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Raine Hermans and Martti Kulvik

**SUSTAINABLE BIOTECHNOLOGY
DEVELOPMENT**

– New Insights into Finland

The Research Institute of the Finnish Economy (ETLA)

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Preface

The present book condenses the essence of ETLA's research project "*The biotechnology industry as part of the Finnish innovation system*" financed by Tekes. The project has resulted thus far in eight journal articles reprinted in this book, a dissertation for the Helsinki University of Technology, a Master's thesis for the Helsinki School of Economics, an edited book published in Finnish and about thirty discussion papers and other articles.

The rapid emergence of new science-based entrepreneurship related to biotechnology necessitates the evaluation of potential niches that the Finnish biotechnology sector could profitably focus on whilst developing products with commercial potential. Moreover, the competence base must be sufficiently large to generate the critical mass necessary for spawning successful products and services. This book looks at the pre-conditions for turning research into commercial products from the standpoint of the competence base underlying such a critical mass by:

- 1) utilising international trade analysis to identify the most competitive biotechnology-based industrial clusters (Chapters 1 through 6),
- 2) classifying the statements on the most significant threats and opportunities expressed by the biotechnology company leaders (Chapter 3),
- 3) analysing the earnings potential of biotechnology related intellectual property rights (Chapter 4),
- 4) comparing the financial sources and realised business activity of the biotechnology businesses by region within the country (Chapter 5),
- 5) combining the results of the above discourses and applying them to the identified industrial clusters (Chapter 6).

Based on the analytical results and the international trade framework, this book provides important policy implications for both governmental bodies involved in innovation policy and start-up companies on their way to global markets.

Helsinki, 20 February, 2006

Sixten Korkman
ETLA, Managing Director

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25th January 2006, in Evanston and Helsinki

Raine Hermans and Martti Kulvik

Summary

This book analyses the features of the Finnish biotechnology industry from three complementary perspectives as a basis for a strategic sustainable biotechnology development framework:

- 1) How do the company leaders see the future of the industry?
- 2) How do the companies value their intellectual property rights?
- 3) How does the regional resource allocation reflect the prosperity of the industry?

The strategic framework stresses orientation towards customer value as opposed to a strongly technological focus; the development of biotechnologies should not contain any intrinsic value *per se*. The commercial value of biotechnology could be benchmarked against the value of alternative technologies, and consequently, biotechnology could become part of the technology options for companies active in established and conventional industries.

The government might have an important role in preparing the companies for the harsh realities of the global market place and strengthening the links with the existing industrial pillars. However, the framework suggests the public support should be only temporary in each field of application and for any single company. Furthermore, the public sector should strengthen those ventures that share the government's long-term goals of sustainable development, or those that utilise a regionally sufficient critical mass of skilled and specialised production factors.

The tools and forecasting methods applied and developed in this book could form a justified foundation for further discussion and measures. These tools could also be used in other high technology sectors at an infant commercialisation stage.

Below we present six central policy implications open to discussion:

1. Biotechnology in parallel with other technologies in public sector technology programmes. In order to ensure that technologically advanced projects reach their economic potential, the public sector should organise their technology programmes with the primary aim of developing specific industrial application areas or processes instead of a sole commitment to a certain technology field. The central issue is to guide the technology development projects to meet the needs of the market place. Accordingly, the technology programme on energy applications, for example, might subsidise research and development also in potential technological fields of conventional physical and more modern biological technology, not solely in biotechnol-

ogies. The biotechnology development should be mirrored and compared against presently dominant technologies in the production and utilisation of the specific application. If, and only if, a new technology offers clear advantages to the existing technology, the new technology should be strongly [but temporarily] supported.

2. Bioinformatics as a basis for the distinctive application areas. Utilising the Finnish population and patient databases would necessitate a strong development of the Finnish bioinformatics research and industrial activities. Furthermore, there are many application areas within plant and industrial biotechnologies. The accumulated competencies in the Finnish information and communication technology (ICT) sector provide a strong resource that could be exploited in the field of biotechnology. The creation of commercial applications in bioinformatics might bring together highly competent business experts of the Finnish ICT sector, venture capitalists and the biotechnology industry.

3. Public sector promoting R&D programmes: emphasising sustainable development. R&D projects of the biotechnology companies are aimed at increasing the owners' wealth. Sustainable development, which is focused on long-term perspectives, does not necessarily provide any incentives for the leaders of a company. The public sector could be a sole actor steering the company's R&D activities to such application areas, which are aligned with the strategic aims of the public sector related to sustainable development. Society could define how much it would be willing to pay for the promotion of sustainable development, and the biotechnology companies could assess the opportunity costs of the societal goals with the terms of financing from the private sector.

4. Public sector subsidising start-up companies: the customer approach. The public sector can set economically meaningful policy goals, which support sustainable development. As an example, the public sector can pursue restrictions on the increase of health care costs. Accordingly, a public sector financier should demand the same goals from the project that it subsidises; the public sector acts as a customer. Such behaviour would also steer the subsidised start-up company to consider the customer benefits. This requires the company to place special emphasis on pricing the product, and to communicate the cost-benefit ratio in measurable terms. The latter creates a basis for a solid valuation of the company. Thus, the public sector's role as a customer advances the accumulation of business attitude and competencies within the company.

5. Public sector financing biotechnology companies: the venture capital approach. The financing body of the public sector can provide

external market-based financing for the companies at a more matured stage. In order to avoid serious market disturbances, the finance terms should be comparable to those of a private venture capitalist. Conventional milestones are set according to the strategy of the biotechnology company. If the R&D activities and the commercialisation do not proceed according to set milestones, the governmental venture capitalist performs a sanction; the project can be cancelled, the related IPRs can be realised or the ownership of the company can be transferred to another party. The failure of a publicly funded project should, however, produce some spill-over effects to other commercialising organisations in society, as opposed to privately funded projects. In all cases it is imperative that both parties have a clear incentive to act as transparently as possible, with clearly defined upside and downside risks.

6. The creation of globally competitive clusters. The biotechnology sector would benefit from the formation of clusters built on domestically abundant but globally relatively scarce resources that are regionally identified as critical masses. These clusters should be based on:

- a. Unique factors of production
- b. A domestic market laboratory
- c. An internationally competitive supporting industry
- d. A clearly communicated and well exercised sequential strategy.

The public sector can, for a limited period, boost such parts of an industrial cluster that are identified as being critical elements for long-term economic growth. We identified four clusters. This is however not an exhaustive list, and the identified clusters are, for example, pending on legislation and preferences of the public sector.

The development of biotechnologies should not contain any intrinsic value *per se*. The commercial value of the biotechnology could be benchmarked with the value of alternative technologies; and consequently, biotechnology could become part of the technology options for companies active in established and conventional industries.

The efforts in Finland have created a strong domestic biotechnology industry base. In the following step the key issue is to capture highest possible value from the efforts expended. We hope that the tools and forecasting methods applied and developed in this book and the appended related articles, could build a justified pathway for further discussion and measures.

The developed tools could favourably be used in other high technology sectors at an infant commercialisation stage as well. To that end, the valuable experience gained from the creation of the Finnish biotechnol-

ogy industry could be utilised even more pro-actively when considering prospective technological leaps.

Nanotechnology has been described as the next paradigm shift in technology. Being both highly technological in nature as well as generic by definition, it bears clear resemblance with the expectations put on biotechnology 1-2 decades earlier. Consequently, it could be fruitful to extend the presented methods and analyses to the context of nanotechnologies. This should be done in the near future, while the sector is still in its infant stage, at present an estimated 15 years behind biotechnologies in terms of commercial applications. The presented strategic framework, based on international trade literature could provide a solid basis for innovation policy and business activity in the small and open Finnish economy – before dedicating to major investments.

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