooperation succeed while others fail.

This trend of enhanced explorations of the phenomenon of industry–university cooperation is not unique to selected research groups in Europe or the USA. In the 1980s, in many of the Western economies, there has been a concentrated effort to better understand the forces that shape the industrial competitiveness of companies and nations. In the wake of this trend, the area of industry–university cooperation has begun to occupy an important place. Researchers, business executives and government officials have all expressed a surging interest in such cooperation and in a more cohesive grasp of the role it plays in industrial and national competitiveness. The emerging consensus clearly indicates that university–industry–government cooperation plays an important role in fomenting and accelerating innovation and in creating conditions which facilitate the commercialization of new products. Examples abound: from the MITI experience in Japan, the major thrust by the US National Science Foundation, to cases of successful implementation of academic research in industrial settings in the USA, Western Europe, and also in some developing countries.

This special issue was designed to offer a comprehensive and global view of this phenomenon. The first of the three sections in which the special issue is structured deals with the key issues of the cooperation. Burrington (British Petroleum) discusses key issues and usual misconceptions prevalent in such cooperative arrangements. Andrés (Government of Spain) provides an insightful review of common issues of concern to the parties in a cooperative effort – through the eyes of the Spanish experience. Klus (University of Wisconsin) advances some issues in the framework of the national environment. Block (The Threshold Group) lists eight issues of critical importance in

establishing and successfully managing R&D consortia. Dearing (Michigan State University) suggests that problems of industry–university cooperation should be approached from a much broader perspective of technology transfer. Liesch (University College of Southern Queensland) describes the Australian Government Offsets Program designed to upgrade the technological base of Australian industry. He suggests that the markets–hierarchies paradigm may explain the uniqueness of the organizational form for technology transfer in government–industry cooperation. Papageorgiou (University of Massachusetts–Boston) discusses the US R&D position in the world economy. He considers some trends in key indicators and concludes that international geopolitical trends are essential in predicting a country's technological competitiveness. Finally, in this section, Khan (Technology Policy Group, Norway) argues that a strategy of cooperation among companies, and between government and industry, would lead to a better environment for growth and economic success.

The section thus contains a mix of the opinions of academics and business executives. They offer a menu of issues these experts consider essential for understanding the phenomenon of university–industry–government cooperation. In addition, the eight contributors to this section also provide a diverse and multidisciplinary set of approaches and models for a systematic analysis of cooperative efforts. In this first section, the reader learns why the topic is important, and what are the key or crucial questions and issues with which we are grappling.

Section II describes illustrative cases of university–industry–government cooperation. This section is the most voluminous, since I purposely designed the special issue to contain as many relevant examples as possible. Hence the variety of institutions, forms of cooperation and national identities of the cooperative efforts.

Ledeboer and Gorter (Phillips) describe the trials and the outcomes of the ESPRIT program in Europe. Allesch (TVA, Germany) analyses the role of cooperation in regional and national policies in Eastern Europe. In a similar venue, Bramorski and Madan (University of Wisconsin–Whitewater) describe technological partnerships in Poland. Van Helleputte and Van Overstraeten (IMEC, Belgium) describe the case of the Belgian Interuniversity Microelectronics Center.

The first four papers in this section provide examples from a continent, a region, a country, and an institution. They are illustrative cases of four levels of cooperative efforts.

Frye (Chrysler) discusses his company's experiences in its cooperation with universities in the USA. Werner (Werner Associates) analyses the Microelectronics and Computer Technology Corporation (MCC) in Austin, Texas, and continues to expound a model of second-generation consortia through vertical partnership. Werner's ideas are thought-provoking and refer to ideas recently considered by several US federal agencies. Radosevich (University of New Mexico) discusses the interaction between a federal laboratory and its large industrial partner. He develops and critiques a mixed-strategy model which seems to apply to this type of interaction. Shenhar (Tel Aviv University, Israel) describes a joint effort between a university and a large aerospace company.

Evans, Starbuck, Kiresuk and Gee offer a unique description of their Engineering Research Center. Their paper is a marvellous mix of description and analysis of the Center for Interfacial Engineering of the University of Minnesota, USA. In a concerted effort, four distinct perspectives are assembled in their paper. Evans is the Director of the Center; Starbuck is Director for Technology Transfer; and Gee is a senior fellow in the Center. In addition, this paper offers an introspective view from Kiresuk, who is the

evaluator of the Center, assigned to this task by the National Science Foundation. To my knowledge this is the first such review of a viable and successful university-based Engineering Research Center (ERC) and its relations with industry. This set of three elaborate papers represents, in my view, a significant contribution to the literature on industry–university cooperation.

Tanaka (University of Tokyo) reports the results of his survey of science and technology policy-making in Japan. He classifies the policy-making process into three models. Tanaka concludes that the closed policy-making process in Japan, which relies heavily on consensus-building and informal negotiations, is ineffective in the case of R&D. He also suggests that this process weakens the ties between government and the other sectors in the Japanese economy. Pilorget (ISI, Germany) describes his survey of some national programs in Europe to promote innovation in commercial firms. He classifies these programs and describes their evolution. Pilorget also suggest a correlation between the culture of the country and the type of program it implements.

Chang, Shih and Hsu (National Chiao Tung University, Taiwan) describe a strategic process for technology transfer from government research institutes to industrial companies. They provide a case study of the commercial applications of integrated-circuit technology, transferred from Taiwan's Industrial Technology Research Institute to local companies. In a similar study of the European scene, Marchetta *et al.* (Italy) describe the role and activities of government agencies promoting technology transfer to industrial companies. They discuss agencies in Italy, UK, Holland, Germany, France and Denmark. Although their study does not offer comparisons between programs across national boundaries, they provide some guidelines for a successful cooperation in R&D/technology. Link (University of North Carolina at Greensboro) describes a single cooperative program: the Advanced Technology Program (ATP) in the USA. He proposes an evaluation plan, emphasizing the evaluation of needs, processes and outcomes. He also provides measures to assess the performance of the program in the short, medium and long terms. Finally, Link offers a case with some data to show the feasibility of his plan.

In a different venue, Debackere (University of Gent, Belgium) and Rappa (MIT) surveyed some 600 scientists in the field of neural networks in France, Germany, Japan, Great Britain and the USA. They report that US scientists are leaders in the field, with a strong commitment to continue in this position. They examined the collaborative research efforts in this field and report that European scientists are more likely to cross national boundaries than their colleagues in the USA or Japan.

Finally, in this section, Lee, Lee (Korea) and Bobe (France) describe some cases of technological cooperation between small firms in Europe and Korea. They offer a typology of cooperating firms: dependee, leader, exploiter and reactor. They suggest that success or failure of cooperative efforts is related to the type of firms which engages in such cooperation. Four success factors are identified: (1) intent to be involved in cooperation; (2) willingness to have usership rather than ownership; (3) long-term goals with incremental procedures; and (4) having strong technological capabilities.

The cases reported in this section are a revealing mixture of modes of cooperation, levels of interaction, type of entities and content of the cooperation. They were assembled with the objective of giving the reader a flavour of a diversity of cases – as illustrations of university–industry–government interactions.

The last section, Section III, deals with research horizons: where are we now and

where should we go from here? What are the preferred and also perhaps the less than obvious directions we should follow? This section is primarily directed at academicians. Yet the business executive and the government official will find this section particularly fascinating since it provides expert opinions on where this area is going and what will be the forthcoming questions and issues of concern to be investigated in the near future.

Souder (University of Alabama–Huntsville) summarizes the challenges and rewards of consortia. To some extent Souder offers a critical review of the issues and the illustrative cases of the previous two sections. He offers eight rules to maximize the effectiveness of consortia. In addition, he advances three areas of concern which he believes remain gaps in our knowledge: effectiveness of consortia, principles of their management, and the value of consortia.

The second paper, by Geisler and Furino, is an attempt to bridge theory and practice in industry–university–government cooperation. It offers a research agenda, in which not only the academic aspects of the suggested research are emphasized, but also the practical concerns are maintained. Their research agenda includes the development of theoretical foundations of R&D cooperation, as well as studies – across industries – of the impacts of cooperation on the performance and competitiveness of cooperating entities.

Finally, Salisbury (University of Arkansas) presents a selective and annotated bibliography of industry–university cooperation, covering over 120 key papers published since 1987.

In summary, industry–university–government cooperation is a critical activity in our quest for innovation, new product commercialization, and industrial competitiveness. In the 1980s new products accounted for about one-third of all profits of US companies. In the 1990s, we predict that new products will account, across industries, for over one-third of sales and an even higher percentage of the profits. Universities and government laboratories are fertile producers of knowledge, new ideas, technology, and innovations. Although the mantle of competitiveness covers the eyes of many companies, thus creating formidable barriers to cooperation, academics and practitioners alike are increasingly cognizant of the crucial and under-utilized role cooperative R&D and technology play in new product development and commercialization.

This special issue is a modest contribution to the state-of-the-art in this field, and to a clearer and perhaps more acute understanding of this phenomenon by academics, corporate executives and government officials.

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