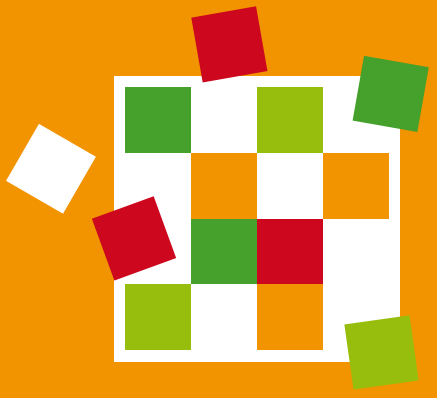
Partners in the polder

A vision for the life sciences in the Netherlands
and the role of public-private partnerships

Valorization

Authors

Koen Wiedhaup
Chrétien Herben, NGI, Valorisation Unit
Ingeborg Meijer, Technopolis



VIII Valorization

A. Introduction

Over the last decade, a lot of public and private money has been invested in research in the life sciences under the assumption that this will generate substantial economic and social benefits.

The life sciences offer technological solutions for many of the health and resource-based challenges that the world faces. Developments in the life sciences can help increase the supply and environmental sustainability of food, feed and fiber production, improve water quality, provide renewable energy, improve the health of animals and (ageing) people, and maintain biodiversity by detecting invasive species. However, the life sciences field is unlikely to fulfill its potential without appropriate regional, national and, in some cases, global policies to support its development and application of ensuing knowledge production.

The impact of life sciences research can already be illustrated with many examples, for instance better clinical treatments, less pressure on the environment, new business activities through spin-offs and the production of new products and services at existing companies. Several applications such as biopharmaceuticals, in vitro diagnostics, some types of genetically modified crops and enzymes are relatively "mature" technologies. On the other hand, there are many applications with limited commercial viability either due to absent supportive policies (e.g. bioplastics, some biofuels), or because they are still in the experimental stage, such as regenerative medicine and health therapies based on RNA interference.

Even though there is a solid scientific foundation for building a strong valorization track record, the Netherlands is still lagging behind in the valorization of life sciences research. This problem has been recognized by the Dutch government, and several important and rewarding initiatives have been taken in recent years. Examples are the BioPartner program (2000-2005), the Technopartner program, and the valorization activities of the Netherlands Genomics Initiative (NGI), the Foundation for Applied Sciences (STW) and Innovative Drug Research and Entrepreneurship in the Netherlands (STIGON; ZonMW).

While these initiatives are primarily directed at strengthening technology transfer out from our academic institutes, the need was felt to also stimulate a closer and more effective relationship between academia and industry and create an open innovation culture. Thus, in all important application sectors of the life sciences, public-private partnerships (PPPs) have been set up, covering a wide range of topics. Examples are the Center for Translational Molecular Medicine (CTMM), focusing on diagnosis and imaging of biomarkers in the health sector, the Top Institute Food and Nutrition, covering research issues in the field of food and health relevant for the food industry, and the Top Institute Green Genetics on research relevant for the plant cultivation industry. These initiatives provide opportunities for the strengthening of our valorization track record in the life sciences.

Government and stakeholders should be fully aware of the typical characteristics of innovation in the life sciences, such as the need for focus and mass to be able to compete internationally, requiring integration and coordination of activities. Another characteristic is the relatively long timespan it generally takes to fully develop a new idea into a marketable product (often more than ten years). Finally, many regulatory procedures may delay marketing approval

as well as the actual uptake and effective use of newly developed products.

The innovation programs that were set up by the Ministry of Economic Affairs aim to support the building of critical mass and to work towards an integrated approach to innovation in a particular sector. The life sciences are essential in three of these innovation programs: Food & Nutrition Delta, Life Sciences & Health and the "Innovatietraject Chemie" (innovation route chemistry), all sectors which are covered by this book. Two of these also coincide with the *Sleutelgebieden* (key areas) of the Innovation Platform: Flowers & Food and Chemicals.

In order to fully utilize our country's valorization potential, a stronger entrepreneurial climate at universities as well as in industry is mandatory and needs to be further stimulated and supported.

What is valorization?

The Dutch Innovation Platform defines valorization as "the process of value creation from knowledge by making it suitable and/or available for economic and/or social use by translating it into competitive products, services, processes or new commercial activities".

The process of creating added economic and social value out of research findings is a complex and iterative process: it does not happen spontaneously, but requires a set of dedicated activities relating to the objectives and human and financial resources.

Valorization is, however, not only the dissemination of research findings. It also includes (demand-driven, user-inspired) research programming, interaction with stakeholders during the research and (more indirectly) through network events and transfer to industry of researchers after having finished their degrees, the impact of which is often underestimated. However, ultimately valorization is the transformation of knowledge into concrete new products, services and processes.

Valorization can be realized through various processes in various institutional settings. We can distinguish between valorization processes that lead to new business opportunities of established firms and those that lead to the start of a new company. For the first type, public-private partnerships (PPPs) can be suitable instruments. PPPs are consortia of publically funded research organizations (universities and research institutes) and companies. Collaboration can vary from bilateral to large groups, from one location, to co-location, to even virtual. However, by definition they are collaborative, involve partnerships and deal with precompetitive research. A number of PPPs in the life sciences involve consortia of large and medium-sized companies and research organizations (see the chapters on the life sciences in specific application areas, and that on technology). However, these large settings are not always appropriate: bilateral consortia including only one research organization and one company may be preferred in specific cases to avoid forced partnerships.

Another aspect of valorization is that of technology transfer to companies that are not actively involved in R&D (and for that reason cannot be a partner in a PPP), but will use the results of public research for improvement of their products and production processes.

The universities and the university medical centers (for reasons of readability we will refer to universities and university medical centers in this chapter by "universities") have a central place in our vision, as they are important loci where valorization of research findings starts. Valorization also occurs at other publically-funded research institutes, for instance TNO and the large technological institutes (GTIs). Most of these institutes have committed to the valorization of their newly developed knowledge. While the universities are expected to consider knowledge transfer as one of their missions (in addition to research and education) adequate measures to firmly implement this mission in terms of valorization are still limited at most universities and, as a whole, in this respect, our country is still considerably behind other countries with which we have to compete.

FIGON recommends the Scottish Knowledge Transfer Grants
Recently FIGON, the Dutch Federation on the Innovation of Medicines, presented a series of recommendations to stimulate the creation of new drug companies out of academic research.

One of these recommendations emphasized the need to recognize valorization as a central mission, and consequently, as an unambiguous commitment of universities. To allow Technology Transfer Offices to function on a truly professional level, new money should be made available without requiring matching support from institutes. If not, it would be seen as competitive with core research and teaching activities, and affect academic motivation in terms of validation and commercialization.

FIGON recommended considering the Knowledge Transfer Grants (KTG) implemented by the Scottish Funding Council as a best practice to boost technology transfer.

The KTG have been allocated since 2001 and concern funding on top of what institutes already receive for teaching and research. Annual funding currently amounts to approximately EUR 22 m, of which around EUR 5 m is available for each of the two major Scottish universities of Glasgow and Edinburgh (size comparable to Leiden University, including LUMC). The success of the KTG system is illustrated by the fact that academic productivity in terms of patents, licenses, spin-offs, etc. is four times the average of the ten major universities in the USA and also substantially higher than the UK average.

Taking the Scottish model as a best practice for our country would imply that the Dutch government invest an additional 2-3% of current funding ("eerste en tweede geldstroom") available to the universities, corresponding to an overall EUR 100-150 m annually. While this amount is in line with the more recent recommendation of the Valorization Project Group of the Dutch Innovation Platform, it seems wise to analyze the conditions and the strict monitoring system under which the Scottish government is making this funding available.

Source: FIGON, *Creating New Drug Companies by Empowering Academic Research*, October 2007

It is for that reason that this chapter devotes much attention to the strengthening of technology transfer from academia, realizing that if the valorization process does not adequately function, it will hamper the successful utilization of new knowledge both in the creation of new companies and in PPPs.

This chapter introduces our vision of how valorization will become an integral activity of Dutch universities and other public research institutes by 2020 (section B). In order to draw conclusions and recommend actions that are necessary to reach the desired situation in 2020, we will first describe the current status. Section C presents our vision of what value creation in the life sciences entails, and, more specifically, how this varies among the most important application sectors: health, agriculture, food, and chemicals & energy. In section D, we discuss the barriers that hinder optimal technology transfer and exploitation in the life sciences in the Netherlands. The last section (E) summarizes our recommendations.

B. Valorization in the life sciences by 2020

In order to achieve the vision for 2020, several actions need to be taken to change the culture, to raise commitment and to improve and increase the necessary capacities and conditions. The first steps towards this goal are already in progress; further reinforcements are still necessary and will be presented in section E.

The universities

In our vision, by 2020, optimal exploitation of the results of life sciences research in the Netherlands has been realized through important changes. Our first focus is on the universities where changes in culture, commitment and capacities have taken place. The national government facilitated these changes by creating conditions for structural and long-term support of valorization.

Culture

By 2020, Dutch universities have:

- An excellent base in the life sciences;
- Courses in business development, IPR and marketing to create awareness of the utilization of research results as an integral part of their education/training programs;
- An incentive system that motivates and rewards entrepreneurial researchers;
- A culture that also values making and doing business.

Commitment

By 2020, Dutch universities have:

- High commitment for the valorization of research from people at all levels (executive boards of universities and academic medical centers, faculties departments, research groups);
- Technology Transfer Offices that fall directly under the responsibility of the Executive Board (illustrating this commitment), and striving for coherence with education and research;
- Researchers that exploit their findings through TTOs.

Capacities

By 2020, TTOs at Dutch universities have:

- The capacity for scouting and screening of ideas and knowledge on intellectual property;
- Professionals who are able to develop business concepts (set up a management team, perform market analysis, write a business plan, secure funding);
- Funds for studies to establish the feasibility of a new business concept or start-up company;
- A network of business people who are able to act as coaches for new companies;
- Professionals who are able to negotiate, secure and carry out knowledge transfer deals with new and existing companies;

> “Ideally, valorization in 2020 looks like this: organization with and around universities is on track, boards of governors realize that valorization is a core task and that they formulate an integrated strategy, providing seniority and expertise in the TTO. Old habits are avoided and TTOs are broadly supported, say, by involving CEOs from companies. ”
>
> **Edward van Wezel, Managing Partner Biogeneration Ventures**
>
> (Quote from telephone interview on June 9, 2009)

- Created an nationwide network of TTOs to exchange know-how and experiences, adopt best practices and pool resources and results whenever appropriate.

Conditions

By 2020, the following conditions have been met for realization of these goals:

- The national government has an explicit policy that universities are responsible for knowledge/technology transfer and exploitation;
- This policy is implemented through policy instruments and related budgets;
- The budget for valorization activities at universities and their TTO's is supplementary to the existing budgets for education and research;
- There are no matching requirements from universities for these budgets for valorization activities;
- This budget is conditional with set valorization targets (in terms of patents, licenses, new companies) that are monitored. Funding will be proportional to output delivered;
- Universities are closely working together in exchanging best practices in technology transfer and valorization, coordinating and pooling activities and expertise on a national level whenever appropriate;
- The above measures are in addition to a governmental policy to maintain an excellent and internationally competitive science and knowledge base at our academic institutes.

The open innovation structure; public-private partnerships

Well functioning TTOs are a prerequisite for both the creation of new start-ups as well as for the establishment of effective collaborations with existing industries. In the Netherlands, the creation of PPPs in a number of specific fields, financially supported by the government, are considered crucial for the development of an open innovation structure by 2020.

Culture

By 2020, open innovation is flourishing because:

- Cooperation between academia and industry is standard in all fields of life sciences;
- Industry and other social stakeholders are able to articulate demand; universities are keen providers of knowledge, technologies and concepts for application by industry;
- Bioregion Netherlands (www.lifesciences.nl) – consisting of regional and countrywide networks and clusters – is accessible to international industry and attracts new businesses.

Conditions

By 2020, the following conditions have been met for realization of this culture:

- Universities and industry consider an entrepreneurial climate as one of their greatest assets;
- Government and stakeholders are aware of the need to focus on excellence and competitiveness within the context of the existing PPPs;
- Sustainable and structural policies are implemented by the government, ensuring full development of new products, services and technologies by newly started SMEs as well as within the context of PPPs;
- Regulatory procedures and measures delaying economic or social use of new innovations have been alleviated;
- An active policy for attracting foreign companies and keeping Dutch companies in the Netherlands (taxes incentives, facilities, free regulation) has been developed;
- The government has developed an explicit public procurement policy (launching customer) similar to the SBIR regulations in the USA;
- The national and regional governments promote the Netherlands as one of the top bioregions in the world in terms of knowledge, partnerships, fiscal advantages, investment climate, geographical location, etc.

C. The Process of valorization in the life sciences

Value creation chain

In our vision, the chain of value creation ranges from awareness to economic and social added value. We reemphasize that valorization is an iterative, non-linear process. This means that valorization is not only transferring knowledge from a university into a new company or new business of established companies, but it also includes (demand-driven, user-inspired) research programming, and interaction with potential users during the research. Here, we will focus on the transfer of research findings into concrete new products, services and processes. These value creation chains consist of eight discrete stages of valorization (see box: "The eight stages of valorization").

The eight stages of valorization

1. **Awareness of utilization.** A continuous awareness of the utilization of research results is required. Rewarding systems (in terms of academic career, but also financially), should also consider excellence in terms of potential benefit for society, and not only in terms of benefit for scientific progress
2. **Scientific creation.** This stage leads to results that are novel and patentable and which are "user-inspired". Excellent and front-line science is the first condition, but needs to be supported with a stimulating environment, excellent facilities and strategic thinking by the university sector
3. **Feasibility.** This stage confirms the potential business viability of the project. This leads to research results that are protected by patents and that have the potential to mature into a project in a PPP or into a product or company
4. **Validation.** This stage leads to the creation of a business plan or a well-defined project. Stimulating and facilitating (potential) start-up companies by financing applied follow-up research and the development of a solid business plan that will attract a team and investors. Resulting in inventions that have proven to be commercially viable, either as a license or as a spin-off
5. **Valorization studies.** These lead to proof of concept results. Once proof of concept is demonstrated, financial and coaching support is necessary in order for it to mature into sustainable business, leading to successful exploitation of knowledge
6. **Commercialization phase I.** Once a project has reached the commercialization phase I (or is well on its way towards that phase), further development will generally be funded by additional PPP funding, private money (equity or debt), via licensing out to another company, a buy-out or by going for an IPO
7. **Commercialization phase II.** This stage includes all large-scale activities needed for introducing the product to the market (e.g. clinical trails, field trails, manufacturing processes, demonstration plants)
8. **Market introduction.** Approval for marketing and reimbursement of costs (in case of diagnostics, medicines, etc.) are subject to governmental regulations and measures that may delay access to the market. Increasing requirements may be costly and can considerably delay introduction

> “Successful innovation requires that the entire value chain be adapted, and that you strive towards simultaneous and iterative processes: then you'll have much more chance of impact. Innovation success is characterized, for example, by the involvement of people in business development from early on. This way, goals and activities can be much better defined. TTIs can play a role in this. ”
>
> **Emmo Meijer, Senior Vice President of Global Foods R&D, Unilever**
>
> (Quote from telephone interview on June 15, 2009)

Characteristics of valorization in the life sciences

There are a number of characteristics that apply specifically to the life sciences, and which influence the value creation process in this field considerably.

- Time > Long-term developments. For most life sciences innovations, the R&D trajectory and valorization process take more than 10 years, going up to 15 years, such as for new polymers, many food products, pharmaceutical entities, enzymes for industrial processes in downstream sectors and for biofuel production;
- Risk > Risk profiles are very high because of the high failure rates of development. For example, it is estimated that 1 in 5,000-10,000 substances become a marketable medicine;
- Money > The R&D trajectory is expensive due to the cost of field trials for new plant varieties, (pre)clinical trials, the amount of resources to get approval from regulatory authorities, etc. Thus, substantial cash flow is required;
- Regulation > Extensive regulatory requirements to protect consumers exist. The ICH, FDA, EMEA and the GMO, and novel food regulatory guidelines, are becoming more and more complex, especially for the health and food sector;
- Governmental measures that delay uptake in the market (e.g. cost containment in health).

Therefore, the lifecycle of life sciences products is much longer than that compared to, for instance, ICT innovations. This affects return on investment for capital investment providers, who are very aware of the risks and usually choose to be on the safe side. As a result, the only certificate of value during this long and expensive process is the IP that protects findings, and which can be sold to the next investor or company in case of a takeover.

Globalization

In the life sciences sectors globalization is important in two ways:

- As the market of the life sciences is worldwide, multinational companies operate globally, and this holds for acquiring knowledge as well. Multinationals are shopping around for the knowledge they need. As a result, they will benefit from investments in the life sciences and the strong knowledge base that has been built in the Netherlands. For the Dutch economy to profit as much as possible from this, a strong industrial base needs to be present. At the moment this is the case for the agriculture, food and chemicals & energy sectors and the medical equipment sector (that integrates life sciences); in the pharmaceutical sector this industrial base is smaller but growing in size and number of (small) companies.

Agendia's MammaPrint

Established in 2003, Agendia is a company that is pioneering the development and commercialization of validated tests that assist healthcare professionals and pharmaceutical companies in determining the diagnosis, prognosis and therapeutic responsiveness of cancers in individual patients.

In 2004, Agendia became the first company to commercialize a test (DNA chip) that predicts the risk of breast cancer recurrence (MammaPrint). In 2007, MammaPrint became the first in-vitro Diagnostic Multivariate Index Assay (IVDMIA) to acquire clearance from the US Food and Drug Administration (FDA). On the basis of Mammaprint analyses, about one-third of breast cancer patients on average can be treated without chemotherapy and its heavy side effects. The potential market for this DNA chip is very large, as about 200,000 women in the USA and Europe are potential breast cancer patients can benefit from MammaPrint test results.

Market introduction of the Agendia test depends on the validation and acceptance of its tests. In the USA, approval for market introduction by the FDA is sufficient. In the Netherlands however, market approval does not necessarily mean that health insurance companies reimburse the cost of the test. Here, every new, FDA or EMEA approved test or drug must be judged by the Health Care Insurance Board on its cost-benefit profile in order to be included in the basic (health insurance) package and subsequent coverage of the cost of the test. For companies, this last step (or barrier) is important for making any profit on a new product.

For MammaPrint, the decision of the Health Care Insurance Board is still in progress, and thus health insurance companies generally do not reimburse it. This is why at the moment there is a limited use of this prognostic test even though doctors are increasingly convinced of the benefits of MammaPrint.

While many have claimed Agendia's success, it now lacks the support from all those who were so eager to share in its success. According to Bastiaan van der Baan, Vice President of Commercial Applications at Agendia: "The Agendia test is rather new and it costs very much time to inform and convince all parties involved: the Ministries of Public Health and Economic Affairs, the Dutch Healthcare Authority and the Health Care Insurance Board".

Source: *'Bedankbriefjes als beloning' Interview with Bastiaan van der Baan*, C2W Life Sciences vol. 9, May 2, 2009

- Foreign investment or establishment of R&D sites in the Netherlands. The market environment is important for keeping Dutch companies in the Netherlands, and for attracting foreign companies to do research in the Netherlands. Therefore, the generic tax and investment climate is a parameter for valorization that needs attention as well, in order to be able to translate our investments in research into economic and social added value.

It should be noted that an up-to-date global vision is mandatory at all times in terms of policymaking, since most other European countries and the USA realize the importance and potential impact of the life sciences as well. In the spring of 2009, the UK established the Office of Life Sciences, led by the Minister for Science and Innovation, in order to support the UK's life sciences industry as a major growth industry and to help ensure the UK's place as a global leader. Similarly, France and Switzerland have recently expressed interest in reinforcing the life sciences. These developments show that a country has to act aggressively in order to stay ahead of competitors, and needs to have the ambition to become or remain one of the top bioregions in the world.

Government ambitions for the life sciences in France and the United Kingdom

President Sarkozy
I undertake today to ensure that the healthcare industries become a major focus of France's competitiveness. Given the increasing complexity of therapeutic innovation, greater cooperation is needed between publicly and privately funded research. We achieved this in the aerospace and the civilian nuclear sectors. Why not do the same thing in the pharmaceutical industry?

Source: Speech to the heads of R&D of the International Pharmaceutical Research Laboratories, Paris, June 5, 2009

Andy Burnham, UK Secretary of State for Health and Lord Mandelson, UK Secretary of State for Business, Innovation and Skills
We need to do more to ensure that the UK continues to offer an attractive environment for the life sciences companies to do business. The Government has a crucial role to play, helping to remove the barriers that prevent the UK from making the most of its strengths.

Source: Foreword, *Life Sciences Blueprint, Building Britain's Future*, July 2009

Differences in the value creation chain in the health, agro-food and chemicals & energy sectors
The life sciences field finds its applications in many industrial sectors. The most important are health, agriculture, food and chemicals & energy; in Europe also referred to as the red (health), green (agriculture and food; or agro-food, as in this chapter the two are discuss together) and white (chemicals & energy) biotechnology sectors. In other chapters of this book, these sectors are discussed in more detail. The innovation processes in these sectors show large differences with respect to R&D intensity, the way product regulation affects the innovation process, the types of stakeholders that are involved, the Dutch industrial presence, etc. This also applies to the valorization chains in the different sectors. They are rather similar in the first five stages, but show the largest differences from the commercialization phase onwards (stage 5-8). Differences that affect valorization are discussed below.

The health sector
The health sector comprises both pharmaceutical companies and those in medical equipment that increasingly integrate biotech-based sensors and diagnostics within their products. A number of PPPs operate in this field including the three Leading Technology Institutes (TTIs) CTMM, Top Institute Pharma (TI Pharma) and the Biomedical Materials Program (BMM) – focusing on diagnosis and imaging of biomarkers; on drug discovery and development; and on devices building upon biomaterials, respectively. Furthermore, enabling technology and infrastructure partnerships have been initiated to support innovation in and outside PPPs such as the technology centers of the NGI and "Parelsnoer", a national biobanking partnership between the eight UMCs. In the spring of 2008, the innovation program Life Sciences & Health (LSH) started. It aims to enhance the innovation and investment climate in the sector for SMEs and for the value creation of knowledge that results from PPPs and academia.

In the health sector many aspects of the life sciences are converging with medical technology. In this book the focus is primarily on life sciences, and does not address medical technology in its broadest sense. In this section we therefore

pay particular attention to the pharmaceutical part of the sector. It should be noted, however, that in the Netherlands a range of very relevant medical technological developments are taking place with a huge valorization potential. Examples of these developments are given elsewhere in this book.

The health sector is very knowledge-intensive in all stages of valorization. Excellent research is needed to fill the pipeline, but subsequently excellent technology transfer is the basis of start-up companies and of collaborations with industry, including both SMEs and large pharmaceutical companies. Taking new pharmaceutical entities from a university spin-off through a biotech company phase up to takeover by a large company includes several distinct – capital-intensive – steps.

In order to create value from research to proof of concept and ultimately to the market, large amounts of funding are required. In the first stages of valorization, these funds are provided for by governmental pre-seed and seed facilities. The next phases of development require appreciable amounts of venture capital from different sources.

The commercialization phases are very expensive due to complex international regulations that have to be complied with in order to register a new product. It is difficult to maintain cash flows in fluctuating financial markets, but more funding may come from multinational pharmaceutical companies that are increasingly concentrating on the last phases of product development (clinical research, production, marketing). This, in turn, leads to more and more outsourcing (e.g. through strategic alliances with start-up and biotech companies, and academia to guarantee access to knowledge). As a result, the scale of precompetitive research and open innovation at academic medical centers may increase.

The innovation program Life Sciences and Health offers support to SMEs facing high risks in these commercialization phases. These companies can apply for so-called Innovation Credits and may also be eligible for financial support when partnering on an international scale.

Continuous support of life sciences research in the health domain should be prioritized on the basis of excellence and social demand. Society's expectations of new therapies, diagnostics, prevention and care are high. However, the final stage of valorization, the uptake and use of innovative products and services in healthcare, is heavily regulated as well. Reimbursement of innovative products is often granted on the basis of various regulations and may take another year or two after registration, thus hampering the overall process of innovation and valorization in the life sciences for health in many cases.

> "The Pharma industry is transitioning into a new business model in which the early phase of the R&D path is becoming increasingly outsourced. In the public domain, increase of scale and free exchange of precompetitive research are easier. This creates plenty of possibilities for universities and university medical centers."
>
> **Maarten le Clercq, Member of the Board of Directors of Leiden University Medical Center**
>
> (Quote from telephone interview on August 18, 2009)

The agro-food sector

The agro-food sector in the Netherlands is dominated by a strong innovative, R&D-driven industrial capacity in several domains: seed, food, food processing and health-related products. Long-standing relations between Wageningen University and large companies like Unilever and DSM have resulted in one of the first PPPs in the Netherlands: the TI Food and Nutrition. This TTI has been able to bridge the gap between basic research and applied research by creating a common research agenda, carrying out a roadmap to define individual strengths, establishing strong ties between industry and academia, conducting research through consortium agreements, and making use of a program-based collaboration rather than a project-based approach.

The PPPs in the agro-food sector have undoubtedly resulted in the creation of new value chains and of business models where supply and demand collaborate. Parallel innovation processes, where all stakeholders are involved in all stages of valorization, are the new paradigm. Companies active in biotechnology in this sector are mostly large and medium-sized companies. Compared to the health sector, there are less small and medium-sized high biotech companies operating in this sector. For SMEs in the agro-food sector that are less knowledge-intensive and innovative, it is less straightforward to have them benefiting from knowledge transfer.

Several issues in the agro-food sector are worth mentioning here. Introduction of new nutritional ingredients in the market is increasingly hampered by stricter regulations on claim substantiation (e.g. cholesterol reduction, blood pressure lowering, weight management), resulting in expensive and time-consuming clinical studies.

Another, major social issue in agriculture is that of GMO plants. Although Dutch food crops breeding companies have moved most of their GMO activities including field trials outside of Europe (except for Spain), this issue also led to the development of alternative breeding techniques such as cisgenese. The major issue in food is the discussion on health food, and the amount of research that is necessary to substantiate a health claim.

In terms of increasing valorization, more focus and delineation in much smaller and sharply defined themes that line up with industries' interests are expected to occur. Since the economic impact is strong in this area, rebalancing of scarce governmental funding is to be discussed.

The chemicals & energy sector

Only a few firms in the Dutch chemicals & energy sector apply bioprocessing. Most of them participate in the PPPs in this field. The positive contributions of bioprocesses that replace chemical processes, and the use of biomass replacing fossil fuels as raw material in this sector lead to more sustainable production processes in the chemicals & energy sector. The Kluyver Centre for Genomics of Industrial Fermentation is an example of how valorization in a PPP in this sector is being managed. In this PPP, participating companies have direct, confidential access to the results of the research activities in the Centre that are performed by academia and financed by the NGI, and companies are allowed to pre-screen research proposals of these projects. This enables companies to rapidly identify research output for valorization. In addition, individual companies can participate in tailormade projects, mostly bilateral collaborations, in which they receive adequate intellectual property protection (Part I, box on page 55).

Patents are important carriers for transferring research findings of university groups to companies. They are used to protect the large investments that are necessary to develop new chemicals or new product processes. There are no differences between the legal requirements to obtain a

“ **Hidden value**

Reliable DNA diagnostics for about 2000 rare diseases have been developed, even while in many cases no sufficient therapy exists. The social value of the diagnosis is tremendously undervalued. The 50,000 DNA tests performed annually provide relief in 80% of the cases. Including the family members that would have had the same genetic disorder, this annually reliefs about 150,000 people, setting them free to enjoy the rest of their lives. Underestimation of valorization potential also holds for therapies for rare diseases. Because of the very well-defined patient population, these therapies and the information/models obtained during their development often play a major role in developing therapies for common diseases. ”

Gert-Jan van Ommen, Head of Human Genetics at LUMC, leader of the Center for Medical Systems Biology (CMSB) and first winner NGI Valorisation Award

patent for an invention in the chemicals or pharmaceuticals fields. Yet chemical patents are different because they can include generic structures (structure of the chemical group the patented chemical belongs to); these are used to make the patent claim as broad as possible.

In addition, an important stage in valorization with the chemicals & energy industry is the development of large-scale production processes for these new chemical entities (commercialization stage). These development processes are very expensive: it is for these reasons that tests are being done on a smaller scale, including the development and testing of the production processes on a pilot scale (100 kg to 10 tons of product per day) and demonstration scale (up to hundreds of tons of product per day).

Except for issues specific to the life sciences, in this sector other aspects also play an important role in the valorization chain, such as certification of biomass, logistics, futures and international trade agreements. Environmental regulations, especially those focused on reducing greenhouse gases, are a driving factor behind innovation in this sector.

D. Barriers to successful valorization in the life sciences

Stage 1, Awareness of utilization
Although business development courses are offered to young scientists in the life sciences at a number of universities, scientists in the Netherlands are still only vaguely aware of the users' value of their research, and more specifically, of the commercial or social value of potential applications of their findings. The culture within most universities is dominated by norms and values that relate to performing high quality research and education. In addition, there is too little awareness of the specific expertise that is needed to create value out of research.

Stage 2, Scientific creation: Third mission
Although many universities and other public research organizations (academic hospitals, research institutes) have institutionalized valorization support activities, there is still little commitment to valorization at the strategic level of these organizations. Missions of most universities are

The success of K.U. Leuven Research & Development (LRD)
K.U. Leuven has become well-known for its approach to valorization and knowledge transfer. Within the university, a separate entity, K.U. Leuven Research & Development (LRD), has the specific mission to promote and support the transfer of knowledge and technology between the university and the industry. In order to do this, LRD offers professional advice with regard to legal, technical and business-related issues. The activities of LRD include contract research, IP management, the establishment of new research-oriented and innovative spin-off companies, access to venture capital, and the promotion of high-tech entrepreneurship and innovation by stimulating networking initiatives.

The main elements of the success of LRD are:

- A long-term commitment: over a period of more than 30 years, researchers and staff have become familiar with industrial innovation and have learned the pros and cons of academic entrepreneurship;
- A decentralized management style: to give researchers and research groups sufficient freedom on the one hand, but stimulate them to compete for innovation in the market on the other;
- The introduction of an interdisciplinary matrix structure within the university: in this matrix structure, research excellence prevails along one line, while valorization excellence is rewarded along another line;
- The introduction of innovation coordinators: to ensure close contact between LRD and the research groups;
- The appropriate mix of incentive mechanisms, targeted to the research groups and to the individual researchers;
- Budgetary and human resource management autonomy within the university: LRD divisions have the autonomy to balance revenue and expenses.

Source: Koenraad Debackere and Reinhilde Veugelers, *The Role of Academic Technology Transfer Organizations in Improving Industry Science Links*, Research Policy vol. 32, 321-342 (2005)

formulated in terms of research and education, but not in terms of valorization. Adding to this, reward systems only address research excellence or teaching qualities but do not reward entrepreneurship. Universities and research organizations need clear objectives as to what they want to achieve within the context of their "third mission", which activities and instruments are needed to support the objectives, and a proper monitoring and evaluation system that addresses the third mission as well.

Stages 3/4, Feasibility and validation: Quality of TTOs questionable and patents under pressure

In most universities, Technology Transfer Offices (TTOs) have only recently come into existence. In the first years, they were staffed primarily with officials and were not very integrated into the university/academic medical center organizations. There is still a long way to go before they are staffed with professionals who have a sound relationship with the scientists, and an extensive network with industry, lawyers who have specialized knowledge of patenting and licensing, business developers who are able to write plans for new companies and to negotiate, secure and carry out deals with existing companies, have knowledge of specific markets and who have realistic expectations about the financial returns of their activities. Collaboration and exchange of best practices between TTOs should be stimulated, leading to a network and to pooling of information on patents, etc., whenever required. Such a network could also be instrumental in positioning our country as an attractive bioregion.

At a more general level, there are increasing problems with the patenting system. As mentioned above, patents play a central role as they capture the stock of potential returns on the investments made in science and in the activities to valorize them. However, the patenting system is under pressure as it has been driven away from its original goals: open access to "protected finding" and commercialization of findings.

Deadly sins

- Think your TTO does not need objectives
- Think your TTO will generate loads of money
- Think your TTO will break even in less than 5 years
- Think your TTO can be staffed with "lost" administrators
- Think it's all about money
- Think it is not about money
- Think your patents don't need marketing
- Think no one will notice the scary increase in patent costs
- Think you don't need a lawyer for your agreements
- Think a lawyer will handle the deals

Source: Rudy Dekeyser, *Thinking start-ups grow on trees*, VIB, Belgium (2008/9)

The number of patent applications, especially in biotechnology, has increased considerably over recent years to more than 200,000. This overload of applications has posed enormous problems for patenting bureaus, and one effect has been that they have become less critical and have granted most patents. This also affects the TTOs, since patenting and the marketing of patents are their main activities: when a new finding has to be patented, it takes considerable effort to get an overview of relevant patents and to find out if there is an infringement. In the USA, the market is even more assertive against infringement and in litigation. International organizations have identified the problems with the patenting system and are discussing how to deal with them.

Stage 5, Valorization studies : Lack of expertise

In the life sciences, professionals who know how to create value are scarce. Of course, this has to do with limited entrepreneurial awareness. But there are also a limited number of serial entrepreneurs who have practical experience in biotechnology, and know how to deal with the

Progentix Orthobiology

Progentix Orthobiology B.V. is an example of a successful spin-off company. Progentix was established as a spin-off from Twente University in 2008 by former Isotis founder Clemens van Blitterwijk and Joost de Bruijn, former CSO of Isotis. Progentix develops CuriOs (TM), a unique osteoinductive material for clinical application in bone regenerative surgery. The Progentix product portfolio currently consists of a novel family of calcium phosphate synthetic bone substitutes attracting stem cells after implantation.

Progentix Orthobiology obtained financing from BioGeneration Ventures in early 2008, allowing the accelerated development of its technology. Only a year later, it closed an investment agreement with NuVasive (USD 10 m upfront payment), a medical device company from San Diego (USA) which focuses on developing products for minimally invasive surgical treatments of the spine. Under the terms of the agreement, NuVasive will gain access to Progentix's synthetic bone substitutes designed to accelerate bone healing through a novel microstructure created by a proprietary manufacturing process. In addition, NuVasive obtained exclusive worldwide distribution rights and an exclusive option to purchase Progentix entirely under certain circumstances (USD 70 m milestone payments).

NuVasive's initial commitment allows Progentix not only to grow in the spine market, but also to continue developing its unique family of bone graft materials, and makes the near term commercialization of these products possible. Or in other words, in course of a couple of years, Progentix has developed into a global player and has secured investments as a firm base for future innovation.

Source: www.progentix.com

capital needs and regulatory requirements. Similarly, if transfer to large companies is the objective, proper legal, business and marketing expertise is needed. Thus, if valorization is a true goal, a critical mass of TTO staff is needed, including professionals who understand both business and research, speak their languages, and know their habits and needs. The actual size of staff of several Dutch university TTOs is still far below the required critical mass and desired quality. Within the context of a PPP, industrial partner(s) can provide essential input on market need and business experience.

Stage 6/7, Commercialization stages

An issue related to the commercialization stages in a more general way has to do with the Dutch start-ups' insufficient ability to grow. Only a few reach substantial size or grow into a mature firm; others have chosen for an exit strategy such as merging with or selling themselves to another company in the business. This is mainly due to the absence of long-term consistency in the set of instruments needed to support start-up growth. Various reasons account for this, varying from lack of experienced management able to run a larger company, insufficient focus on the business goals, to lack of funding required to perform relatively costly proof of concept studies.

Small budgets for valorization

One cannot expect valorization to happen by itself: when the objective is to create added economic and social value, specific activities relating to the objective need to be in place. The Netherlands is seriously lagging behind in measures to stimulate the separate valorization stages in the value creation chain. The first phase of NGI (2003-2008) has shown that a separate set of well-balanced instruments is needed in order to stimulate valorization; a number of them were created recently and are now operational. STW also has the mission to stimulate the utilization of research results, and has developed instruments. Yet, compared to the amount of funding that is spent to maintain the excellent, precompetitive knowledge base through PPPs and other programs (currently ~EUR 400 m/year for the life sciences, of which ~50% is matching funds, excluding direct funding from the Ministry of Education, Culture and Sciences, and NWO and STW programs and projects), public funding for the distinct valorization stages is rather limited (see Table 1).

Success and failure factors of academic life sciences spin-offs

Arthur Tolsma studied the results of the BioPartner First Stage Grant and STIGON programs. He made a detailed analysis of all 89 spin-offs that were supported by the two programs in the period 2000-2007 in order to answer the following question: What are the experienced determinants of success and failure of academic life sciences spin-offs within these two programs?

His main conclusion was that various factors determine success and failure. Attracting an external CEO, preferably with experience in the industry and as an entrepreneur, was the most decisive factor for successful spin-off creation. Two other very distinctive factors were commercial quality and focus on business development of the spin-off team.

Explaining these significant findings, Tolsma pointed to several potential benefits of an external CEO compared to the inventor/scientist as CEO. First, the external CEO will bring the needed business focus. Second, he or she brings valuable entrepreneurial skills into the team and, as a consequence, this may increase the value of the firm, which in turn increases the chances of attracting investor capital. Finally, the CEO brings in dedication and commitment to commercialize the scientific invention. Compared to hiring a consultant to write the business plan, or as an interim manager, a CEO with shares in the firm has a strong incentive to make the firm economically successful.

Source: A. D. Tolsma, Success and failure factors of academic life sciences spin-off creation, MSc Research Graduation Report, TU Delft (2009)

Table 1: Instruments for creating knowledge and valorization

Stage of valorization	Instrument examples	Approximate budgets per year (2009)
Awareness	Master class Biobusiness Entrepreneurial Skills Business Course Technopartner SKE** Centers of Entrepreneurship**	EUR 200 k EUR 50 k EUR 1.75 m EUR 1.25 m Total: EUR 3.25 m
Scientific creation*	PPPs in LS	Total EUR 400 m***
Feasibility	NGI Venture challenge NGI Valorisation Award Valorization in NGI Centres Technopartner SKE**	EUR 300 k EUR 1 m EUR 3 m EUR 2 m Total: EUR 6.3 m
Validation & Valorization studies	Pre-seed grant (NGI, ZonMw, LSH) STW Valorisation Grant** ZonMW translational programs	EUR 2 m EUR 0.5 m EUR 2.5 m Total: EUR 5 m
Commercialization I	BioGeneration Ventures Technopartner LS seed funds	EUR 1.5 m EUR 5 m Total: EUR 6.5 m

* Valorization is a small aspect in most PPPs; the main activity financed is research
** These instruments are not life sciences specific; estimation is made of the life sciences contribution
*** The number is estimated using data from PPP websites and the Ministry of Economic Affairs, and includes government, academia and industry contribution

In addition, these budgets are temporary; for instance, the NGI budget for valorization (EUR 32.5 m) is currently one-third of the total available for valorization, and will only be available until 2012.

Overall, we can conclude that valorization of the life sciences in the Netherlands comes against a number of serious barriers. Although the awareness of the importance of valorization issues of policy makers within public research organizations and at the national level has increased in recent years, considerable actions have to be developed in order to overcome the innovation paradox (good in science, not good in valorization). We have excellent research in the life sciences; the next step is to have successful business in this field.

NGI Valorisation: an integrated approach to valorization in the life sciences

NGI is striving to implement the necessary measures to ensure successful valorization of the research results obtained in its 16 research centers, and to boost the valorization in the life sciences sector in general. The NGI Valorisation strategy is implemented along three major action lines:

NGI Genomics Centres

Each of the NGI Genomics Centres has its own budget for valorization accompanied by a set of valorization targets. To further stimulate the NGI Genomics Centres, NGI annually awards a EUR 1 m Valorisation Award to the NGI Genomics Centre that has performed best in terms of valorization.

NGI Valorisation Network

Strong and effective TTOs lie at the heart of successful valorization. NGI therefore brought all life sciences TTOs together in the NGI Valorisation Network to exchange "best practices" and strengthen the profession. NGI also supports the TTOs by offering low-cost access to valorization/licensing and business development courses/trainings and workshops, and organizing visits to foreign TTOs and valorization events.

NGI Start-up Support

NGI has set up a coherent set of activities to support the successful start-up of life sciences companies. The NGI Start-up Support includes the NGI Venture Challenge (a coaching program to help potential entrepreneurs build their business case) and the NGI Pre-seed Grant (a grant for technological and commercial development resulting in a solid business plan). NGI also provides seed funding to early stage life sciences companies through BioGeneration Ventures, sponsors the Masterclass BioBusiness, and supports network activities for young entrepreneurs through partnerships with Yels.Net and New Venture.

A prestigious international Valorisation Advisory Board has been installed to provide NGI with the necessary advice and steering and to act as the jury for the annual NGI Valorisation Award.

E. Valorization 2020: What needs to be done

A starting point for formulating our recommendations was the "Nederlandse Valorisatie Agenda" of the Innovation Platform, published in May 2009 by the Committee of Marco Waas. Our recommendations are mostly in line with those of this committee, but of course more specifically directed towards the life sciences.

The first part of our recommendations relates to valorization at universities (phases 1, 2 and 3 of the eight stages of valorization) and the validation and valorization studies leading to proof of concept (phases 3 and 4 of the eight stages of valorization) following the spinning-out of a new venture.

In addition, we present recommendations on how to strengthen the relationship between universities with established firms in valorization (e.g. within the context of a PPP). Finally, recommendations are presented on how additional national policies can help realize the vision set out in this chapter.

Professional valorization support at universities and university medical centers

In order to increase both the quality and the size of valorization activities at universities, the following actions need to be taken on the level of organizational strategy, culture and financial and human resources.

1. **In addition to research and teaching, valorization should be recognized as the third mission, and consequently, as an unambiguous commitment of universities.**
   More specifically, an integrated policy approach by each university and UMC should be developed that includes all university actors involved in valorization, varying from the executive board to the individual research groups, working towards a mutual goal with commitment from people at all relevant levels.
   We recommend implementation by:
   - Developing a valorization perspective for the long term and commitment at all levels, which means thinking in terms of ten years ahead and even further;
   - Defining strategic goals at each level, documenting them in contracts between the board and faculties (in performance target agreements), and communicating these in valorization plans for university, faculty departments and research groups;
   - Implementing this strategy at an operational level in quality assurance plans and the planning and control cycle as well, and using a set of indicators for monitoring purposes.

2. **Valorization should be adequately funded through new money, not requiring matching support from the university.**

> "In the end I would like to move towards the Scottish model; universities there have reserved 2.5% of the budget received from the government for the execution of valorization activities. And they are also judged on their results."
>
> **Marco Waas, Dean at TU Delft, Project Leader Valorization Innovation Platform**
>
> (Quote from interview on June 26, 2009)

In line with the recommendations of the Committee Waas (and the FIGON recommendation based on a best practice realized in Scotland, see page 222), the investments in a valorization infrastructure in universities over the next five years should constitute 2.5% of the public funding of the universities ("eerste en tweede geldstroom"). This budget is additional and structural and should thus not be competitive with existing budgets for research and education (this budget is estimated to be around EUR 100-150 m annually) Of course, it should be clear that this budget should be available for all valorization activities, not only for the life sciences.

- These extra funds are needed for:
  - Professionalizing the Technology Transfer Offices;
  - Implementation of stimulating measures such as the NGI Venture Challenges and Valorisation Awards;
  - Funding of feasibility studies and other activities needed to establish viability of project or business model.
- After several years, the amount of funding for each university will be based on metrics related to performance reported on an annual basis (e.g. disclosure interviews, patents applied or filed, technologies licensed, royalties generated, collaborations started, companies formed).

3. Universities should reinforce their TTOs by investing in skilful valorization professionals, seasoned in business development, IP and other legal affairs.

Our concrete recommendations are to:

- Attract and train people who have knowledge of R&D and business experience. They need to be bilingual (i.e. understand both the market and academia);
- Create appropriate compensation for highly skilled people in the TTO: adjustment of the salary scales is needed to ensure that wages are competitive with those in the business world;
- Invest in people who have market intelligence, and dedicate a budget for market research;
- Involve scouts at the research group level and other more generic support services at a central university level;
- Invest in people with management skills for establishment and growth of start-ups (professional managers);
- Invest in specialized support staff (IP, licensing, financial-administrative support);
- Coordinate all of these among universities to ensure exchange of best practices, strengthen the profession and create a nationwide valorization network.

4. Universities should develop an entrepreneurial culture with a high level of awareness of utilization of research.

Measures to be taken are:

- Employment of financial incentives for researchers, for instance by rewarding their valorization activities in terms of added funding. Additionally: create incentives that reward them professionally;
- Embedding entrepreneurship in the education system by including it as a permanent part of the curriculum;
- Marketing good examples of valorization (brochures for the broad public) and invite good role models to the university.

5. Additional breeding ground for (open) innovation and facilitating the start-up of new companies should be realized.

Our concrete recommendations are to:

- Stimulate and expand initiatives such as Health Valley Nijmegen/Wageningen/Twente, and life sciences parks/campuses as breeding grounds and drivers of open innovation by creating investment funds initiated by universities and local and regional government;
- Develop a dedicated policy for marketing of life sciences parks/campuses with the aim to attract new (R&D) companies to the site;

- Attract professional management for establishment and expansion of life sciences parks. This should ensure the attractiveness of the life sciences parks in terms of facilities and sufficient support (in ICT, management, etc.);
- Provide a meeting place for those located at the life sciences park for exchange of experience and best practices in valorization, organization of mutual activities, and for training;
- Ensure integration of these local hot spots of valorization activities into the Dutch bioregion concept.

From university to proof of concept

Sufficient professional and financial support should be available to ensure that following its exit from university, the start-up will be able to successfully bridge the "equity gap" and develop into a venture that is sufficiently robust and attractive to private money, either from venture funds or through collaboration with existing companies.

We recommend:

- Continuation and reinforcement of sufficient pre-seed funding, in line with the successful examples of the previous BioPartner Program and the current NGI/LSH Pre-seed Fund and Technopartner Seed fund;
- Continuation of early stage seed funds such as BioGeneration Ventures;
- Continuation of credit facilities as initiated by the LSH program;
- Establishment of a network of experienced entrepreneurs able and willing to assist or strengthen management teams in terms of business development, financial/fiscal aspects or commercialization.

Development of long-term strategic relationships between universities and industry

These recommendations address the development of strategic relationships of universities with companies and stakeholders in society (including government departments).

Recommendations are:

1. **Development of a strategic research agenda by each university together with large companies and relevant public authorities.**

   Our concrete recommendations are to:

   - Ensure that in the selection of themes, priority setting is based on excellent research quality and valorization opportunities (focusing on "user-inspired fundamental research"). These themes should be specifically aimed at social and economic benefits;

"In the Netherlands, government subsidies are uncoordinated and complex. My biggest criticism of Dutch (valorization) instruments is that every arrangement has a short lifespan. STIPt, BTS, Biopartner, everything that once was has already disappeared. For 16 years, Flanders has had an instrument to help companies get through the first phase, which is linked to the growth of employment in Flanders. If you do not grow, it becomes increasingly harder to get subsidies as a company."

Onno van de Stolpe, CEO Galapagos

(Quote from interview on June 11, 2009)

Instrument of the Institute for the Promotion of Innovation by Science and Technology in Flanders (IWT)

Like in many regions, Flanders has a government policy to stimulate innovation. The central organization for implementing this policy is the Institute for the Promotion of Innovation by Science and Technology in Flanders (IWT).

IWT supports (among others) RTD projects for industrial research activities, projects for industrial development activities, and projects for strategic basic research of industrial relevance.

The RTD projects for industrial research or for industrial development are submitted by industrial enterprises. These are the so-called "bottom-up" projects, with no limits on scientific or technological discipline. This bottom-up approach has significant advantages. The most important one is that the program is open to all sectors and is not dominated by "top-down" choices. Another important feature determining its success is the continuity of the IWT instruments. Because the instruments for RTD projects exist for a very long time, and the conditions have hardly changed, the companies know what instruments are available, are familiar with the conditions and the procedures, and are able to incorporate it in their strategic planning.

With respect to start-up companies and small SMEs, IWT has a sharp eye for the potential for economic growth of companies. A requirement for continued funding is that starters and small SMEs do grow. In this way IWT, is favorable for successful companies and not for those with an "arrested development".

Source: www.iwt.be

Valorization in the university medical centers of the Netherlands: Conditions and regulations for transparency in conflict of interests

All commercial development by definition carries the risk of conflict of interest between the public and the commercial stakes. The Dutch Federation of University Medical Centers (NFU) has agreed on a framework for valorization and commercialization of research findings. In the brochure *Naar een goede waarde*, UMCs generally agree that valorization is a social need because knowledge and expertise need to be used, and not stay "on a shelf". In the brochure, the NFU describes the conditions and agreements for commercial valorization. Since the UMCs endorse the stimulation of the use and application of knowledge, they acknowledge potential conflicts of interest that may arise when exchanging public-private researchers. In order to enhance transparency on this issue, they present essential conditions for UMCs such as:

- A clear structure of responsibility (signaling, judgment and decision taking) in the UMCs to deal with conflicts of interest (conflict of interest code);
- An up-to-date code of scientific integrity;
- An independent system of examination/qualifying research projects to be carried out with commercial parties;
- Control of financial incentives such that integrity and public interest are not overruled by commercial interests;
- Additional supervision where normal procedures do not apply;
- Transparency on all commercial activities and choices in publications or public statements.

Source: NFU, Naar een goede waarde, July 2009

- Include stakeholders from society and the business world structurally in the theme selection and development process. Organize platform activities for stakeholder discussions.

2. In order for large companies to utilize the new research findings of universities, their "absorptive capacity" needs to be up to date.
Our concrete recommendations are to:
- Invest in post-academic education and decide on the specific themes in agreement with stakeholders;
- Extend the mobility programs for public-private exchange of researchers (Casimir, academic practice ateliers, etc.). With this exchange, university researchers can obtain a better knowledge of the type of problems companies or specific public authorities have and vice versa: researchers from industry get the opportunity to stay up-to-date on developments at the forefront of scientific developments. At the same time one should acknowledge potential conflicts of interest.

3. The contact between universities and SMEs should be intensified, in order to stimulate technology transfer to SMEs and realize valorization of research findings by companies other than those involved in PPP and existing bilateral contacts.
We recommend:
- One information desk at each university should be installed for SMEs so they are able to easily (find and) approach the university with their knowledge requests;
- Application projects should be initiated together and in agreement with regional innovation centers (with budgets from these centers) to translate knowledge to application for SMEs.

Additional policies to be implemented by government and research councils

The national government and research councils can play an important role in the realization of the valorization goals set out for 2020. This can be accomplished by using a combination of the following types of innovation policy instruments.

1. Public policies and governance.
Clear agreements between the national government and universities about their "third mission". by means of contracts and accountability (evaluations and indicators).

2. Investments: strengthening investments in excellent public research and valorization.
- An excellent science base is a crucial breeding ground for new economic activity, and improvement and realization of public needs. It is recommended to

"The continuity of the PPP set-up should be better safeguarded by the government. In the Hague, people must realize that investments in a serious research program must be made for at least 10 years (to have it take the lead) and once it is in the lead, to invest again (to keep it in the lead)."

Anne Flierman, Chair of the Board of Governors, University of Twente

(Quote from interview on July 13, 2009)

increase the investments in research in accordance with the Lisbon goals;
- As the FES funds provide impulse support, these resources should be spent on the basis of a long-term national strategic agenda for the life sciences (10-12 years with firm midterm review);
- Sufficient funding for valorization is needed in order to allow universities to implement their mission of knowledge transfer: the budget each university received from the government should be raised by up to 2.5%. After several years, the amount of funding will be monitored and adjusted on the basis of valorization output;
- Sufficient financial support should be given to pre-seed and seed capital initiatives needed to bridge the equity gap that a company faces between exiting the university and being able to attract private funding.

3. A long-term commitment to and consistent policy for valorization.
A set of integral valorization instruments according to the IWT (see box on page 240) should be installed that cover each stage in the valorization chain. They are related to the long-term research programs.

4. Proper legislation for company creation, company growth and attracting foreign companies.
- Tax benefits for companies such as expansion of the WBSO, exemption of royalties for companies (like in Belgium) and reduction of the corporate tax to develop business will stimulate company investments in R&D and attract foreign companies to the Netherlands, thus improving the national industrial base;
- A rapid introduction of the Green Card for Europe, and more simple regulation for attracting scientists from abroad is instrumental for success.

5. Finally, governments can boost innovation in the life sciences by means of public procurement and acting as launching customers, for instance in the field of biomass-based products.

To conclude, only through a structural and long-term valorization national policy that integrates the elements presented above, can our vision for 2020 of valorization in the life sciences become a reality!

“My biggest worry is that Boards of Governors now, with second generation Technology Transfer Offices, make the same mistake that they did in the 90s, that is, that they come to expect that knowledge transfer is a sport where you can earn money as a university. Knowledge transfer into society is a core activity of a university and you must accept that it costs money. Valorization is not a cash cow.”

Eppo Bruins, Director of Technologiestichting STW

(Quote from telephone interview on June 10, 2009)

> “Considering the wish for more structural interaction between industry and academia, the government must – via an attractive business climate – ensure that the knowledge that is generated in the Netherlands is also actually further developed and applied here. This also means that the government must make our country (more) attractive for foreign knowledge workers and students: the Netherlands teeming with knowledge! ”
>
> **Douwe Breimer, Pharmacologist, former Rector and Board Chairman of the Leiden University**
>
> (Quote from telephone interview on June 25, 2009)

Acknowledgements
The realization of this book was supported by Technopolis Group the Netherlands, special thanks goes to Christien Enzing and Frank Zuijdam.

This chapter could not have been accomplished without the highly appreciated input received through interviews and from those who participated in the valorization workshop (July 1, Utrecht), during which we obtained very useful feedback on and support for our vision.

Interviewees: Douwe Breimer, University Leiden; Eppo Bruins, STW; Anne Flierman, University Twente; Maarten le Clercq, Leids Universitair Medisch Centrum; Emmo Meijer, Unilever; Onno van de Stolpe, Galapagos; Marco Waas, TU Delft, Project Leader Valorization Innovation Platform; Edward van Wezel, Biogeneration Ventures

Valorization workshop participants: Koen Besteman, Roland Berger; Bart van den Burg, Biodetection Systems en Ecogenomics Consortium; Peter van Dongen, Octrooicentrum Nederland; Hans Dons, Bioseeds; Paul van Grevenstein, STI Management; Johan Hanstede, Biofarmind; Martin Hessing, TiFN, Nutrigenomics Consortium; Gionata Leone, WUR, Centre for BioSystems Genomics; Ellen Moors, Innovation Studies UU; Bob Poldermans, DSM; Jan Sikkema, TIFN; Rein Strijker, ex DNAge, Pharming; Martin Stutterheim, Technopartner; Alie Tigchelhoff, Holland Biotechnology en Science Park Utrecht; Koen Verhoef, TTO NKI; Edward van Wezel, Biogeneration Ventures; Jan Wisse, Niaba

Herman Wijffels, Professor of Sustainability and Social Change, Utrecht University

... I would like to see a truly sustainable society and knowledge economy develop, and I am convinced the life sciences can and must play a major role in bringing it about ...

Ab Klink, Minister of Health, Welfare and Sport

... A long-term vision supported by all stakeholders is essential to guiding the innovations that will help us overcome these challenges – together ...

Robert-Jan Smits, Director DG Research, European Commission

... A knowledge economy can only be created by investing in it! ...

Feike Sijbesma, CEO Royal DSM

... The only other ingredient needed for a flourishing life sciences field and bio-based economy is a firm commitment from all stakeholders involved to help make the Netherlands the world's "Life Sciences Polder" ...