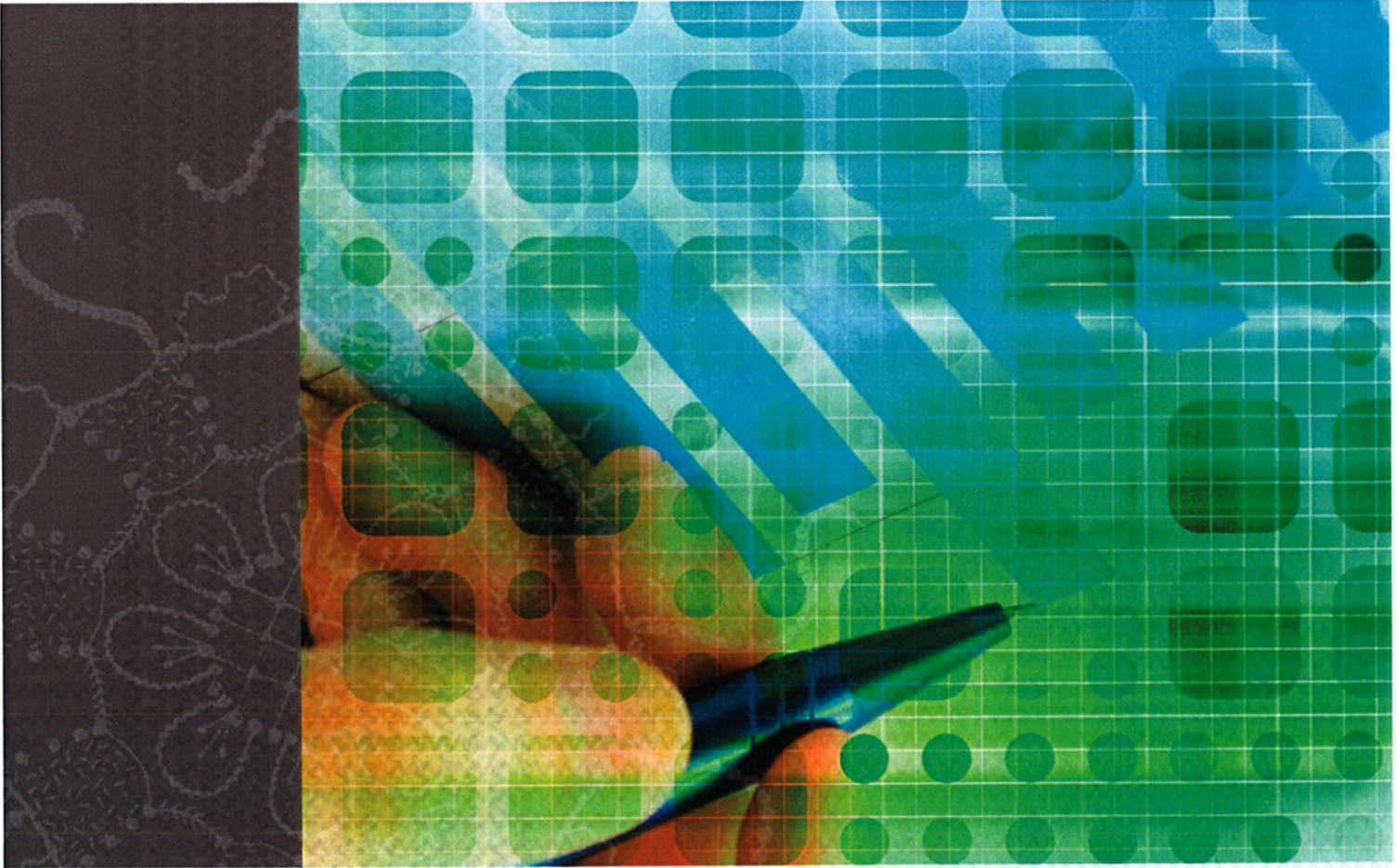




# Self-evaluation for the Midterm Review of the Netherlands Genomics Initiative (NGI)



# Foreword from the Supervisory Board of NGI

Without intending to pre-empt the  
Evaluation Committee's findings,  
the Supervisory Board of NGI felt it was  
useful to record its own reflections after 10  
years of operation.

It is our shared opinion that the Dutch Government in 2002, and subsequently for a second phase in 2007, took the bold and wise decision to allocate almost € 600 mln for genomics R&D in the Netherlands with the aim of transforming a weakness into a forefront position and appointing a separate organisation to execute the business plan. The importance of genomics has markedly increased over the past 10 years from both an economic and societal point of view. We are convinced that without the investment made, the Netherlands would have failed to have kept pace with the rapid international developments in genomics and the associated sciences, and that trying to rectify such a situation now would require a substantially higher investment than that already made. Moreover, as the activities of NCI increasingly support several Top Sectors in the Netherlands (Life Sciences & Health, Agrofood, Horticulture, Chemistry) including activities around the Biobased Economy, and the number of applications in genomics is growing rapidly, NCI will - in our opinion - continue to be a valuable and indispensable asset in further strengthening the Top Sectors in their societal and economic development.

We really appreciate the efforts of the Evaluation Committee in evaluating NCI as an instrument in governing genomics R&D in the Netherlands, and hope that you will enjoy reading the self-evaluation report as well as the other documents. We look forward to receiving your evaluation and recommendations, as these will help us to maximise NCI's output and impact for the coming period and to answer the key question: has the money been well spent?

With kind regards on behalf of all the Supervisory Board members,

Prof. S. Lamberts

Chairman

September 2011

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# Introduction

The evaluation framework and questions for the Midterm Review of the Netherlands Genomics Initiative were drawn up by Technopolis, submitted to the official Genomics Steering Group representing all funding departments and approved by the Governing Board of NWO under whose formal responsibility NGI as a directive body falls.

## NGI first phase 2002-2007

NGI was established in January 2002 to promote Dutch genomics research and its application. A sum of €300 million was invested to strengthen the position of Dutch genomics research and - based on specific choices - to create more coherence. NGI's task was to build a structure that links high scientific quality to economic and social returns. The emphasis was placed on four subjects, directly relevant to the quality of life and economic growth: food, multifactorial diseases, infectious diseases and sustainability. In addition, NGI focused on two supporting areas: technology and society. In 2005, a Midterm Review was organised for the first phase. The assessment by the panel of international experts was positive. NGI had succeeded in further developing the existing strengths of research and industry in the Netherlands into a coherent programme. The primary recommendations were to continue to focus and strengthen critical mass, international orientation, social and economic returns from research activities, and the interaction between social research and genomics research.





## NGI second phase 2008-2013

For the second NGI phase, a new strategic plan was drawn up. The NGI's 2008-2012 Strategic Plan had four different lines of action: 1. Strengthening the knowledge base;

2. Social research and public communication; 3. Valorisation; 4. International expansion. These lines of actions have been elaborated further in the 2008-2012 business plan; differences in emphasis have been applied and quantitative and qualitative targets formulated. In this second phase, there is a greater emphasis on valorisation; the 'pipeline' was well-filled in the first phase and consequently the targets for the second phase could be set even higher still. A total of €280 million was made available for this business plan by the government.

Although the initial plans mention 2012 as the final year, the decision was already taken in 2009 to extend the operating period of NGI by one year until 2013 due to delays in the start of several consortia. The agreement with NWO and the Ministry of Education, Culture and Science runs until 2014.

## Evaluation process in 2011

The multi-staged Midterm Review for the second phase of NGI is taking place in 2011. The 16 NGI centres first of all conducted self-evaluations in March/April and were then assessed comparatively in May by a broad-based scientific committee chaired by Douwe Breimer. This assessment mainly concerns the scientific results, valorisation and anchoring of the NGI centres and their mutual collaboration. In the autumn, another, more strategic/management-oriented committee will meet, again chaired by Douwe Breimer, to assess NGI as a directive body. In addition to NGI's self-evaluation and the report of the May committee, supplementary reports from Technopolis (international benchmark, multiplier research) will also be made available to the committee. Additional interviews will also take place.

The evaluation focuses on the performance of NGI as a directive body and on the adjustment of NGI's strategy and operations, as needed. This concerns conclusions about the past period and recommendations for the next period when the national genomics programme will be completed and parts will be anchored in the Dutch life sciences R&D infrastructure. Central to the evaluation framework is the question of whether NGI "is considered an ideal tool for the effective and efficient management of Dutch genomics research and its applications"; (Business Plan 2008-2012).

A subsequent question is whether such a directive structure / coordination function and the proposed incubator model (see page 13) deserve science-wide recommendation in the future.

## Evaluation questions

The self-evaluation text follows the structure of the evaluation questions. There are seven main questions and a number of other questions that more specifically address the aspects of research and infrastructure, valorisation, genomics and society, talent and international expansion. The seven main questions for evaluating the NGI as a directive body are:

- To what extent has NGI achieved the goals set in the business plan? What have been the effects of the deployed and developed activities (intentional and unintentional)?
- Have the conditions been created for a coherent genomics knowledge infrastructure - in which excellent research, enabling technologies, innovation and social embedding are approached integrally?
- Is the method used by NGI sufficiently focused on achieving the set goals? Are the resources used in proportion with the results?
- Has NGI fulfilled its role as director, coordinator and liaison with policy makers and NWO to the satisfaction of the stakeholders in the field?
- Is NGI sufficiently focused on embedding its activities? Which recommendations can be made for the period following 2013 in the field of genomics, with the focus on: further entrenchment and consolidation of what has been achieved/started up thanks to NGI and avoidance of (potential) loss of what now can be seen valuable from the effects of NGI's work.
- What is the possible significance of NGI's experiences as a directive body in other areas of science policy?

# Main questions

1. To what extent has NCI achieved the goals set in the business plan? What have been the effects of the deployed and developed activities (intentional and unintentional)?

In the 2008-2012 Business Plan, NCI has set quantitative goals centred around the following lines of action:

## Research and infrastructure

NCI's main objective is that all centres be of world-class quality by the end of NCI in 2013. This will be assessed according to the Standard Evaluation Protocol (SEP) in common use by the Dutch knowledge infrastructure. This means that the centres must be assessed with the highest score - a 5 - for each of the following criteria:

- Quality
- Productivity
- Relevance
- Viability

The results of the individual self-evaluation committees for the Midterm Review show that the scores average between 4 and 5 and are also higher than the Midterm Review results of 2006. It is expected that these scores will

increase further during the remainder of the NCI period until 2013, as the evaluation committees have given the centres valuable suggestions and it can be expected that the biggest gain/impact will be realised over the next few years.

In the business plan, no separate targets were set with respect to the scientific output of the NCI centres. These targets are, however, stated in the grant allocations, based on an international benchmark (VIB). Besides a total of 4455 publications in the period 2008-2010, publications are also counted with an impact factor of >5 and >10. In all cases, only those publications were counted in which NCI or the relevant centre was named in the acknowledgements or affiliation. A certain overflow of publications exists for research that was funded in the first phase but which was only published at the beginning of the second phase. NCI has included these results in the summaries since the same will apply for publications resulting from work in the second phase that will be

Table 1. Scores by individual MTR evaluation committees of NCI centres

	CMSB	CCC	VIRGO	NCHA	CDC	NCSB	NPC	NMC	NBIC	CSG	NTC	FGCN	EC	KC	NC	CBSG	Average
MTR 2011	5	5	4.6	5	4.4	4	4.8	4.4	4.4	4	4.3	4.6	4.5	4.2	4.2	4.6	4.5
MTR 2006	4	5	4.5	NA	4	NA	4.5	NA	4	3	NA	NA	NA	4	4	4	4.09

NA = Not Applicable



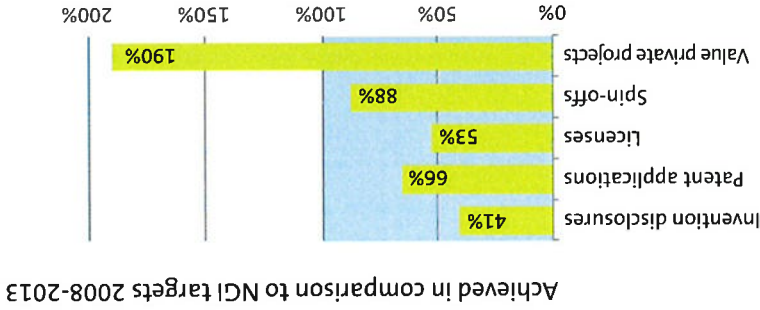


Figure 3: Achievement of valorisation targets. 100% values are for invention disclosures (370), patent applications (185), licensing agreements (150), spin-offs (16) and extra income/value from private parties (£45 million).

The number of invention disclosures is slightly behind schedule; there was some ambiguity at the centres about the purpose and intent of invention disclosures at the start of the second phase. This has been resolved and the desired increase in invention disclosures can now be seen. The additional revenue from new collaborations with private parties is higher than NCI had promised on the basis of international benchmarks and it is growing strongly (see Figure 4). In addition, NCI monitors more valuation parameters: additional income from licensing, the number of new public projects and their value, and the outflow of researchers to industry (see Table 3 for the complete list). The general picture emerging from this is that all the centres have been able to attract both public and private funds and have therefore grown in size. The motto of the NCI's second phase can be characterised as: "From Publication to Product". A more detailed explanation of the valorisation goals achieved is described in Questions 13 to 19.

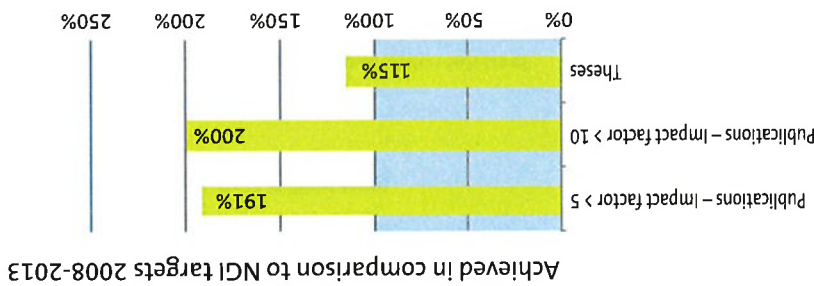


Figure 2: Realised vs. NCI targets for the entire 2008-2013 period, including the number of theses.

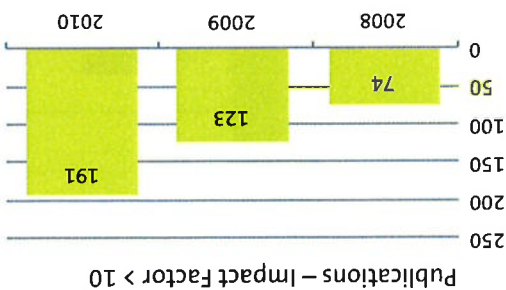


Figure 1: Number of NCI publications per year with an impact factor of > 5 and > 10.

published after the end of the NCI (2014 and later). The results show that the NCI centres not only achieve large numbers of publications with high average impact factors, but that they have largely achieved their goals already - set according to international benchmarks - halfway through the second phase (see Figures 1 and 2).

## Valorisation

International benchmarks show that every €1 million spent on research leads on average to 0.5 invention disclosures, between 0.2 and 0.4 patent applications, half as many licensing agreements (0.2 per €1 million), 0.03 spin-offs and to €50k of private party income (ref: MERIT, June 2006 A5TP Survey). NCI's economic valorisation objectives are purposely well above these averages. Figure 3 below is taken from the 2010 annual report and shows that NCI is on the right track. The number of patent applications, licensing agreements and spin-offs is completely on track.

thus into additional PhD candidates. Other initiatives that NCI has developed for nurturing talent include the organisation of the Young Researchers Event following the 2007 Genomics Momentum, the participation since 2010 of 25 postdocs in PCDI's annual three-day Postdoctoral Career Retreat at NCI's expense and

way are usually converted into additional research and private funds that these centres have raised along the large number of PhD graduates is that the additional public for the period after NCI. Another reason for the relatively phase. A similar, perhaps even greater outflow will apply funded in this phase gained their PhDs in the second phase. Understandably, a large number of researchers total is partly attributable to an overlap from the first researchers have now gained their PhDs (see Figure 2). This second phase. The tally at the end of 2010 is that 278 researchers at the 16 NCI centres will gain their PhDs in the In addition, the business plan states that 225 young achieved are explained further in Questions 23 to 28. other results the Horizon programme has gradually phase). The above goals are expected to be met. These and available to it (as compared to €12 million in the first which had additional resources of €20 million made are the results of the first phase's Horizon programme, a future principal investigator. The strengthened targets up their own research line for €500k and thus to qualify as 20 young researchers with a proven successful idea to set carry out their own Breakthrough project of €100k and for make it possible for 100 young talented researchers to each The business plan states that, in the second phase, NCI will

## Talent

described separately in a report by Technopolis. health, 6.5 for agrofood, 7.1 for sustainability and is 1.1 for the enabling technologies, 2.3 for safety, 6.1 for invested by NCI in 2003. This research shows a multiplier of gain insight into the development of value from the euros Moreover, NCI had Technopolis calculate a multiplier to illustrates the state of affairs as of 2010.

Figure 5: Cumulative budget of the 16 NCI centres during and after the NCI period in € mln. In addition to NCI and matching funding, the centres receive additional funds by attracting extra public and private resources. If the aforementioned amounts are greater than €300k, they are then projected over time according to a scale (10% in the 1st year, 30% in the 2nd and 3rd years, 20% in the fourth year and 10% in the final year), since such funds are typically used for hiring PhDs and/or postdocs. This figure illustrates the state of affairs as of 2010.

Figure 5 reflects the overall picture of financial flows within NCI (as of 2010). This illustration also indicates that the private/public ratio increased from 11% in 2008 to 17% in 2010 and that the additional funds raised, extrapolated over time, make a partial continuation of the NCI heritage through the centres possible after 2013.

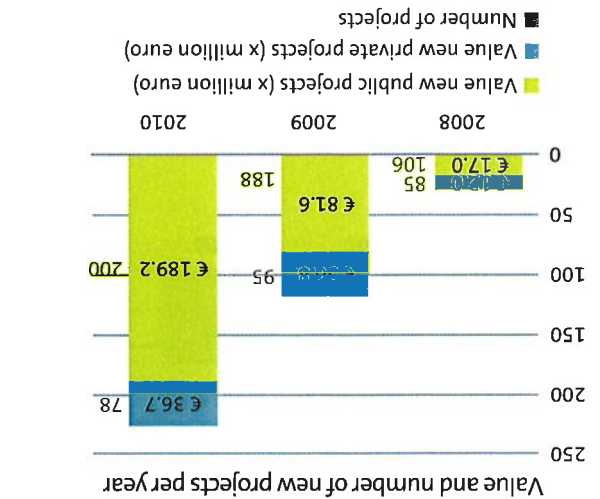
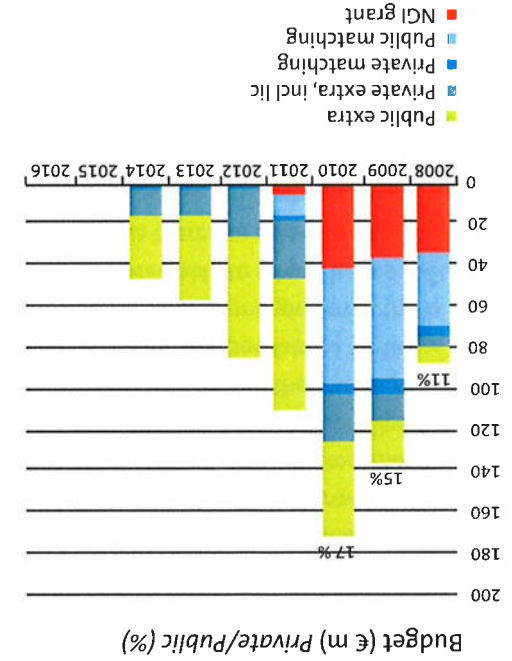


Figure 4: Value/extra income and number of new projects per year.



the facilitation of the Young Entrepreneurs in the Life Sciences network. Such initiatives are (according to surveys) highly appreciated by the young NCI researchers. Each year, NCI also sponsors the Dutch student teams that participate in the prestigious iGEM (international Genetically Engineered Machine) competition.

### Genomics and society

During the first phase of NCI, communication mainly had an internal focus, i.e., towards the NCI centres and stakeholders. One important goal that NCI has set for itself since 2009 is to initiate more public-oriented communication. More and more results from the centres are interesting to a wider public and can convince them of the importance of genomics research for society. To this end, the NCI office focuses on the dissemination of research results, whereas the Centre for Society and Genomics (CSG), in collaboration with other centres, focuses more on the social context (debates, dialogues, etc.) and on education. Targets are set for CSG in the business plan. These have gradually been complemented with a number of new objectives. These targets and objectives will largely be met. More detailed information about this can be found in Questions 20 to 22.

The NCI office has initiated the following communication activities since 2009:

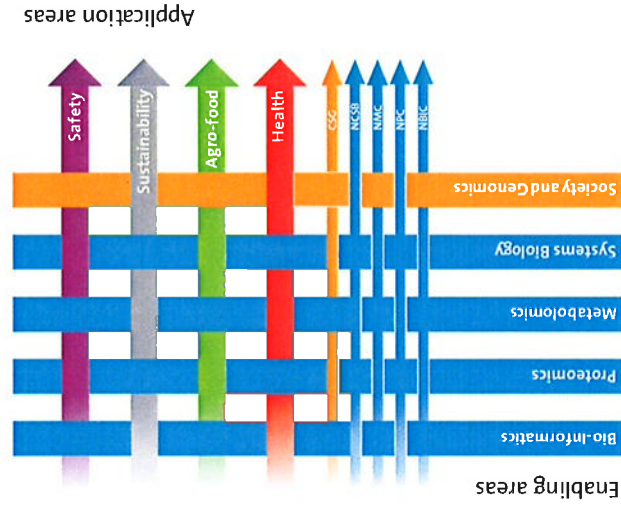
- The NCI website has been made more accessible by displaying more results from the centres, by making the newsletter more attractive, by adding YouTube-like films with interviews, and by presenting things in an electronic magazine format. The annual report has also been published in the form of an electronic magazine and made more accessible by using short messages with appealing research results and interviews with (young) researchers.
- Various publications have appeared that were intended for a wider audience. Examples are the Life Sciences special in the free newspaper Metro (circulation: 500,000, reader rating: 7), as well as specials in De Telegraaf and Het Financieel Dagblad.
- Making a TV series entitled: Lang zullen we leven (Long Shall We Live), which demonstrates the usefulness of genomics research for society in an easy to understand manner. The following centres have contributed: CMSB, CBSC, NPC, VIRGO, CDC and NCHA. This series will be broadcasted on RTL 4 starting in September 2011.
- Stimulating bio-art in the form of the Designers & Artists 4 Genomics Award for teams of young artists or

- designers and scientists from the NCI centres. In 2010, there were three winners and the results are being exhibited in the Naturalis Museum in Leiden. Due to the great success (publicity-wise), this initiative will be continued in 2011.
- For a more specialised audience, a number of educational books on biotechnology and life sciences have been published for which NCI has made a sponsorship contribution. This concerns the following books: Scorpions in the Corn, Man Proposes and Nature Disposes, Modern Biotechnology and The Micro Canon. In addition, NCI published Partners in the Polder aimed at policy makers and administrators (see Question 4 as well).
- NCI intends to participate in the MicroZoo initiative at Artis in Amsterdam. This zoo wants to render the invisible visible. In collaboration with other parties NCI will develop a genomics activity directed at high-school students.

## 2. Have the conditions been created for a coherent genomics knowledge infrastructure - in which excellent research, enabling technologies, innovation and social embedding are approached integrally?

The 2005 Midterm Review revealed that the coherence of the genomics infrastructure could be further enhanced. Therefore, in the second phase, NCI chose a design in which the technology centres (NBIC, NPC, NCSB, NMC) and the CSG were to set up a number of joint research projects with the original centres of excellence (CGC, CMSB, CBSG and Klyver Centre) and therefore had to budget for this as well. Figure 6 illustrates the intended collaboration between the enabling centres and the application-oriented centres. A survey of collaborative projects in the spring of 2011 by the InnoTact office revealed that collaboration was not confined to the original centres of excellence, but has also expanded to other NCI centres and external organisations such as the top institutes.

Figure 6: Network of enabling centres and application-oriented centres.



According to the study, not only has there been a large number of collaborative projects with other NCI centres (approx. 186 PhD or postdoc projects), but this collaboration is also generally well appreciated. The appreciation for these centres concerns the technological and other expertise, scientific quality and communication. Centres that did not cooperate at all in the first phase, or which cooperated only with difficulty, enjoyed much better and more intensive collaborative relationships in the second phase. The 'more mature' technology centres, such as NPC and NBIC, are valued more highly than the recently founded centres such as NMC and NCSB. According to the InnoTact report, this form of integration is unique within genomics research and the preservation of this structure for the future is recommended. The technology centres are working together on a plan for continuation beyond 2013 in the form of a Dutch Tech Centre for Life Sciences (DTL). Integration with the research focused on society's needs came about because CSG primarily allows the centres submitting proposals to realise these following CSG's review and approval. Moreover, CSG has explicitly aimed for the social valorisation of research since the start of the second phase. Further information about this can be found in Questions 21 and 22.

InnoTact has not identified the exact increase in collaboration between centres, but it is known that the non-technology centres are also collaborating more frequently. This includes collaborations that were not immediately expected at the outset, such as a joint booster grant for a new consortium by Klyver and CBSG to produce plant-derived chemicals in microorganisms, a recent collaborative project between CGC and NTC in the field of toxicity and the development of cancer, and a new research collaboration between FGCN and NCHA to determine age as well in the context of offender profiling.

### 3. Is the method used by NCI sufficiently focused on achieving the set goals? Are the resources used in proportion with the results?

In the grant decisions for the NCI centres, NCI has included targets with respect to scientific output and valorisation output. The grants are made available subject to the condition that NCI also approves the consortium agreements and budgets. For this, NCI seeks advice from NL Agency. Payments are not initiated until these conditions are met.

Each year, on 1 April, all centres report about the results achieved using a fixed template and they also submit an output table. Individual monitoring discussions, in which the reports are discussed with the management teams of all the centres, take place in May. Prior to these discussions, NL Agency advisers draw up brief monitoring recommendations based on the centres' reports and they attend the meetings. During the spring meetings, the overall progress and output in relation to the goals are discussed in detail.

Each autumn, on 1 October, the centres submit reports concerning valorisation and anchoring activities only (using

a fixed template for both the results and the planning). In November, discussions are held about these two subjects. Prior to the spring and autumn meetings, general business and best practices are discussed in the so-called directors' meeting of all scientific/operational directors and the NCI office.

There is also frequent contact in addition to these biannual meetings. The NCI team has an account holder for each NCI centre who has regular contact with that particular centre throughout the year. This person functions as a first point of contact for questions, and remains substantially involved (e.g. by visiting meetings and conferences). This method provides NCI a balance between efficient monitoring and substantive consultation. NCI also strives for transparency in presenting the results, as in the annual report. NCI's total overhead rate in the second phase is 3%. This percentage is far below the overhead rate of NWO (5%), ZonMw (8%) and NL Agency (>10%).

# 4. Has NCI fulfilled its role as director, coordinator and liaison with policy makers and NWO to the satisfaction of the stakeholders in the field?

• Consultative structures. Regular consultation takes place with the Genomics Steering Group, where NCI's progress is discussed at an official level with the government departments involved. In addition, regular consultation occurs with the director generals or the state secretaries and ministers of the departments involved, the NWO General Management, and with the NWO Governing Board and NWO's Task Force on Life Sciences (TFLS), in which all NWO's divisional boards that have anything to do with life sciences (ALW, CW, STW, ZonMw) are represented. Recently, the NCI Director was asked by the NWO General Management to write a proposal for an NWO-wide PPP approach.

In the context of Partners in the Polder, regular meetings were held with the stakeholders to create support for investment in public-private partnerships in the life sciences, but also with members of parliament and other politicians.

Regular consultations are held with the President of the Royal Dutch Academy of Arts and Sciences (KNAW), The Confederation of Netherlands Industry and Employers (VNO-NCW) Technology & Innovation Committee, the Dutch Federation of University Medical Centres (NFU), Association of Universities in the Netherlands (VSNU), various companies, and the relevant steering groups in the Netherlands, including the steering group for Chemistry, ICT, Food & Nutrition and the interdepartmental workshop Bio-based Economy. As part of the Ministry of Economic Affairs, Agriculture and Innovation's new top sectors approach, meetings are also held with members of the top teams (Life Sciences & Health, AgroFood, Horticulture and Chemistry), during which the importance of an incubator model of PPPs is emphasised.

Besides these more externally focused consultative structures, there is also a clear internal consultative structure between NCI and the various centres (see Question 3). Last but not least, progress and strategy are discussed four times a year with the Supervisory Board of NCI.

A major change from the first phase is that, since 2008, NCI has increasingly operated across the spectrum of life sciences and was not confined solely to its own centres and isolated genomics activities. The rationale for this was that genomics is increasingly an integral part of the entire field of life sciences and that the value of genomics research is best expressed only in this larger context. This approach should also contribute to the embedding of NCI.

This expansion has been designed in the following ways:

- **Life Sciences Momentum.** In 2009, the annual NCI congress, the so-called Genomics Momentum, was renamed Life Sciences Momentum. Since then, several parties have been involved in the convention's organisation and content. This has, for example, resulted in a substantial increase in participants from an average of 400 to 700 and a concomitant increase in business participation from about 10% to 35%, which indicates that more and more companies are becoming interested in the public-private partnerships headed by NCI.
- **Partners in the Polder.** In 2009, NCI took the initiative, in consultation with all other life sciences parties, to elaborate and implement a vision for the life sciences in the Netherlands and especially the role of public-private partnerships in this. The resulting book describes the past, present and future of PPPs, the added value, lessons learned and best practices. It has become a guide for the entire field of life sciences (Health, Chemistry and Energy, Agriculture, Food, Technology, Education, Valorisation and Society) and has attracted considerable interest from foreign governments. This book has also led to cohesion in the life sciences community and the proposal to set up a science-wide incubator of PPPs serving the top sectors in the Netherlands (see Question 5 for a more detailed explanation).



## 5. Is NCI sufficiently focused on embedding its activities?

### Embedding the centres

In the second phase, the NCI office has put a lot of energy into ensuring that the NCI centres make concrete

embedding plans to safeguard their own future after NCI.

Furthermore, NCI has developed the incubator model with

the aim of embedding the NCI philosophy - cultivate a

network of cooperating PPPs in the Dutch R&D

infrastructure.

So far, four centres have been embedded. The

Nutrigenomics consortium was formally merged into the

Top Institute Food & Nutrition (TIFN) and now functions

there as a platform technology within the larger TIFN

programme. The Ecogenomics centre is now part of the

larger BE-BASIC consortium that focuses on industrial

biotechnology. In both cases, industrial participation has

increased from around 10% to 25-30%, thus achieving the

intended aim of moving up in the knowledge chain. In the

second phase, the CMSB succeeded in acquiring 85% of its

budget from elsewhere and so can also be considered to be

embedded. Other centres, such as VIRGO, have attracted

substantial funds to carry on independently either alone or

in combination with other centres. Each centre's anchoring

status is reflected in Question 1.1. This demonstrates that

there is no one-size-fits-all method for embedding. Besides

embedding in top institutes or becoming subsumed in

existing companies or in new business, we find that some

centres seek continuance in European networks, within

their own university, or various combinations of this. In the

autumn of 2011, NCI will hold discussions with the

participating executive boards to gain insight into the

universities' willingness to embed "their" centres or, if so

preferred, to continue them in another form after 2013.

The overall figures show no increase in permanent staff in

NCI's working areas. However, it is known that a number of

centres, including CDC, NCSB, CSG and NBIC, have

appointed additional permanent employees.

### Incubator model for embedding NCI

Although the NCI taskforce will stop its activities at the end of 2013, the strategy is that scope should remain in the Dutch knowledge infrastructure for generic and thematic PPPs with sufficient focus and mass, of which NCI is an

example. Currently, government, industry and research

institutes spend around €1 billion per year on PPPs, all

based on temporary funding. Half of this money comes

from natural gas profits (FES). This funding has recently

been used for purposes other than enhancing the R&D

infrastructure in the Netherlands, causing the future of

PPPs to become very uncertain. Some 60% of this €1 billion

per year funding is sector-based and is spent by so-called

top institutes, for example in food (TIFN), polymers and

materials. The remaining 40% concerns generic and/or

thematic PPPs, including NCI, but also several other smaller

programmes. Sector-based PPPs get a large contribution

from businesses (20-40%) and they define the research

agenda that focuses on innovations in the medium term.

The generic and thematic PPPs focus mainly on

technological developments. Here it is mainly science that

sets the agenda. Companies contribute less here (10-20%),

since the added economic is realised only later. The generic

and thematic PPPs actually constitute an incubator

because after they have been nurtured for a few years (the

proposal is for two periods of 4-5 years with an

intermediate evaluation) they can acquire a place in the

Dutch R&D infrastructure in existing centres of excellence

(see the examples of Nutrigenomics and Ecogenomics

above) or new business, or they can stop should the

developments become commonplace or fail (see Figure 7

below). Besides embedding PPPs, there should also be

scope for setting up new PPPs in areas of innovation that

build on the strengths in the Netherlands and that fit

seamlessly into the plans of the top sectors. The incubator

thus positions itself between the open, fundamental

research typically funded by NWO on the one hand and the

industry-oriented institutes on the other. Accordingly, the

incubator forms the link between fundamental science and

applied research in the top institutes and thus constitutes

an R&D matrix/network which enables synergistic

collaboration.

The funds that are invested in this model (typically 50%

public money, 20-30% from the research institutes and 10-

20% from industry) pay for themselves. In that respect,

they are not subsidies but profitable investments. The

Technopolis multiplier analysis clearly reveals that every

euro invested back in 2003/2004 is now worth between 1.1

and 7.1 euros. In addition to economic value, PPPs deliver

## Embedding valorisation activities and instruments

The motto of the second phase "From Publication to

Product" is also shaped by the start of various instruments

and valorisation activities. This concerns the following tools

clustered in the Lifesciences@work programme: Venture

Challenge, Pre-seed Grant and participations in New

Ventures, the seed fund BioGeneration Ventures and

Milbiton. In addition, many valorisation activities have been

undertaken such as the organisation of the Technology

Transfer Office (TTO) network in the Netherlands, re-

invigorating the Masterclass BioBusiness and the YELS

(Young Entrepreneurs in Life Sciences) network, which has

recently been transformed into the BioBusiness

Entrepreneurs Network, supported by the industry

association NIBA (see also Question 13). In NCI's opinion

it is important that these best practices be embedded.

Plans to do this are currently being developed and focus on

finding follow-on financing (Pre-Seed Grant BioGeneration

Ventures Milbiton), privatising the Venture Challenge and

BioBusiness Masterclass and embedding the TTO network

by setting up a Dutch association of technology transfer

professionals. Discussions with the executive boards, too,

emphasise that the third core function of the universities, "knowledge exploitation", can only take shape through a well-functioning TTO department.

societal value along with scientific standing and - last but not least - highly trained people who can shape the future of the Dutch knowledge economy. The €200 million in natural gas profits that the Netherlands, until recently, invested in the generic and thematic PPS is therefore a profitable investment in the top sectors, which will hopefully be continued using the incubator model described here.

The NCI plea is to adopt this incubator model on a broad

scientific scale and to bring it under the aegis of NWO. That

would allow the generic and thematic PPS within NWO

and beyond to be clustered. This would create focus and

mass, avoid fragmentation and allow a more efficient

operation by combining back office functions and

introducing best practices across the entire knowledge

chain. Such a structure fits well in the top sector policies

and offers the possibility of achieving an optimal

connection with the top institutes. The PPP incubator

model has been discussed with all the relevant

stakeholders in the Netherlands (NWO, KNAW, VNSU, VNO-

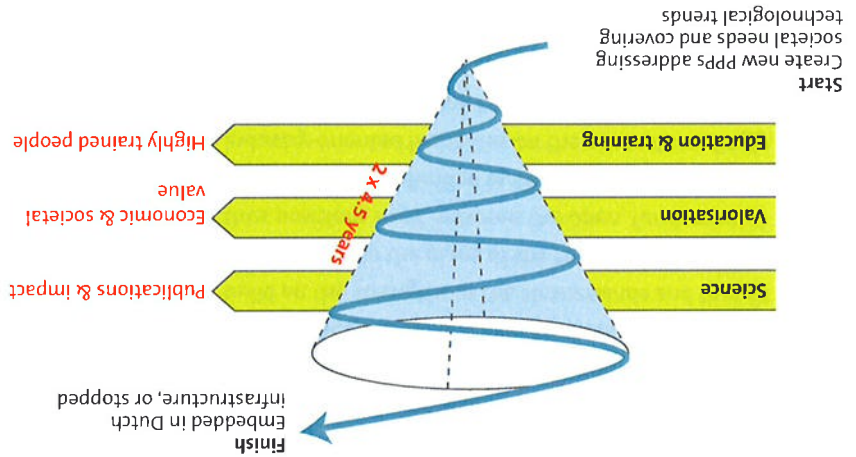
NCW, top sectors, steering groups, etc.) and the utility and

importance of an incubator are subscribed to by all parties,

as evident from the agenda of the top sector Life Sciences

and Health (LSH) and as now actively propagated by NWO.

Figure 7: Incubator model for PPSs.



## 6. What are the recommendations for the period following 2013 in the field of genomics, with the focus on: further embedding and consolidation of what has been achieved/ started up thanks to NCI and avoidance of (potential) loss of what now can be seen as being of value from the effects of NCI's work?

The main recommendations and grand challenges for embedding are:

- Embedding the centres New funding sources from within and outside of the Netherlands should be tapped so that the desired research and valorisation activities can be continued after 2013 and the chosen path of mutually reinforcing PPPs can be further developed. The May committee that evaluated the centres emphasises NCI's view that public funding continues to be necessary to, as the name implies, shape public-private partnerships. Experiences from abroad also show that at least 50% public funding is needed in the beginning and that - depending on the subject, progress and the interest of private parties - this rate can be reduced to 30%. Where possible, the NWO office will help the centres, but it remains a task for the centres themselves to ensure their own future.
- Embedding valorisation activities This implies the continuation of the - in our view - successful valorisation tools and making these applicable to a wider field, such as those clustered in the package

- Embedding the NCI philosophy Here, the combination and development of generic and thematic PPPs is considered under the governance of NWO using the incubator model. This approach would avoid fragmentation and provide an efficiency boost by introducing best practices and the harmonisation of consortium/IP agreements, reporting/monitoring formats, valorisation tools, et cetera, as well as the sharing of back offices and the development of an exit strategy. This incubator is certainly not just meant for those NCI centres that basically are still eligible - i.e., the centres that have received only one round of funding and the recently-started booster consortia - but also for other PPPs, since the incubator has been established as a model for all generic and thematic PPPs (see Question 5). The themes for the PPPs result from the agendas of the top sectors. The incubator also aims to be synergistic, especially because the technologically and socially positioned PPPs are expected to cooperate with the other PPPs.
- Embedding the NCI philosophy Here, the combination and development of generic and thematic PPPs is considered under the governance of NWO using the incubator model. This approach would avoid fragmentation and provide an efficiency boost by introducing best practices and the harmonisation of consortium/IP agreements, reporting/monitoring formats, valorisation tools, et cetera, as well as the sharing of back offices and the development of an exit strategy. This incubator is certainly not just meant for those NCI centres that basically are still eligible - i.e., the centres that have received only one round of funding and the recently-started booster consortia - but also for other PPPs, since the incubator has been established as a model for all generic and thematic PPPs (see Question 5). The themes for the PPPs result from the agendas of the top sectors. The incubator also aims to be synergistic, especially because the technologically and socially positioned PPPs are expected to cooperate with the other PPPs.

## 7. What is the possible significance of the experiences of NCI as a regulatory/directive body for other areas of science policy?

The NCI experiences, as described under Question 6, can easily be extended to other fields of science. NCI has already expanded itself from genomics to life sciences in the second phase and, for the future, NCI has proposed the so-called incubator model for PPPs (see Question 5 and Figure 7), which enables an extension to all scientific fields, including potential public-public partnerships.



# Research and infrastructure

## 8. Did the selection of new centres go well? Does the selection method provide sufficient scope for capitalising on new trends?

In the first NCI phase, the selection of centres was performed in a combined fashion: top-down and bottom-up. The government had stated five themes top-down: nutrition & health, sustainability, infectious diseases, multi-factorial diseases and alternatives for animal testing. For these themes two open tenders were conducted (bottom-up) and the best eleven proposals were accepted.

The second NCI phase is primarily aimed at the continuation of the initiatives started in the first phase. Therefore, NCI has asked the centres of excellence that were already active in the first NCI phase (CSG, CBSG, CCG, GMSB, KC) to submit another proposal. In addition, it has also asked the centres that had received a limited booster grant in the first phase (NCHA, NTC, NMC) to submit a more detailed plan for the second phase. Moreover, to take advantage of new developments, prior to the start of the second phase two experts were asked to write a proposal for a new consortium in the field of systems biology and forensic genomics (NCSB and FGCN). The innovative clusters that NCI financed in the first phase (NBIC, NPC, CDC, VIRGO, NC, EC) from FES resources were also given the opportunity to submit subsequent applications for NCI funding at a later stage.

All proposals were submitted to international scientific committees, or by other means recommendations with respect to funding were provided by peers. All proposals were judged very good to excellent. The selection procedure therefore complied with current NWO procedures and was effected with due care. Judging from the reviews of the NCI centres by the evaluation committees, these centres did in fact meet the expectations.

At the start of the second phase, the NCI budget was already largely allocated according to the business plan and so there was little room for NCI to respond to new trends. However, as the NCI office significantly reduced management costs in the second phase and because a number of other items were either fully or partially closed, NCI was able to raise the required budget for a limited number of booster grants (the so-called Booster grants) for new consortia. Via the NWO website, NCI published an open call for proposals in three new demand-driven areas that were also considered very important by the government departments: 1) personalised diagnostics, 2) sustainable production of fuels, chemicals & materials, and 3) food security, in combination with one of the following technologies: epigenetics, next-generation sequencing and synthetic biology. An independent international jury selected a limited number of proposals for further elaboration and NCI has approved the top four prioritised proposals.

NCI has therefore been able to confer four booster grants to relatively new technology areas, combined with important social issues, in a competition that was open to all parties. The recipients of the booster grants face the challenge of constructing a well-operating consortium within two years and with finding additional resources for their continuation. For a future incubator model, it is recommended that new consortia be started in the same way each year. At first, limited booster grants should be used so that there is the flexibility to take advantage of new trends and questions that are aligned with the themes arising from the agendas of the top sectors.

All the centres can therefore be considered internationally recognised contributors. The research's degree of innovation is evident from the large number of patents and publications with a high impact factor (nearly 400 articles with an impact factor > 10 in the period 2008-2010, see Figure 1). It can also be seen in the report of the NCI evaluation committee that reviewed the centres, as well as the CWTs analysis which showed that the scientific impact for the centres is higher than the world average and has increased during the NCI term. Furthermore, the Technopolis benchmark report shows that NCI has done very well compared to similar organisations.

## 10. Do the position and method of the technology centres and of the Centre for Society and Genomics (CSG) require adaptation, also in the context of integration within Dutch Life Sciences research?

According to both the review committees that have reviewed the centres and the broad-based evaluating committee that reviewed the centres comparatively in May, all NCI centres score at least 4 (very good) to 5 (excellent) according to the SEF standard. According to this SEF rating, a 4 means 'Research is internationally competitive and makes a significant contribution to the field. Research is considered nationally leading'. A 5 means: 'Research is world leading. Researchers are working at the forefront of their field internationally and their research has an important and substantial impact in the field'.

CSG and the technology centres are not limited in the forms of collaboration to the genomics centres (see also Question 2 and Figure 6), but focus on life sciences in the widest sense. This development was put in motion at the start of the second phase. Both CSG and the technology centres initiate partnerships with various types of organisations (research institutes, companies, TTIs, advisory bodies, international networks) outside the context of NCI. This is also essential as part of the embedding. It is expected that the number and diversity of partnerships will increase in the coming years. The method will require more adjustment in the future, dependent on

funding. The technology centres strive for a future collaboration called the Dutch Techcentre for Life Sciences (DTL). The ever-increasing availability of data in the life sciences and cumulative developments in technology require that a structure be set up for the future, which focuses on the harmonisation and integration of data and technologies. The Midterm Review committee noted that the technology centres must be sufficiently focused on answering specific biological questions from the other centres and ensuring that these centres need their expertise rather than just focussing on technology development. A good balance is needed here.

## 9. Were the research and technology developments in the chosen centres sufficiently innovative across the whole period and do they make an internationally recognised contribution?

# 11. Is the embedding of various genomics centres within the Netherlands' life sciences knowledge infrastructure on schedule? Where are changes needed?

The table below shows the embedding status of all 16 NCI centres. The NCI office has used the traffic light colours red, orange and green to estimate the degree of embedding. Green means the centre, though now with limited backing from NCI, can be continued with other funding in principle: alone in a slimmed-down form, merged with or subsumed by other PPS and consortia, or otherwise embedded. Orange means the centres have concrete plans and, in NCI's opinion, are on the right track. Red means that the probability of embedding is estimated by NCI as being low, or that the plans have not been sufficiently developed yet. Grey means that the centre has just started (since 2008) and that it has had insufficient incubation time to form an idea of realistic embedding possibilities. In NCI's estimation, all centres are well aware that no additional public funds such as those from FES will be likely after NCI and that they must either stand on their own two feet and/or collaborate with others somehow to safeguard their own financial future. For the time being, it seems unlikely that a centre will disappear due to inadequate functioning, a lack of demand for its expertise or because the expertise has become commonplace. Therefore, no centre was assigned the red category. The desired direction (growing private funding) is already visible in the four embedded centres. It is expected that this will also apply to the centres that have not been embedded yet.

Table 2: Embedding status of the 16 NCI centres. Colour code: ● Green means centre is embedded; ● Orange the embedding process is in progress; ● Grey means: too early to tell.

Centre	Embedding status
Nutrigenomics Consortium	Started in 2003. Now part of a larger entity with more private contributions (TIFN early 2011).
Ecogenomics Consortium	Started in 2003. Now part of a larger entity with more private contributions (BE-BASIC early 2011).
VRGO	Started in 2003. Embedded with extra FES money and spin-offs at the end of 2011.
Centre for Medical Systems Biology	Started in 2003. NCI funding has gradually decreased from 50% to 15% now. For valorisation purposes only since 2008. Obtained additional financing from EU funds, charities and direct government funding.
Cancer Genomics Centre	Started in 2003 through an international network of cancer centres and the Centre for Personalised Treatment.
Centre for BioSystems Genomics	Started in 2003. Embedding plans via top AgroFood and Horticulture sector and connection with TTI Green Genetics and a booster grant in the area of food security.
Kiuyver Centre for Genomics of Industrial Fermentation	Started in 2003. Concrete embedding plans to form a single PPS with BE-BASIC and TIFN in the area of industrial biotechnology.
Celiac Disease Consortium	Started in 2003. Continuation using EU funding, funding from the patients' association and the Celiac Disease Expertise Centre.
Centre for Society and Genomics	Started in 2003. Embedding plans under development. Funding to be achieved through the EU and based on an increasing number of assignments from the public and private sectors.
Netherlands Bioinformatics Centre	Started in 2003. Collaborating substantially with other technology centres outside NCI on a consolidated activity: the DTL. Connection with major EU infrastructure programmes, such as Elixir, is sought.
Netherlands Proteomics Centre	Ibid. Increasingly receiving EU funding (Prime-XS) and has submitted an application for large-scale infrastructure to NWO.
Netherlands Centre for Metabolomics	This centre only started recently in 2008 after a booster grant. Plans are under development together with other technology centres to form a DTL.
Netherlands Centre for Systems Biology	This centre only started recently in 2008. Plans are under development together with other technology centres to form a DTL.
Netherlands Toxicogenomics Centre	This centre only started recently in 2008 after booster grants. Plans are under development together with other technology centres to form a DTL. Actually started at full scale only recently in 2008.
Forensic Genomics Consortium	Embedding plan under development with the NFI, NWO (new Forensic Sciences programme) and private parties. Centre only started recently in 2008.
Netherlands Consortium for Healthy Ageing	This centre actually started in 2008 after a booster grant. Plans are under development. Collaboration with the Groningen Healthy Ageing Initiative has been realised in the meantime.



# 11. Which best practices can NCI demonstrate as an 'incubator' of public-private partnerships? Which role should private parties play in this and at which stage?

Several best practices have already been mentioned in

Questions 5 and 6. These best practices are summarised again below (in no specific order):

- Using NBIC, NCI has developed a consortium agreement in consultation with all relevant stakeholders (universities, Dutch Federation of University Medical Centres, companies, etc.), which includes general purpose clauses regulating the rights of software packages.

- NCI has developed a simple format for monitoring the progress of the financial, scientific, economic and social valorisation. This format provides maximum information with limited effort by the centres. The value of PPPs can be made clear with such data.

- A 2-compartment model has been developed within NCI, which means that the grant is used for pre-competitive research that is accessible to all parties and that the matching funding is partially used by competitive, often bilateral, research between or among any of the participating research institutes and industry. According to the Kluiver Centre and NCHA, the clear separation of pre-competitive and competitive research makes this model extremely attractive to foreign companies that have little experience with PPPs. The added value for industry is that they have access to more research results for the same money and that IP rights are well regulated in both compartments.

- NCI's approach to valorisation - in which valorisation is an integral part of the research centres - ensures the availability of a specific budget for valorisation and responsibility at management level.

- The integrated valorisation package 'lifesciences@work', in which not only financing and spin-off creation play a role, but in which attention is also paid to coaching, training and networking, is highly valued by the researchers, TIOs and venture capitalists.

- The support units developed by the technology centres (research hotels, development labs), where the partners can have short-term application studies performed, have led to increased interaction and assignments from industry and convey a positive image towards the international scientific community in particular.

- There is a synergistic effect when the centres are encouraged to work together. This applies to the technology centres which also play a service/support role with respect to the other centres alongside technology development, but not to them alone.

- It has gradually become clear that the centres can best be managed by a management team that includes at least a scientific director, an operational manager and a valorisation manager. Experience shows that such teams function best when these three persons operate at the same level and tasks are well-defined/distributed.

- Low management costs can be achieved by outsourcing many of the office's activities purposefully and temporarily to those organisations best equipped for that purpose. This allows NCI to be run as a small office (8 FTE) and management costs remain low (3%).

- It is important to involve industry closely from the outset when setting up a PPP, in terms of both content and organisation. So industrial leadership is key and the industrial contribution must be actively managed.



- A long-term commitment should be obtained in advance from all parties in a PPP (public, research institutes and companies). The research funds, with a minimum duration of 4 years, go largely to PhD students. Effecting large interim changes is difficult. Greater flexibility can be achieved by appointing postdocs and technicians.
- Interim 'go-no go' decisions should be incorporated so that programmes can be adjusted or stopped as necessary. Good exit strategies must be developed for this.
- There should be sufficient financial leeway for dynamic programming at the NCI level or for a future incubator initiative. This means using strict exit strategies and launching new initiatives. The research programme should not be inflexibly designed from the start. Sufficient financial resources are needed to stimulate collaboration, to provide promising activities an extra boost, to start up new developments and to achieve other meaningful connections.
- It is useful to give the centres a clear identity through a dedicated communications person, website, own events, a newsletter, etc. The centres are, after all, the 'brands' that should be positioned internationally and, ultimately, embedded.

# Economic valorisation

In the second phase, valorisation receives much attention and is elaborated with great ambition and new tools. Valorisation is seen in a broad context at NCI: it involves the training of talent, technological infrastructure, economic activity, and socio-cultural valorisation. In terms of valorisation, NCI has set itself the target of

## 13. To what extent has NCI achieved the planned valorisation activities or objectives?

and continuity, which ultimately benefits valorisation from within the NCI centres.

### NCI Genomics Centres

The first line of action, 'NCI Genomics Centres', concerns the valorisation of the results of research funded by NCI. Each eligible centre had targets imposed that were above the international average. Some assumptions were that

Valorisation at NCI, as described in the business plan, is structured along three lines of action, as shown in Figure 8. The valorisation budget is roughly 10% of the total NCI budget and is €35 million for the period 2008-2013. When implementing the valorisation strategy, a broader approach than just the NCI centres was used from the start. The idea is to build a solid foundation for valorisation that enables valorisation to be strengthened throughout all of the life sciences. This allows the achievement of greater quality

Figure 8: 3 pillars of the NCI valorisation strategy



	CBSG	CGC	CMSB	KC	NBIC	NPC	CDC	EC	NGC	VRGO	FGCN	NTC	NMC	NCSB	NCHA	Horizon	Total
Invention disclosures	4	13	0	19	0	1	1	0	2	1	0	17	5	0	0	7	70
Patent applications	2	10	2	5	0	4	1	1	2	2	4	0	2	2	0	12	49
Patents granted	0	2	0	0	0	0	1	1	0	0	0	3	0	0	1	1	9
Licenses	1	2	0	2	4	0	2	7	9	0	0	0	0	0	0	0	27
Value licenses (x million euro)	0	0.5	0	0.6	0	0	0.2	0	0.4	0	0	0	0	0	0	0	1.7
Spin-offs	0	1	1	1	0	3	0	1	0	0	0	0	0	0	0	0	7
Number new public projects (e.g. EU)	25	35	34	4	7	19	3	18	0	13	0	0	12	10	3	17	200
Value new public projects (x million euro)	8.6	21.0	10.0	3.5	6.7	16.0	2.3	61.3	0.0	8.8	0.0	0.0	9.7	5.6	21.0	14.6	189.2
Number new private projects	20	4	5	0	1	7	1	15	0	7	0	0	5	5	1	7	78
Value new private projects (x million euro)	7.7	0.4	2.4	1.9	0.2	3.0	0.0	0.4	0.0	14.7	0.0	0.0	1.3	0.9	1.9	1.9	36.7
Transfer researchers to industry	3	2	0	6	23	2	0	7	0	1	0	0	0	2	0	0	46

Table 3: Summary of 2010 economic output for all NCI centres and the Horizon programme.

participating research institutes. Since many research institutes are involved in several NCI centres, this approach has also led to the TOS of these research institutes, in collaboration with NCI, expounding some common principles for the valorisation of results from the NCI centres, such as using comparable procedures for the assessment of new findings, but also agreements on how to deal with joint findings. Regular meetings between the valorisation managers and the TOS involved have also led to the birth of a strong network of valorisation professionals in the Life Sciences (more about this under the TTO network line of action).

Although the practical implementation of the valorisation resources differs at each centre, many of the centres use a significant portion of the funds for so-called proof-of-concept studies. These are short-term projects in which a finding is validated with the aim of bringing it a step further towards (commercial) application. The structure of the proof-of-concept funds varies per centre depending on the setting and needs. Examples are the NPC and CGC vouchers, the KC KIT projects and CBSG Innovation Grants. In the NCI programmes such as the Horizon programme, a similar valorisation facility has also been set up with the Horizon Valorisation Project Grants and by linking Horizon project managers with the relevant TTO staff or valorisation managers as soon as the grant is awarded.

With respect to the results from this line of action, the numbers in Figure 3 (Question 1) show (economic) output well on track towards the set targets, even if those targets are well above European (ref: MERIT, June 2006 ASTP

valorisation was to be seen as an integral part of the research and that its practical implementation is often related to sector-specific dynamics and characteristics that require a customised approach. Finally, there was the principle that valorisation should be carried out close to the researchers, at the knowledge locus where the results are created. The university TOS play a crucial role in this because the ownership of the developed knowledge legally rests with the inventor's employer - the university or medical centre.

NCI implemented valorisation by asking all centres to submit not only a scientific plan in their business plan, but also a valorisation plan that describes how the expected results of the research are to be exploited. The centres have subsequently received a specific budget (amounting to 10% of the research budget) over and above the regular research budget for realising the valorisation plan. The valorisation plans could vary per centre, but they had to meet certain conditions: a valorisation manager had to be appointed for the centre, the TOS of the participating institutes had to be involved in the valorisation and the valorisation budget had to be matched by an equivalent amount from the research institutes and/or participating industry. In addition, the plan had to clearly describe how the valorisation should be set up in order to meet the targets put forward for the specific setting of that centre. In addition to the economic targets set by NCI, the centres were also challenged to submit additional targets. The result of this approach is that, at all NCI centres, a valorisation manager was appointed who is responsible for the realisation of the valorisation plan and who has a coordinating role with respect to the TOS of the

Survey) and world averages (ref. annual AUTM survey) for taking into account that research at the NCI centres is still of a fairly fundamental nature. Moreover, all the results reflect a continuous upward trend, which underpins the expectation that the set targets will be attained by the end of the NCI period.

The table above states in more detail what each centre's and the Horizon programme's economic valorisation has been in 2010 (see Question 28). Besides the targets as mentioned in Figure 3, NCI has monitored other things as well.

### Valorisation Award

Besides the focus on economic valorisation, attention is also paid to social valorisation (see Question 22).

Challenges in Question 6).

continued after 2013 by other parties (see Grand valorisation resources, as currently provided by NCI, be and medical centres. In this respect it is important that the constancy factor due to their embedding in universities of their ownership of the knowledge, but they also offer a significant role in the valorisation of the research because up of this valorisation line of action. Not only do they play a involving the research institutes' TTOs during the setting That has also been one of the considerations for closely valorisation infrastructure and instruments beyond 2013. This makes it all the more important to maintain the become apparent after the research is completed in 2013. behind the research. Many valorisation results will only results, just as the number of theses and publications, lag it should be noted at this point that the valorisation

As the Valorisation Managers and TTOs play a central role in the valorisation of NCI research results and because the NCI centres are virtual collaborations among several research institutes and companies, building a network in which all persons involved in this valorisation effort meet regularly and share knowledge has been an important valorisation pillar since the start of NCI. Since 2005, all valorisation managers have met every two months to discuss progress, but also to share problems and bottlenecks and learn from each other. The network has since grown into a network in which all TTO employees in the life sciences participate, know each other well and make active use of each other's experience. NCI has invested in the quality of these valorisation professionals by offering them access to valorisation courses, training and conferences, and this is used enthusiastically. From 2008 to 2010, network members from 16 different TTOs and/or NCI centres followed a total of 73 courses and training sessions. NCI also visited (national and international) TTOs regularly to learn how others organise their valorisation efforts. Meanwhile, TTOs themselves have recognised the importance of a network and have established the Dutch Association for Technology Transfer Professionals. Among others, they have adopted the idea of visiting various TTOs in the Netherlands by organising an annual TTO networking day that rotates between the various TTOs. NCI is involved in this association as one of the founding members with the goal of embedding the Life Sciences TTO network set up by NCI in the broader association borne by the TTOs themselves.

With the advent of the Tech Transfer Professionals' international registration, such as through the ATP (alliance including American, European and British technology transfer organisations), NCI has chosen to join this and to facilitate RTP training (Registered Technology Transfer Professional) for members of the valorisation network instead of participating in individual workshops and trainings. Young technology transfer professionals can now follow an entire training programme and end up with a track to RTP registration. More experienced technology transfer managers can take a shorter path. Currently, 12 young technology transfer professionals from 10 different TTOs and NCI centres are participating in this training programme.

### TTO network



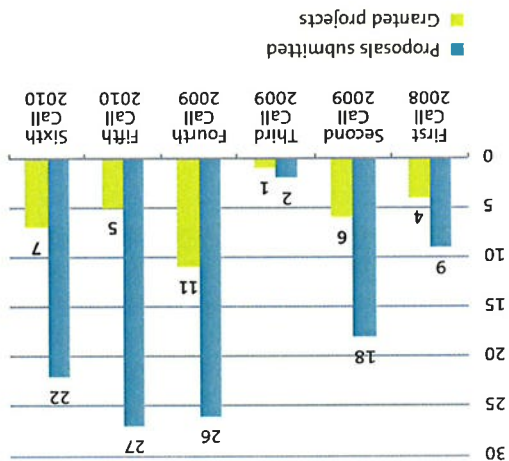


Figure 10: Number of submitted and approved Pre-Seed Grant proposals.

The Venture Challenge is a coaching programme led by a professional organisation (eNoviTe) in which six teams, led by experienced business coaches, work to improve their business idea. Through mutual feedback and participation by teams from both research institutes and teams from (large) companies, a basis is created for collaboration and networking. Interest in the Venture Challenge is increasing (from 8 applications in the autumn of 2008 to 18 applications in the spring of 2011). A maximum of 6 teams may participate each time and the challenge concludes with a pitch competition, in which all participants present their case to a jury and in which all relevant seed funds are present in the audience.

In the BioBusiness Masterclass, a sort of mini-MBA, potential entrepreneurs can further develop their personal and business skills. The New Venture business plan competition offers, in addition to an extensive network of general coaches, considerable media coverage and presentation and communication training, as well as interaction with many other (non-life sciences) entrepreneurs.

The Pre-Seed Grant is an opportunity to obtain initial funding of up to €250k for the establishment of a new company and is based on the successful Biopartner First Stage Grant programme that existed until 2005. Besides the €9 million that NCI made available for the Pre-Seed Grant, other resources have been added to the budget from



Figure 9: LifeSciences@work programme

The LifeSciences@Work programme (Figure 9) consists of a number of different programmes, each serving an element of starting up a business in the life sciences. These are partly existing programmes in which NCI is involved as a partner or financier, such as the New Venture business plan competition, the Masterclass BioBusiness and the Mibiton equipment fund, but also new programmes set up by NCI such as the Venture Challenge, the Pre-Seed Grant and, of course, the Biogeneration Ventures fund. All of these initiatives together form a coherent package of activities aimed at 'potential' life sciences entrepreneurs.

The third valorisation pillar is aimed specifically at starting new businesses in the life sciences. In the first phase, NCI has already helped establish a Biogeneration Ventures seed fund that can invest in early-stage start-ups. In the second phase, this is supplemented by a full range of support activities consisting of coaching, training, funding and networking. Although initially designed to support potential spin-offs from the NCI centres, the decision was soon made to extend the scope not only to genomics but to life sciences in the broadest sense and to open up the activities to all potential spin-offs - whether these arise from research funded by NCI or not. The idea here is that a stronger programme could be designed in this manner with greater added value for Dutch society, which also can provide higher quality because of greater critical mass.

The LifeSciences@Work programme (Figure 9) consists of a number of different programmes, each serving an element of starting up a business in the life sciences. These are partly existing programmes in which NCI is involved as a partner or financier, such as the New Venture business plan competition, the Masterclass BioBusiness and the Mibiton equipment fund, but also new programmes set up by NCI such as the Venture Challenge, the Pre-Seed Grant and, of course, the Biogeneration Ventures fund. All of these initiatives together form a coherent package of activities aimed at 'potential' life sciences entrepreneurs.

Life sciences start-up support: LifeSciences@work

Continued funding is now being assiduously sought for this successful programme.

The table below shows the number of spin-offs that have emerged from NCI's valorisation efforts. For the sake of completeness, the spin-offs are included from the entire NCI period.

2003	Bioceros
2006	Mucosis
2006	NovioGendix
2007	MyLife Technologies
2007	Progentix
2008	ARGEN-X
2008	Genovum
2008	Mucosa
2009	Griffin Discoveries
2009	IVitality
2009	Medisse
2009	NightBalance
2009	Photonics Healthcare
2009	Regenesance
2009	Vabrema
2010	AAK Biotech
2010	Angita (3D-Pharma)
2010	CQ-Path
2010	GlycoCheck
2010	Khondrion
2010	Maxam Medical
2010	Swan Diagnostics
2010	Syntecnos
2010	Visimetrix
2010	XAIR Diagnostics
2011*	Aeolos
2011	Biomimiq
2011	Biotxs
2011	ClearDetections
2011	Cristal Delivery
2011*	EnCARE Biotech
2011	IS Diagnostics
2011	Nano-FM
2011	Ocello (4DBio)
2011*	Polaris
2011	Preselect Diagnostics
2011*	SafeGluten
2011*	Seq-cure
2011*	Silenti Solutions
2011*	Solvartis

2002	Proensa	CMSB
2002	ServiceXS	CMSB
2003	Agendia	CGC
2004	DNAge	CGC
2004	Boke	CMSB
2004	Flexgen	CMSB
2004	ISA-Pharmaceuticals	CMSB
2004	ZOBIO	CMSB
2005	Synaptologics	CMSB
2005	Crosslinks	NBIC
2005	Knewco	NBIC
2006	Nsure	CBSG
2006	InteRNA Technologies	CGC, NBIC
2006	Harbour Antibodies	CGC, NPC
2007	InteRNA Genomics	CGC
2007	Agamyxis	CGC, NPC
2007	U-Protein Express	NPC
2008	Hitexacoat	Klyver
2008	Lifewiz	Klyver
2008	Bio-Product	NBIC
2008	Phasar	NBIC
2008	R-Consultancy	NBIC
2009	Explant Technologies	CMSB
2009	Acknowledge	NBIC
2010	MicroLife Solutions	ECO
2010	PR-Systemdesign	NBIC
2010	Sequenomics	NBIC, CMSB
2010	Purionics	NPC
2010	UbiQ	NPC
2010	Trajectum Pharma	VIRGO
2010	Viroclinics Biosciences	VIRGO
2010	Pepscape	VIRGO, NPC
2010 (2008)	Arcarius (therosteon)	CGC, NPC
2011	45ee Diagnostics	CGC
2011	Mycodanio	CGC

Table 4: Spin-off companies resulting from the NCI centres and valorisation activities. \* indicates the expected date of formation.

the innovation programme - LSH (€250k), the FES-LSH programme LSH (€3 million) and ZonMW (€400k). The programme has thus been open to the entire life sciences sector since late 2009. From its launch in 2008 through to the end of 2010, 104 proposals already have been submitted, of which 33 were approved (see Figure 10). Around €2.7 million remains of the original €13.4 million.

## BioGeneration Ventures

In 2007, BioGeneration Ventures (BGV), started investing in young life sciences starters with a total of €17 million, €6 million of which was a loan from NCI/NWO. Meanwhile, BGV has invested in thirteen early-stage life sciences companies. In this period, the fund was the most active investor in the Dutch life sciences. Approximately 100 FTEs currently work at businesses (partly) financed by BioGeneration Ventures.

Since the launch of BioGeneration, the share of NCI-related investment proposals has increased from less than 10% of the total deal flow per year to more than 33% in 2010. This increase was a direct result of new starters that emerged from the NCI Venture Challenge and the Pre-Seed Grant. This makes clear that the valorisation of NCI sponsored projects will mainly take shape in the coming years through start-up companies that are still being formed. Four of the companies in the BioGeneration Ventures portfolio were previously started with the help of BioPartner funding. This also demonstrates that a long lead time must be considered between (applied) research funding and the start of commercial exploitation.

Bringing all these activities together in one programme improves the help offered to start-ups, and it also creates a community in which new start-ups, experienced entrepreneurs, coaches and financiers meet. One example of this is the annual Lifesciences@Work event in which participants in different parts of the programme can meet each other, conduct one-on-one sessions with investors, entrepreneurs and coaches, and share experiences and knowledge in interactive workshops. There is also the Yels.Net network that brings together young entrepreneurs in the life sciences. The organisation of this network was recently transferred to the biotech industry association NIBA where it is now embedded. Although, as the name suggests, the Lifesciences@Work package is accessible throughout the life sciences, the NCI centres still participate to a significant extent. Participation in the NCI Venture Challenge is around 30% and in the Pre-Seed Grant around 20%.

Meanwhile, more than 50 new companies have participated in the various parts of the Lifesciences@Work programme. These companies range from very early-stage (a project still without legal status), through companies with (venture capital) funding and products under

development, to companies with products/services on the market. An overview of all these companies can be found in the Lifesciences@Work booklet *Nice to Meet You*.

## Mibiton

NCI participates with a relatively small amount (€500k) in the Mibiton foundation's revolving fund. This foundation invests in equipment and facilities for start-ups in the life sciences, and thus complements the entire Lifesciences@Work package.

## Valorisation Advisory Board

The Valorisation Advisory Board (VAB) is a board of six national and international valorisation experts, led by Rudy Dekeyser, Managing Director of the Flanders Institute for Biotechnology (VIB). The VAB provides NCI and the NCI centres with strategic advice in the field of valorisation. For this, they meet twice a year, with discussions taking place individually with each of the NCI centres. These discussions examine the organisation and status of valorisation in the centres, after which the board provides recommendations for further improvement. VAB also advises NCI on valorisation activities and how best to design these for the life sciences in the Netherlands. Several members of the VAB are also involved in the top sectors. In addition to its advisory role, the VAB is also the jury for the annual Valorisation Award. Individual members have been deployed for strategic masterclasses for TTO directors, have conducted workshops for the TTO network and have advised at the start of the Dutch TTO Association.

Recently, the VAB made several site visits to four Dutch TTOs. Once again the aim was to provide recommendations on how to improve the organisations. According to the VAB, the bottlenecks currently faced are the financing of TTOs in the Netherlands and the commitment from research institutes' boards to valorisation. This is further expounded upon in Questions 16 to 18.



**14. What is the so-called hidden valorisation, i.e., the estimated (future) value for the companies involved in sales of new products or services based on the knowledge generated by the centres?**

**15. What are the opinions of stakeholders on NCI's (economic) valorisation, (especially the companies in PPPs)?**

Both of these questions are addressed in a separate investigation into the multiplier that was carried out by Technopolis. The hidden valorisation, i.e., knowledge transferred to the companies involved without it being clearly and quantitatively expressed, is recognised by NCI, and the NCI Genomics Centres are reminded to make this form of valorisation as visible and quantifiable as possible.

In several centres, the companies involved have been questioned about the value of the research and knowledge generated for these companies. This was also included in Technopolis' multiplier study. NCI will continue to emphasise to the participating centres and companies that the visualisation of the added value of the research is very important.

## 16. Are additional activities required in the field of valorisation?

The NCI valorisation programme is broadly based and includes many of the necessary components to stimulate valorisation. In the Lifesciences@Work programme NCI has a complete package for supporting the first phase of starting businesses. However, there are still obstacles in the next stage, e.g., for performing clinical trials with patients and for further developing businesses. For the time being, this is outside the scope of NCI, since NCI's core activities centre around building a solid genomics knowledge base and infrastructure.

Valorisation from the NCI centres has been actively taken up as well: proof-of-concept resources are present and the NCI centres are well known to the TTOs involved. The TTOs ensure that there is commitment from the university long-term investment in the TTOs in the Netherlands and on several occasions recommended making considerable The aforementioned NCI Valorisation Advisory Board has ensuring that there is commitment from the university executive boards. NCI has also made these recommendations via the VSNU and the NFO and through the TTO directors and TTO visits directly to the university are still faced with understaffing and limited budgets as there is little structural funding for them in the Netherlands. Since 2005, universities have officially had valorisation as a third core task alongside teaching and research but, in most cases, this task has yet not led to any financial commitments.



by temporary resources. There is no structural funding for valorisation in the Netherlands.

To ensure that valorisation activities as set up by NCI will continue to exist beyond 2013, considerable effort is being put into top sector plans that also have a national and substantive focus. For example, an amount for start-up support has been included in the top sector plan for Life Sciences & Healthcare.

The NCI valorisation activities are now widely known to the existing valorisation infrastructure. Virtually all Dutch research institutes are involved with the various programmes and tools, as also evidenced by the participation in programmes such as Venture Challenge and Pre-Seed Grant. The national NCI valorisation tools are generally seen as complementary to the existing regional initiatives. Whereas these are often generic but regionally focused, the NCI initiatives focus nationally and specifically on life sciences. The problem with all of these (local and national) valorisation instruments is that they are funded

## 18. Has there been effective alignment with the existing (local, national) valorisation infrastructure in the Netherlands? Where can this be further improved?

Question 16: structural funding and commitment for TTOs, but it is also important to have a formal point of contact for companies and governments for the TTOs. VSNU and NFI need to actively lobby for this together. Structural funding of valorisation activities could be designed in two ways. On the one hand through increased efforts by the universities through direct government funding; on the other hand by reserving a portion (a minimum of 10%) of the PPP resources (preferably via the incubator model, see Question 5) for valorisation purposes.

NCI took part in the EU project Valor that examined a European approach to valorisation and in which a comparison of best practices in Europe was made, particularly in the area of valorisation through the creation of new businesses. The structure NCI designed – with valorisation as an integral part of research, with specific valorisation budgets, valorisation managers and the start-up support package – was found to fit perfectly with the recommendations that emerged from this project. However, several things still need to happen if a sound valorisation structure is to be set up that leads Europe not only in genomics but also in the broader life sciences. The

Question 5 under embedding centres). The issue will also be highlighted at the top sectors.

boards, but so far with little result. In the autumn, NCI will visit all relevant university executive boards to discuss this subject and the embedding of the NCI centres (see also

# 19. How is NCI doing in societal valorisation, i.e., the application of results that do not deliver immediate economic benefits but are of social value?

From the outset, NCI has adopted a broad definition of valorisation that comprises both economic and social aspects. No targets have been set for social valorisation, but the centres are requested to submit reports about social valorisation each year on 1 October.

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The definition of social valorisation has been the source of considerable discussion with the NCI centres. It is much less clear-cut than economic valorisation and it can involve both processes and products. The ERIC (Evaluating Research in Context) guide, developed by VSNU, NWO, KNAW, the Netherlands Association of Universities of Applied Sciences and the Rathenau Institute, offers no ready-made solution. NCI maintains the principle that it aims to monitor tangibly measurable outcomes. The NCI reporting format gives the centres the following guidance for indicators. Social valorisation can include clinical applications, other forms of translational research, methodology development serving legislation and regulation, policy advice, healthcare protocols, training of researchers and technical assistants regarding valorisation, and researchers leaving for industry. Other possibilities are more educational activities (for a non-academic audience), non-scientific articles in newspapers and popular magazines, public debates and dialogues, educational activities such as [www.allesoverDNA.nl](http://www.allesoverDNA.nl) (formerly [watisgenomics.nl](http://watisgenomics.nl)), mobile DNA labs, teaching materials for high-school students or informative material for patient groups, and major information days for patients or other target groups. Since the products of social valorisation are more ambiguous than those of economic valorisation, the centres are free to come up with their own suggestions for indicators. The results obtained from monitoring societal are described in the section Genomics and Society. For further information please see Questions 20 to 22.

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Social valorisation is also spotlighted during the annual Valorisation Award, a prize of €1 million for the NCI centre that has shown excellent results for a given theme of valorisation (which changes each year). In 2011, the Valorisation Award theme is 'Excellence in Social Valorisation'.

# Genomics and society

As part of 'Genomics and Society', both the interaction between social and genomics research, and the strengthening of social returns, including communication and education, are addressed. The NCI offices

communication activities have already been described in Question 1. Questions 20 to 22 focus on the activities of the Centre for Society and Genomics (CSG) in collaboration with other NCI centres.

## 20. Is CSG on track in achieving its research objectives?

Seven targets have been set for CSG with respect to scientific results on the one hand and social returns (education, communication) on the other. According to the 2008-2012 NCI business plan, CSG has the scientific goal of producing 20 theses and 250 scientific articles. The table below clearly shows that the target for the number of scientific publications will certainly be met. The number of theses is still low. Considering the starting dates of most PhD projects, it is not expected that the number of theses will be met before 2013. Completing a thesis in the social sciences usually takes longer than in the life sciences. Unlike the other NCI centres, CSG appointed primarily post-docs in the first phase and the number of PhD projects (four in total) was quite limited. Therefore very few PhD theses resulted from the first phase. Question 22 deals with the other CSG objective: the social return on investment (education, communication).

Table 5: CSG academic output

Academic output	2008	2009	2010
Articles total	39	86	113
IP > 5	3	5	1
IP > 10	2	1	3
Other academic publications (e.g. books)	6	7	12
Invited academic lectures	38	43	38
Conference presentations	27	40	79
Theses	0	1	1

## 21. How is the research collaboration between CSG and the other genomics centres going? Is it leading to adequate interaction between beta, alpha and gamma? Does the collaboration provide an added value?

The proposals for the joint research projects of CSG with the other centres were provided by the other centres at the beginning of the second phase and were reviewed by CSG's international advisory board. In a few cases, the assessment resulted in friction between the parties, but in all cases this was resolved and the research collaboration is going well.

The CSG has chosen a design in which only a small core work at the Radboud University Nijmegen and with the principal investigators and most of the researchers filling a position at any of the other NCI centres. This is actually the ultimate

form of the NCI matrix model. In this way, most CSG researchers work every day in a life sciences environment, yet they also have a home base within CSG where they can experience sufficient critical mass in the field of the social sciences. This latter is considered essential for elevating research and social science theory to a higher level.

Several times a year, CSG organises meetings to which all researchers are invited. In addition to regular presentations of current research, attention is also paid to specific topics such as the social valorisation of the research.

## 22. How are societal valorisation and the communication with society about genomics progressing?

In the context of strengthening social returns, CSG has been given the following targets for the second phase: 50 articles in popular magazines, 55 public debates and dialogues, 200,000 website visitors each year at [www.allesoverDNA.nl](http://www.allesoverDNA.nl) (formerly [wattisgenomics.nl](http://wattisgenomics.nl)) and 24,000 participants each year in the mobile DNA labs in secondary schools. Two major information days for patients must be organised as well. CSG has already surpassed the number of publications in popular magazines, but not yet the number of public debates. Nevertheless, this can be achieved on time. The number of non-scientific presentations is, however, very large as well. Many other centres are also showing good results. It is clear that they too consider communication with society to be increasingly important.

Table 6: Overview of several social valorisation results of NCI centres and the Horizon programme in 2008-2010.

2008-2010	CBSG	CGC	CMSB	KC	CSG	NBIC	NPC	CDC	EC	NGC	VRGO	FGCN	N C	NMC	NCSB	NCHA	Horizon	total
Non-scientific publications	26	76	665	39	107	20	26	17	13	4	52	8	2	22	14	43	25	1159
Non-scientific presentations	32	47	39	34	126	18	54	28	27	8	182	13	1	10	2	21	15	655
Public debates	3	3	31	4	28	2	1	1	2	7	9	0	1	2	0	0	6	100
Educational activities	4	37	199	189	15	76	41	16	4	6	109	18	2	14	22	7	31	790
Clinical appl.	0	0	0	0	1	0	13	1	7	0	8	0	0	0	0	0	1	31
New products	3	0	15	0	1	56	0	0	0	0	0	0	0	4	12	0	7	98
Advisory reports	3	10	6	6	2	0	15	0	1	0	23	0	0	1	6	0	22	95



- Many national radio and TV appearances on various subjects, such as interviews with Martina Cornell on the risks of marrying your cousin (Avro, Radio 1), Cecile Janssens on direct-to-consumer genetic testing on Tros Radar (TV), Hub Zwart about synthetic biology on VPRO Noorderlicht (Dutch TV science programme), Albert Heck on proteomics research on Hoezo?Radio! and Patricia Ossweiler on consumer and genetic modification (Radio Kassa). A great deal of media attention has been devoted to the first woman to have her entire genome sequenced - Marjolein Kriek - who, as a clinical geneticist, could explain in this very well (CMSB). In addition, the social relevance of the research centres CMSB, CBSG, NPC, VIRGO, CDC and NCHA will be highlighted in 2011 at their own initiative in the TV series: "Lang zullen we leven" [Long Shall We Live] (RTL 4).
- Presentations and publications aimed at specific target groups also took place: for example, an article about the usefulness of genetic self-tests for the general practitioners' magazine VUMC, a presentation on carrier and hereditary for V5OP (Cooperating Association Parent and Patient Organisations), but also large-scale public events such as "Cancer Genomics Market Plaza", an event for cancer patients, professionals and interested parties that has twice drawn over 1000 participants (CGC together with CSG). A range of public activities were organised in the international Year of the Potato (CBSG) and a lecture on forensic DNA research was given for thousands of young people at the Lowlands music festival (FCGN).
- Each year, the competition Imagine takes place. This is a competition among groups of high school students who work together with scientists to realise innovative solutions for problems in developing countries (KC and CSG).
- Monthly dialogue meetings are held in "De Rode Hoed" science café about all sorts of genetic issues (CMSB). Dozens of dialogue meetings, debates and panel discussions are also organised at various locations with disparate topics such as: synthetic biology, prenatal genetic screening, autism and genes, biofuels and economics. CSG initiated most of these dialogues.
- Several centres have contributed to museum exhibitions. Together with RANJ, VIRGO developed an online game

- The objectives for the more educational activities that CSG coordinates are not achieved every year. Participation in the mobile DNA labs is behind schedule because one of the planned DNA labs never started (Table 7). In 2010, however, a completely new DNA lab started in the field of forensic genomics. The expectation is that this will result in increased participation in the coming years. The interest in the mobile DNA labs remains unabated; they are fully booked almost immediately after the opening of online registration. They are greatly appreciated by the high school students and teachers, as equally by the students who organise the labs. Besides the mobile DNA labs, a major event has been held each year since 2010 exclusively for teachers so that they can update their knowledge of genomics. The Forensic Genomics Consortium is also using the new DNA lab for the education of trainee police officers so as to properly highlight the possibilities and limitations of DNA analysis in forensic investigations. The possibility of implementing a permanent DNA lab in the Microzoos at Artis in Amsterdam is currently under consideration. During the remainder of NCI, the embedding of the highly successful travelling DNA labs will be examined.
- A number of CSG activities and those of other NCI centres are briefly addressed below:
- More than a thousand non-scientific publications have appeared in Dutch national newspapers and magazines. Examples are "Embryo Selection" (NRC), "More Abortion with Spina Bifida and Hydrocephalus" (various national newspapers) and "DNA Entertainment: Genes Passport: a glimpse of the genes" (Intermediar), "Migration Politics and Genetics Don't Go Together" (NRC), "Set Climate Technology Free Instead" (NRC), "Support for GM Can Be Created" (Financieel Dagblad), "Chemo Often Unnecessary" (Telegraaf) about the Mammaprint DNA test, "Factory Gets Fuel from Wheat Residue" (Volkskrant), "The David Beckham of Virology" (Volkskrant, about Ab Osterhaus), "Is Fasting and Detoxing Good for the Body?" (NRC Next), "Harvest Time for Gene Researchers" about healthy ageing (NRC).

Table 7. Number of visitors to website and DNA labs

Education	2008	2009	2010
Visitors to public website	242,049	240,565	91,167
Visitors to DNA labs on the road	14,405	17,400	17,762

- "The Great Flu" for high school students. This was combined with an exhibition at the Natural History Museum in Rotterdam. CSC and FGCN participated in the exhibition "From Adam to DNA" in the Boerhaave Museum in Leiden and CBSG participated in an exhibition on potatoes in the University Museum Utrecht.
- The centres publish several magazines/brochures, such as CSC's 'LEV', which highlights the social aspects of genomics for a wide audience. NTC described the potential of toxicogenomics as an alternative to animal testing in a brochure for politics, policy and governance.
  - Advisory reports written include those on biofuels for the European Parliament (KC), and the social relevance of biotechnology trends as part of the Biotechnology Trend Analysis 2009 (CSG). Almost 100 advisory reports have been published (one-quarter by Virgo). Another important aspect is the participation of scientists in key advisory bodies such as the Health Council of the Netherlands and WHO working groups.
  - Many new products have been developed. These often are computer programs and manuals, but also methods or tools, such as developing a fully automated laser micro-dissection platform for fixed and live cells (NPC).
  - Non-commercial clinical applications include the development of protocols, for example, a guideline for the prevention of infection in hospitals (VIRGO).
- The calculation of a social multiplier, as was done by Technopolis for NCI's economic value creation, is as good as impossible even though both cases are interdependent and can blend into each other. NCI has therefore limited itself to monitoring the aspects above that are indicators for the social benefit of NCI's effort. This value will become increasingly visible in the future as concrete products and services are brought to the market.

## 24. Were the programmes set up and implemented efficiently?

A funding round is organised as follows: the starting point is the deadline for submitting a preproposal (short application of a few pages). A committee then evaluates the preproposals; the committee consists of genomics and bioinformatics scientists, some working in an industrial environment. Applicants with promising preproposals are invited to submit a full proposal (approximately 20 pages). Two to four national and international experts evaluate each full proposal in writing. Applicants are then given the opportunity to respond with a written rebuttal to the expert reports. Based on the applications, expert reports and rebuttal, the committee makes a recommendation to NCI. The round ends with NCI's decision to approve or reject proposals for funding.

Application pressure: an average of about 100 applications per funding round are submitted. So the application

pressure is high - roughly twice that of the average programme and comparable only to that of the Innovative Research Incentives Scheme.

Time-frame: the average duration of a Horizon funding round is 28 weeks (6½ months). This is shorter than the standard time-frame for a funding round at ZonMw (35 weeks).

Personnel: the programme office consists of a programme secretary (0.7 FTE), a programme assistant (0.6 FTE) and a secretary (0.5 FTE). Programme overhead is 5%, which is in line with the NWO standard. The activities include the organisation and realisation of a funding round, progress monitoring based on annual reports and giving publicity to interesting research results (such as the 2010 Horizon results brochure).

## 25. How did the programmes contribute to a pleasant climate for attracting and retaining scientific talent?

The high application pressure is a sign that scientists are attracted to the structure and content of the programme. The applicants have also proven to be talented scientists, since the committees' and the experts' average assessment of their research proposals and CV was 'very good'. Laureates are generally rated as 'excellent'. To retain proven talent, Horizon banks on progression within the programme. To encourage this process, project applications based on the Breakthrough project go through a simpler procedure during the preproposal phase for a Zenith project. The Horizon committee found that 80% of these preproposals had achieved proof-of-concept as originally described in the Breakthrough project. Progress within the programme has therefore proven to be possible. In Horizon II, during the first round of Zenith, half of the successful proposals (6 of 11) were preceded by a successful

Breakthrough project. At the time of Horizon I, this was one-third (5 of 15).

Horizon laureates have recently been surveyed about the extent to which the grant enabled the attraction and retention of talent. This survey (106 approached, 77 respondents) revealed that the grant has enabled the project managers to perform innovative and risky research that, in their estimation, would otherwise have not been funded. This often led to the setting up of an own line of research, which resulted in a new research group due to the attraction of talented personnel (postdoc, analyst, PhD). In half the cases, the specific topic of research was continued after completion of the Horizon project. Although difficult to substantiate quantitatively, a striking majority (90%) of the respondents indicated that the

## 23. To what extent have the set objectives been achieved?

In the '2008-2012 NCI Business Plan', the following objectives for the Horizon programme are described:

- Encouraging innovative genomics and/or bioinformatics research and the related valorisation of research findings;
- Providing opportunities and prospects to young, promising researchers for starting and developing their own line of research:

The Horizon II programme (2008-2012) has specific objectives: i) focus on the development of individual, talented researchers, ii) support of innovative research, and iii) stimulation of valorisation of research results. For this, the programme is divided into two stages:

- In the first phase, researchers have the opportunity to demonstrate their talent during a short research project: the Breakthrough project (€100k, 12 to 18 months). The focus is on developing an innovative concept to the proof-of-concept stage. Three Breakthrough projects rounds (rounds 5, 6 and 7) have been organised (2008-2010). Funds were available to honour 91 projects.

- In the second phase, researchers with proven talent have the opportunity to submit a larger research project: the Zenith project (€400 to 500k; 4 to 5 years). These projects are designed to elaborate a proof-of-concept into a mature

- Approximately 100 researchers are given the opportunity to perform a promising project (€100k is reserved for each Horizon Breakthrough project)
- Approximately 20 researchers are given the opportunity to continue a project (€500k is reserved for each project, later called Zenith)

research line and to allow researchers set up or expand their own research. The first funding round for Zenith projects was completed in 2011. The second (and final) round will be launched in late 2011 and will end in mid-2012. In total, approximately 20 Zenith projects will be awarded funding.

- Horizon II differs from Horizon I (2003-2007, four rounds of Breakthrough projects and two rounds of major projects) in two aspects:
  - The potential for valorisation has become a criterion;
  - The grant is entirely personal: each application has only one main applicant and no co-applicants.

The programme is ongoing, but it may be concluded that the goals will be largely achieved (91 instead of 100 researchers in the Breakthrough projects and all 20 researchers in the Zenith projects).



# International expansion

Various activities have been set in motion for each component, but some activities that had been started in the first NCI phase have also been continued. The activities listed below relate to the programmes the NCI office was involved in. Most activities in the field of international expansion will be realised/coordinated by the NCI centres themselves, since they are, after all, the NCI 'brands' (see Question 30).

The questions for the evaluation of this component are:

## 29. Is each line of action sufficiently detailed? What was the added value?

For the second phase, NCI has set itself the target of focussing its international collaboration effort on strengthening the quality and applicability of genomics centres. This will be aligned as closely as possible to current or to-be-started initiatives and to responding to new possibilities that offer specific opportunities for the Netherlands. The NCI budget for international expansion is very limited in the second phase (€4.5 million).

promising research area, which could potentially have a strong impact on innovation and technological progress that is beneficial for the economy and for society as a whole.

ERANet Industrial Biotechnology NCI participates via NWO/CW in co-financing both of this programme's calls with a total of €625k. The funded European collaborative projects tie in well with the Kluwer Centre and focus on the optimisation of bio-based production processes and microbial biotechnology.

Valor INNO-NET Valor looks at a European approach to valorisation through spin-off creation. NCI has been a partner on behalf of the Netherlands. The results of INNO-NET Valor are a common methodology and a joint action plan towards the EU for dealing with valorisation. NCI has used recommendations in the report to design the Lifesciences@Work package.

ELIXIR (European Life Sciences Infrastructure for Biological Information) Together with NBIC, NCI is actively involved in the preparatory phase of ELIXIR.

(ERA-CAPS) can be started in early 2012. ERANet Synthetic Biology (ERASynBio) NCI, along with other NWO areas in the life sciences, is represented in the Task Force on Life Sciences (TFLS). Within this TFLS, NCI is involved in setting up a new ERANet ERASynBio. This ERANet is aiming for European collaboration in the field of synthetic biology. Synthetic biology is an emerging and

international networks: ERA Plant Genomics has been continued from the first phase. NCI was the coordinator of this network and the term was originally planned until the end of 2006. A two-year extension has been realised and, in 2007, a successful second call was issued. The programme has established 41 international collaboration projects (of which 18 projects involved a Dutch partner) and has a total budget of €56 million. With an eye to its own term, NCI could not be the motor for a follow-on project, but the BBSRC (as one of the most important partners) was willing to take over the initiative, with NWO/ALW as the Dutch representative in the network. It is expected that the successor to the network (ERA-CAPS) can be started in early 2012.

ELIXIR is the 'Shared European Platform for Data Resources in the Life Sciences'. It is one of 35 large-scale European infrastructure projects selected by an independent commission and published in the Roadmap of the European Strategic Forum for Research Infrastructures (ESFRI).

NCI also has provided direct research funding to a number of international consortia which included NCI centres: Brassica Shortly after the start of the second phase, a collaboration totalling €2 million was established between researchers from the CBSG and Canadian researchers in the field of Brassica. Three PhD projects, with mutual data exchange, have been launched in both countries. The researchers visit each other once a year. The project pairs have already exchanged equipment, people and/or technologies. There is extensive use of complementarity in knowledge and expertise in connection with similar biological targets.

Potato Genome Sequencing Consortium This network (coordinated by CBSG) mapped the entire genome of the potato, which turned out to be a very successful collaborative project. The results of this project were published in a recent article in Nature.

SD-PPM (Sino-Dutch Centre for Preventive and Personalised Medicine) The SD-PPM is a unique collaboration between China and the Netherlands that seeks to link the holistic and personalised approach of traditional Chinese medicine with the emerging Western systems biology. The collaboration with a total scale of €3 million is supported by the Chinese Academy of Sciences, the Chinese Ministry of Science and NCI (NCI contributes €1 million). The programme is conducted as a collaboration between TNO, the Dalian Institute of Chemical Physics (DICP) and the Netherlands Metabolomics Centre (NMC). The project is partly supported by the Dutch Arthritis and Rheumatism (Arthritis) Association for optimal focus on the patient. The project has succeeded in explaining a sub-typing of type 2 diabetes in an early-stage by a comparison of diagnoses using traditional Chinese medicine and those of modern Western techniques. This makes a new personalised approach to type 2 diabetes possible. A sub-typing and a better understanding of the underlying biochemical mechanisms has also become possible for rheumatoid arthritis.

NWO programmes NCI has received resources from the NWO Governing Board for international collaboration projects with the emerging economies of India and China. One such project is a collaboration between CBSG and Indian researchers in the field of anti-fungal resistance in tomatoes. The other project is a collaboration between the Kluyver Centre and the Institute for Industrial Microbiology and Biotechnology of the Chinese Academy of Sciences (CAS-IM) in the area of the production of the biofuel butyl alcohol using microbial fermentation. Initial results have led to a better understanding of the factors involved in the butyl alcohol tolerance of the producing organism.

**Other activities:**

Travel grant NCI has created a travel grant called the Distinguished Visiting Scientist Grant to promote the exchange of top international researchers, to share knowledge and experience, to increase the visibility of the centres, to allow Dutch researchers to go abroad and to temporarily bring top foreign researchers to the Netherlands. In 2009-2011, NCI made a total of 15 grants available to interested NCI centres. Six researchers received a grant to come to one of the NCI centres in the Netherlands, and nine to go abroad. One of the programme's requirements was that the top researchers would receive sufficient exposure and would also actively get in touch with young researchers. The nine top scientists who went abroad have also all received an extra budget to allow young researchers (post-docs or PhDs) to join them temporarily. The duration of the exchange varies from about 3 to 9 months and is sometimes in the form of repeated short visits.

Recommendation to European organisations about PPPs The book Partners in the Polder has led to multiple requests from countries (Finland, the German Free State of Saxony) and institutes (EU) for recommendations about the experiences and do's and don'ts of PPPs.

## 26. How did the programmes contribute to integrating genomics and bio-informatic technology?

Horizon grant clearly had a positive effect on their own careers. The respondents indicate that the Horizon grant gave them a name and status in the genomics/bio-informatics field. This made it possible to establish national and international contacts, become embedded in European cooperative associations, gain a tenure track / group leader position inside or outside their institute, and publish scientific articles (a total of 163 publications based on Horizon research, including articles in Nature and Science).

Although it is unlikely that the size of the Breakthrough project grant (€100k) tempted researchers who work abroad to come to work (again) in the Netherlands, the climate for genomics and bioinformatics in the Netherlands is such that foreign talent are submitting project proposals to Horizon. Approximately 20-25% of the applicants are of foreign origin. The percentage of approved grants is similar.

## 27. How is the embedding process faring: is the new talent finding its way in the Netherlands' life sciences infrastructure?

The final reports and the aforementioned survey reveal that the majority of the project leaders intend to continue the line of research after completion of the Horizon project. In roughly half of the cases, resources for this have been found from many sources (mainly grant programmes from the Dutch government, but also from own resources or from industry). European grants within the FP7 programme have also been secured based on the scientific experience and international contacts gained during the Horizon project. With a few exceptions, all Horizon project leaders are still active in the Dutch life sciences.

An analysis of the Horizon I programme (2003 - 2007) carried out by ZonMw shows that one-third of the applications involved a combination of genomics and bioinformatics research. To stimulate the link between the two areas further and to make this combination a 'matter of course', Horizon II (Zenith rounds) makes it possible to request a supplemental budget (€100k) if the project includes bioinformatics research. In the first Zenith round, two-thirds of the applicants used this option and three-quarters of the approved projects requested additional funding for bioinformatics. Compared to Horizon I, this is more than a doubling of the number of projects that integrate genomics with bioinformatics. The Horizon committee has been expanded to include additional bioinformatics professionals in order to assess the quality of the applications.

## 28. How do the programmes contribute to the NCI's valorisation objective? Have companies benefited from the new talent? How can NCI contribute here?

Horizon has promoted the valorisation of the projects by linking a valorisation officer from the local TTO to each approved project. Also, project leaders may participate at least once each year for free in a valorisation and patenting workshop of NCI or an NCI partner. An active attitude towards valorisation is expected from laureates: this is part of the grant conditions. The steps the project leaders have taken towards valorisation are a recurring theme in annual progress reports.

Selecting according to potential for valorisation has paid off. Final reports and the aforementioned survey show that 16 patent applications have been submitted based on results obtained in a Horizon project. Three patents have been accepted. Also, two spin-off companies have been created from a Horizon Breakthrough project.

For over 30% of the respondents, the Horizon project resulted in collaboration with a company. Usually this involves joint research or further testing of technology developed in a Horizon project. In a few cases, it involved the joint submission of a patent application with a company or negotiation of the licensing for intellectual property.

Since 2010, the programme has a new form of grant: the Horizon Valorisation Project Grant. It can be claimed by winners of a Breakthrough project, with the aim of further supporting the valorisation of the research results - with validation studies, for example, or (pre-) clinical research. Up to €50k is available for each project. The total budget is €600k. Ten applications have been submitted and 9 of these have been approved.



## 30. Are other activities required in internationalisation?

NCI stimulates the centres and, where necessary, facilitates the process of attracting additional EU funds. Figure 4 (Question 1) demonstrates that this is bearing fruit. Of the additional public revenues that the centres managed to secure in the 2008-2010 period (€287.8 million), almost half were obtained from EU funds (ERC grants, FP7). NCI itself will no longer undertake internationalisation initiatives, since it usually takes a long time before such projects can be started and NCI has only a limited lifespan. Furthermore, it is general NCI policy that internationalisation policy should take place mainly through the NCI centres. Where possible, the NCI office will help the centres attract foreign funding or to develop partnerships, since the centres themselves must secure their own future.

Notes



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Postal address: PO-Box 93035, 2509 AA The Hague - The Netherlands Office address: Laan van Nieuw Oost Indië 334 - 2593 CE The Netherlands

Netherlands Genomics Initiative

