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## Preface: Managing technology flows across industrial boundaries

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Humankind has had to wait until the Renaissance to discover that blood was fulfilling its vital role by actually circulating through the body. Similarly, we are only beginning to understand how the whimsical flows of knowledge, particularly those pertaining to technology, play a role in generating wealth. If such flows are indeed full of unpredictability, they also have time as a key dimension. It is estimated that it took 3000 years for the Mesopotamian idea of farming, instead of picking wild plants and berries, to diffuse to Northwestern Europe... Whereas, electronic space draws us into an instantaneous world, the human factor is still the determining filter deciding whether a specific piece of knowledge is dumped or actually put to work.

Staying away from the well-ploughed field of licensing, the richness of diversity of the channels and filters of technological flows, is illustrated by the different perspectives taken by the papers presented in this book. Firstly, authors have adopted very different units of analysis, i.e. the firm, the linkage between organizations and the national innovation system. Secondly, their focus is either on the aligning of technology and strategy, on the intercourse between units, or on the space-dimension of internationalizing R&D.

A first group of three papers is concerned with ways of effectively injecting technology *inputs into corporate strategy*. In this area, the key questions for the CEO are: What expertise do I need? When should it be deployed? Where do I obtain it?

Maisseu's approach provides an enlightening structuring of the various industrial channels used by manufacturers, such as car-makers, for procuring a given component; one must consider how critical this component is to the firm. He therefore distinguishes various families of components: *key, critical, basic and trivial*. Courtial then shows one way of exploiting the patent literature, a unique *published, business-sensitive* source, in order to turn it into an instrument for strategic planning. Clustering patent data through co-word treatment is the way to achieve this. Bye re-visits our old friend, the S-curve, to describe the dynamics of technology trajectories, coming back to the idea that the way of acquiring technical know-how very much depends upon the position of the technical innovation on the continuum from incremental to radical. Indeed, R&D investments have to be done consistent with this positioning.

The second group of papers specifically looks at the flows of technology-intensive intelligence and expertise *into and from the firms*. Ashton's paper X-rays the steps firms need to take in order to effectively implement technical intelligence in business, reaping handsome rewards from it, from gathering to evaluating and internalizing. Brockhoff and Teichert underline the overwhelming importance of the human factor and trust in the

success of projects involving several firms. They single out the complementarity of the partners' objectives as a central criterion as well. George's paper looks at the alliances between US firms and other companies, not necessarily American. In all cases, he uncovers the dominant role of technology in forming alliances, a movement that clearly peaked soon after business schools had made a 'buzzword' to it, i.e. in 1989. Sjölander compares Swedish, technology-intensive firms over time with similar companies elsewhere in the world and concludes that a substantial *outflow* of technology has taken place.

The following paper puts the attention on the flows *within the firm*. Durand takes a fresh look at 'simultaneous engineering', a well-accepted expression but a misnomer, as it suggests teamwork across functions, R&D/Engineering being only one of the actors. He contrasts and compares information flows and organizational structures used to effectively shorten the 'time to market'.

The *national context* of technological flows is then considered by Aganbegyan, who, taking examples in the steelmaking and coal sectors, stresses the interdependence, on the one hand between innovations affecting the various steps along the chain of a production process and, on the other hand, between ecology and technology. Haour's paper stresses that technical, commercial and educational contacts with the 'outside' is the key in Switzerland's use of specialized expertise, especially in the pharmaceutical sector, to bootstrap its export-intensive economy into enhanced competitiveness; Sweden is much like Helvetia in this respect. To what extent, however, will medium-size enterprises in these countries sustain the dominance they sometimes have achieved in narrow technology-intensive niches?

A key issue for the future concerns the defining and shaping of technology flows by electronic space. As computers finally get away from number-crunching by hybridizing with telecommunications, it remains to be seen what actual impact Marshall McLuhan's 'Gutenberg Galaxy' will have on the development of new technical products and on technology management as a whole.