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International cooperation of Competence Research Centres

Final Report for COMPERA

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Abbreviations

AIDICO	Technological Institute of Construction (Valencia)
AIJU	Technology Centre for child safety (Valencia)
BERD	Business expenditures in R&D
BNPT	BalticNet-PlasmaTec (Germany)
BRIC countries	The economic emerging countries Brazil, Russia, India and China
CCS	Carbon Capture and Storage
CIC biomaGUNE	Centre for Cooperative Research in Biomaterials (Basque Country)
CoE	Centre of Excellence
COMPERA	ERA-NET on national and regional programmes and initiatives dedicated to the creation and support of Competence Research Centres
COST	European Cooperation in Science and Technology http://www.cost.esf.org/
CP	Competence Poles: a Flemish innovation support measure
CRC	Competence Research Centre
DG	Directorate General
EC	European Commission
ECTP	European Construction Technology Platform
EIP	Entrepreneurship and Innovation Programme
ELIKO	Competence Centre in Electronics-, Info- and Communication Technologies (Estonia)
ERA	European Research Area
ERA-NET	Policy instrument of the European Commission for the coordination of national research programmes in Europe.
ERC	Engineering Research Centre (USA)
EU	European Union
EuRaMIG	European Radio and Microwave Interest Group
FMTC	Flanders' Mechatronics Technology Centre
FP	Framework Programme (EU policy measure to support the development of STI)
GCCSI	Global Carbon Capture and Storage Institute
I/UCRC	Industry/University Co-operative Research Centres
IAB	International Advisory Board
IBBT	Interdisciplinary Institute for Broadband Technology (Flanders)
ICT	Information and Communication Technology
IMEC	Interuniversity Micro-electronics Centre (Flanders)
IPI	International Partnership Initiative (Canada)
IPR	Intellectual Property Rights
IWT	Flemish Agency for Innovation by Science and Technology
JTI	Joint Technology Initiative
N (or: n)	Sample size
NCE	Networks of Excellence
NCE	Networks of Centres of Excellence (Canada)
NSF	National Science Foundation (USA)

NRW	Nord-Rhein Westfalen
QUB	Queens University Belfast
Questor	Environmental Competence Research Centre in Belfast (Northern Ireland)
R&D	Research and Development
R&I	Research and Innovation
S&T	Science and Technology
SME	Small and Medium sized Enterprises ¹
SRC	Strategic Research Centre: a Flemish STI support measure
STI	Science, Technology and Innovation
VDI-TZ	Verein Deutscher Ingenieure Technologiezentrum (Germany)
ViF	Virtual Vehicle Centre (Austria)
VINN	Excellence Centres programme in Sweden by VINNOVA
VINNOVA	Swedish Governmental Agency for Innovation Systems
VITO	Flemish Institute for Technological Research

¹ See http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm for a definition

Executive summary

The stimulation of international cooperation in research and innovation receives more and more policy support in the EU countries. A selection of nine partners from the COMPERA ERA-NET have commissioned this study on the needs and opportunities of the individual Competence Research Centres (CRCs) in relation to international cooperation and the barriers that exist at the level of the funding agencies and Ministries in order to respond to these needs.

For CRCs the drivers to engage cross-border collaborations come from the centre's stakeholders facing various international challenges, from developments within science and technology that ask for critical mass and excellence and from the European, national and regional policy making bodies that see the potential for opening up to international partnerships.

In the nine reviewed countries a clear trend can be seen that stimulating international positioning of the CRCs has become an integral part of the CRC-programmes. A strong international positioning and visibility is seen as an important element of a CRC's competitive position. A clear and explicit international strategy at the CRCs-programme level does help to push the internationalisation activities a step forward and allows the centres to overcome practical barriers such as allowing some forms of cross-border funding. The Swedish and Austrian competence centre programmes are good examples where explicit internationalisation incentives from the funding agencies Vinnova and FFG have helped centres to integrate international cooperation into their operations.

The CRC-managers do see the potential merits of CRC-CRC cooperation in terms of focusing on a particular geographical area (with strong competences in a thematic domain or strong markets) and working together with another CRC in that area to link the individual members of these CRCs (universities, research institutes and companies). The CRC managers are in principle very customer focused and their first consideration is whether a link with another CRC brings either additional scientific and technological expertise or market access to their companies. As time and management means are scarce (the key barriers according to the survey) this should be a focused effort rather than a more general networking activity.

Nevertheless there still are considerable barriers. Arranging public funding for foreign partners to work within one or more CRCs is still difficult in most countries. Another barrier is the difficulty many CRC-managers and their stakeholders have to identify the right foreign partners and build up a trust relationship with them. Whereas the survey amongst 72 European CRCs showed that the settling of Intellectual Property (IP) is perceived as a large barrier, the case studies showed that the CRCs experienced in international cooperation have found ways to tackle IP issues.

There is a clear pattern in all studied cases considering the development cycle CRCs undergo in terms of engaging into international cooperation. While just established CRCs are mostly engaged with building up trust locally, the most advanced CRCs can already benefit from their international reputation to attract partners. Any policy support for internationalisation should take account of these development stages and not define international cooperation as a goal in itself, but as a means to create added value to the CRC stakeholders. Internationalisation thus becomes an integral part of the CRC's research and business strategy.

The case studies of individual centres also demonstrate that good practices have been developed throughout Europe. The cases provided examples of centres that have foreign partners (including companies) engaged in the centre's governance structures and research programming, where long term alliances with foreign universities and research institutes have been established and regulatory bottlenecks have been circumvented by solid partnership contracts.

This study leads to the following recommendations to stimulate international cooperation in CRCs:

1. Funders of CRC programmes should establish clear guidelines as to what level of international involvement of foreign partners in a CRC is on the one hand expected and acceptable;
2. CRCs that have a certain maturity should be asked to define more explicit internationalisation goals and develop activities to achieve this. This could be integrated in their performance indicators. However, this international cooperation should not become a goal in itself but a means to create added value for the stakeholders of the CRC;
3. National and regional CRC-programme managers could develop a flexible 'internationalisation' package that CRC-managers can apply to in a competitive mode. The Vinnova 'globalisation grant' could be an example of such a scheme. As internationalisation activities are different for each CRC and in various development stages, the types of activities funded should be defined flexibly;
4. As a European CRC-programme network provide a dissemination platform for CRCs on a thematic basis and link these with existing national platforms for CRCs and thematic cluster initiatives to make the activities and competence areas of CRCs more visible;
5. Use the COMPERA type network to provide more active broker services to CRC-managers seeking specific partners in other countries. This could involve the support of a more active CRC-CRC collaboration, for instance through CRC-management exchange programmes where CRC-managers select a desired partner region or CRC to visit;
6. Explore as ERA-NET potential exchanges of experience and possible bilateral co-operation agreements with similar CRC-programmes in for instance the US, Canada and Australia;
7. Develop more explicit links between the national CRC-programme and existing national services for acquiring EU-funding, export support and agencies responsible for attracting foreign investments to match their activities with the specific needs of the CRCs;
8. Develop short and focused CRC-management training modules on topics such as "how to involve foreign companies in my CRC-organisation", "good practice in IPR management". Given that time constraints were a major bottleneck these training modules should be very professionally organised. They could build on the experiences of 'peers': the managers of CRCs that have shown to be successful in their international cooperation activities.

1. Introduction

This report provides the results of a study on internationalisation of Competence Research Centres (CRCs), conducted on behalf of COMPERA.

COMPERA, an ERA-NET set up with support from the European Commission, has 16 partners in 12 countries². The objective of the ERA-NET scheme is to step up the cooperation and coordination of research activities carried out at national or regional level in the Member States and Associated States through the networking of research activities conducted at national or regional level, and the mutual opening of national and regional research programmes. In the case of COMPERA the focus of cooperation is on Competence Research Centre (CRC) managers. The COMPERA definition of CRCs is “structured, long term Research Technological Development and Innovation (RTDI) collaborations in strategic important areas between academia, industry and the public sector”³.

The main mission of COMPERA is to develop useful mechanisms that foster cooperation between the CRC-programme managers. COMPERA is targeted towards the creation of a sustainable network of programmes that are funding Competence Research Centres. It should lead to a strategic decision-making of programme owners and managers at pan-European level with regard to Competence Research Centres. These centres aim to bridge the gap between technological and economic innovation by providing a collective environment for academics and industry and sufficient critical mass. Their activities are multiple: pooling of knowledge, creation of new knowledge by performing different types of research, training and dissemination of knowledge.

Most of the COMPERA partners are STI agencies that foster CRCs. Other partners are technology associations, STI departments and regional development organisations. The variety in partners mainly concerns the geographic scope (national versus regional) and the organisational position (ministry, regional development agency or STI agency). Nevertheless, the goals of the partners are similar, namely closing the gap between research and successful application. The partners use a variety of approaches and measures, ranging from competence centres in a specific thematic field, to bottom-up generic programmes.

Nine of the COMPERA partner organisations are participating and have funded this study:

- IWT, Flanders (Belgium)
- FFG, Austria
- Vinnova, Sweden
- InnoBasque, Basque Country (Spain)
- Enterprise Estonia, Estonia
- Ministry of Higher Education, Science and Technology, Slovenia
- VDI TZ, Germany
- Invest Northern Ireland, Northern Ireland (United Kingdom)
- Generalitat Valenciana, Valencia, (Spain)

² See Appendix A for an overview

³ Presentation Frank Monteny, CRC Conference Düsseldorf, 3 February 2009.

Policy makers and CRC managers find it very important that the CRCs **open up internationally**. This study is aimed to understand the international collaboration activities of CRCs better, their motivations, rationales as well as the barriers and opportunities for this collaboration.

This report is based on a set of research activities to understand international co-operation between:

- A general overview on the debate on internationalisation of R&D and deriving from that a typology of international collaborations;
- A survey and interviews in the COMPERA community on the needs, opportunities and barriers for cross-border collaboration between CRCs;
- Eight case studies of competence centres which serve as an illustration for good practices in international collaboration.

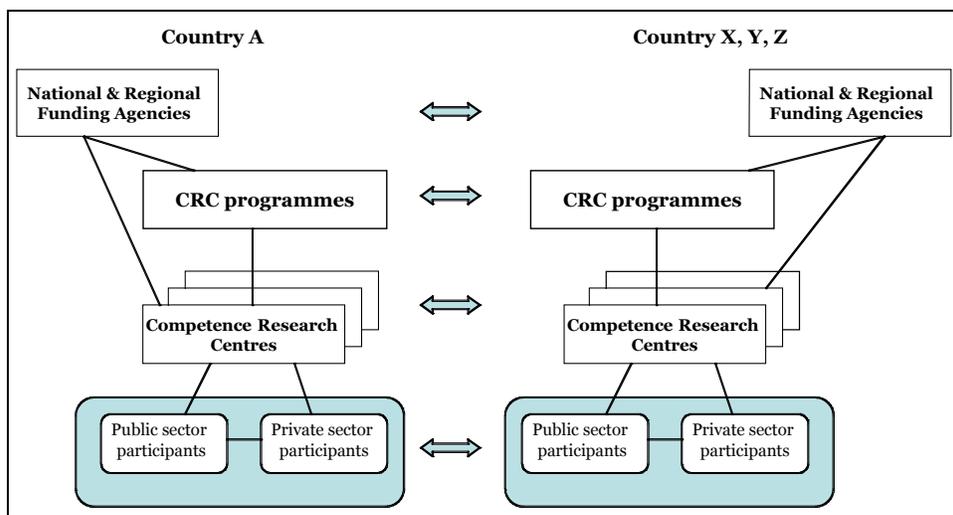
In the Swedish case, VINNOVA asked us not to send out a survey but to re-use information it had collected via an expression of interest for its new Global Links programme. Sweden does not therefore form part of the survey analysis, but we refer to the VINNOVA material as appropriate in the study.

The study looked at different levels of stakeholders that all influence the outlook towards international collaboration. At the centre of the study are the individual CRCs and their management bodies. They represent the community of public and private research performers who perform collaborative research in their different localities. These individual research performers or participants of the CRC research are another layer. Their specific background, sectoral specialisation and international experience influence the likelihood for a CRC to engage in international collaboration.

In many COMPERA countries individual CRCs are part of a broader CRC programme, implemented through various agencies that interact with the individual CRCs. Finally, public funders of CRC programmes mostly set the rules of the game, which could be either very favourable to cross-border co-operation or (unintentional) restrictive.

Figure 1 illustrates these levels and their (potential) interactions. While the focus of the study will be on the middle levels of the CRC programmes and individual CRCs, the role and influence of the other stakeholders need to be taken into account in the generic study and the cases.

Figure 1 Different levels of stakeholder involvement around CRCs



The selection of case studies is based on desk study, the interviews with programme managers, and the survey. The programme managers gave relevant suggestions in which cases might be most interesting, the survey retrieved information on the amount of co-operations of each CRC, and gave insight in what were considered best practices according to the CRC managers. The following set of criteria were used to select case studies:

- the number of co-operations;
- the visibility of the co-operations to the programme managers;
- a good geographical spread;
- a mix of virtual and physical CRCs;
- a mix of regional and national CRCs;
- a mix of different instruments
- a mix of EU co-operations and co-operations with third countries (i.e. extra-EU co-operation)
- the extent to which CRCs are internationalised. However, the CRC needs at least to have some international co-operations, to serve as a good case.

In every participating country, we found CRCs with potential for a case study. The selection of cases was based on geographical spread, the number of co-operations (survey) and the visibility to the programme managers (interviews); Appendix C gives an overview of the selected case studies. The full results of the case studies are given separately in a final Chapter as each contains a quite varied story about its development and the international collaboration activities.

The report is structured as follows. Chapter 2 discusses the emerging discussion on international cooperation in science and technology policy and the (external) drivers behind this trend. Chapter 3 elaborates on internationalisation in CRC programmes in the COMPERA - group and some CRC programmes in other non-EU countries. Chapter 4 provides characterisations of the CRCs based on a survey of CRC-managers and eight case studies of individual CRCs. Chapter 5 discusses the experiences with internationalisation in practice, its drivers, barriers and the effects. Chapter 6 gives the conclusions on the material and the recommendations for future Action for COMPERA and CRC-programme managers. The complete case eight studies are described in Chapter 7.

2. Emergence of international co-operation in S&T policy

International cooperation in research policy is a discussion where the European Commission has played a dominant role, particularly in the context of the Lisbon agenda and the European Research Area. The ERA Green Paper⁴ particularly suggested more well-coordinated research programmes and priorities across member States and also a wide opening of ERA to the rest of the world. The well-coordinated research programmes could be achieved through better joint programming between ministries and agencies across Europe. The ERA-NETs were meant to facilitate this process. For CRCs this could for instance mean the co-design of CRC programmes between two or more countries, with access to each other's programmes and centres for all potential partners. In the summer of 2008 the Commission published a Communication on Joint Programming.⁵ Joint Programming is portrayed as "a voluntary process for a revitalised partnership between the Member States based on clear principles and transparent high-level governance." The Communication made a plea for more intensive use of Joint programming and to move beyond the compartmentalised research landscape. The document states that *"the multitude of national procedures complicates cross-border programmes and discourages internationally oriented research actors from accessing research funding across borders."*

The focus of the ERA discussion is on public-public collaboration and fundamental science, but the door is kept open to include public-private cooperation and applied research as well. Today's spotlight of Europe's Joint Programming discussion is on tackling Societal Challenges, such as Ageing Society, Alzheimer's disease, Food for a growing world population and Water scarcity. In the arena of public-private cooperation, the joint programming and international collaboration policy debate is less clear and national industrial and strategic interests come to the surface in platforms such as the "High Level Group for Joint Programming" set up by the EU Member States. The CRCs are also in this arena and the COMPERA study so far shows that cross-border cooperation on the programme level and the centre level face more political barriers (see Chapter 2) than fundamental and 'societal' research.

A related discussion is that of 'opening up' of national programmes. If states allow participants from other countries to participate, while funding is arranged in the country of origin, administrative barriers for cross border collaboration would diminish. This process is still far from reality. The ERA Expert Panel 'Optimising Research programmes and Priorities' concluded that obstacles and limits for more trans-national collaboration are twofold.⁶ Some arguments are based on the overestimation of the benefits of collaboration (e.g. due to the expected increased transaction costs resulting from the collaboration), others are based on the regional perspective of the member states and the limits of current legislation.

A study⁷ for DG Research by Optimat Ltd & VDI/VDE-IT based on a survey of over 300 European RTD programmes found the following four most prevalent barriers to the inclusion of trans-national elements in national and regional programmes:

⁴ The European Research Area: New Perspectives; Commission of the European Communities, Brussels, COM (2007) 161 final, 4.4.2007.

⁵ Towards Joint programming in Research: Working together to tackle common challenges more effectively, Commission of the European Communities, Brussels COM (2008) 468 final, 15.7.2008.

⁶ ERA Expert Group, Optimising Research programmes and Priorities, EC DG RTD, 2008.

⁷ Optimat Ltd and VDI/VDE/IT, Examining the Design of National Research Programmes, Study for EC DG Research, December 2005.

1. National or regional policy for science and innovation is based on improving national or regional scientific and technological capacity to address own priorities; this is particularly the case in larger economies;
2. Sufficient volume of high quality proposals is received from national applicants. Fear of even larger 'oversubscription' to national or regional programmes limits the enthusiasm for opening them up to non-residents;
3. Often, the (national/regional) programmes do not have any explicit criteria that encourage trans-national activities. Without these explicit incentives to involve foreign partners, users are less inclined to involve them;
4. The legal constitution for public funding of the research programme as a general rule forbids the transfer of funds to non-residents. The study also points out that on this issue there seems to be a lack of understanding from programme managers whether this is genuinely a legal constitutional barrier or the consequence of governance designed by policy makers.

These are mostly issues at the level of R&D programmes. Chapter 3 and 4 will discuss how this applies to specifically CRC programmes and centres.

In addition to the debate on internationalisation of R&D programmes, the European Commission has also been instrumental in promoting the internationalisation of clusters. The European Cluster Alliance was established in 2006 and aims at becoming the single place at EU level for elaborating new ideas and practical tools for improving cluster policy in Europe and for fostering European cooperation at policy level that will facilitate the further development of more competitive world-class clusters in Europe.⁸ Several cluster related INNO-Nets have been formed for this purpose, connecting regions, innovation agencies and member states to exchange practices and develop common policies. The focus of their work is on cluster policy rather than CRCs as centres. The 2009 Entrepreneurship and Innovation work programme (EIP) list transnational cluster cooperation as one of the intended topics for INNO-NET establishment.

There are a number of external trends that form drivers for increased international S&T collaboration and which have triggered the policy debate.⁹

- The emergence of the BRIC countries and particularly China as a country with a large research and technological development capacity that is becoming recognised for meeting high international quality standards
- The increased political debate and urgency of global challenges such as climate change, health issues and sustainable energy resources
- The globalisation of R&D, which is not a new phenomenon, but it is becoming more visible particularly in industrial research and also in the world wide mobility of researchers
- Particularly in Europe, general demographic developments and the decreasing share of graduates in science and engineering have made the shortage of research talent very urgent; STI collaboration can be used to attract talent from partner countries
- The increased policy debates and ambitions in Europe to provide more critical mass and international profile to research excellence, in which partnering with the best plays a big role. The discussion on the European Research Area and the

⁸ See: <http://www.proinno-europe.eu/>

⁹ Boekholt, P. Edler, Jakob et al., Drivers of International Collaboration in Research, Report for EC DG Research, Technopolis, Amsterdam, September 2009.

position Europe should play in the global arena has also spurred more discussion on the topic.

An extensive study was done on behalf of DG Research on the role of internationalisation in S&T policies in EU and non-EU countries. European countries increasingly have a high-level internationalisation strategy in place, sometimes as part of a general globalisation strategy. Examples are Germany, and the Republic of Ireland. Others are in the process of defining such a strategy. The DG Research study found that despite this enormous interest in strategy building, many of these strategies do not appear to be direct drivers of policy action at present, and strategy development and implementation remains more of a promise than a reality in most of the European countries.¹⁰ The policy drivers highlighted by these internationalisation strategies are broadly similar from country to country. In general, the most important drivers as documented in the literature are: strengthening (domestic) research excellence through access to existing excellence and facilities abroad, to increase the attractiveness of domestic systems to overseas researchers (inward mobility), preparing the ground for domestic innovations to be marketed abroad, and to contribute to the solution of global challenges. However, countries are also at least in principle aware of the risks of engaging in international activities, such as those around IPR issues, 'brain drains' or the outward relocation of key companies to other countries.

There is some evidence that governments are less actively pursuing outward technology links for domestic firms than they are attempting to attract inward investment and mobility. Policy makers continue to struggle to find a balance between the promotion of beneficial internationalisation and firmly embedding both domestic and inwardly mobile companies and research organisations within the national research and innovation system. Only limited data is available about the 'openness' of nationally funded research and technology development programmes to overseas partners. That data which does exist suggests that the share of the budgets that are spent on international activities within national programmes is still low even where they are open in principle. There is some evidence that universities and research institutes may be more ready and willing to internationalise than are companies, suggesting that universities and institutes could play an important role in linking different national research and innovation systems.

Some European countries are adopting explicit internationalisation strategies. Finland's Science and Technology Policy Council adopted such a strategy¹¹ already in 2004. This has led the Finnish Academy to extend the scope of its international funding and TEKES to 'mainstream, internationalisation activities into its technology programmes'. In Sweden, VINNOVA adopted an internationalisation strategy in 2009, aiming to strengthen Swedish research and competitiveness through increased European and global cooperation, including the development of focused bi- and multi-lateral programmes with countries of interest and internationalisation of its technology programmes¹². This is reflected in a specific ambition to internationalise its CRC programme in the future.

¹⁰ Ibid.

¹¹ Science and Technology Policy Council of Finland, Internationalisation of Finnish Science and Technology, Helsinki: Ministry of Education, 2004

¹² VINNOVA, VINNOVAs Internationella Strategi, VP 2009:2, Stockholm VINNOVA, 2009

Our literature review suggests that internationalisation in CRC type programmes also occurs outside Europe.

In the Australian Co-operative Research Centres, CRCs are “*encouraged to engage globally. Co-investment with international organisations is particularly encouraged*”¹³. Furthermore, rules underlying the programme, address obligations including: compliance with relevant national, and, if relevant international, research integrity, ethics codes and guidelines. There are CRCs with international partnerships. The CRC Care for instance, co-operates with a similar organisation in China, but partnerships are mostly formed at the level of individual members. Although the CRC programme is not very explicit in its strategy towards internationalisation, the individual CRCs succeed in having international partners. Several CRCs co-operate with foreign partners. International co-operation is however not a core activity of CRCs: a limited number of partners are included per CRC and the partners are not core members of the CRCs.

International collaboration in Australia also takes shape outside the CRC programme. Recently the Australian Global Carbon Capture Storage Institute (GCCSI) was set up . This institute was set up as an international centre, including many national agencies, companies and a small number of knowledge institutes. The GCCSI demonstrates the current trend towards internationalisation (see Figure 2).

Figure 2 Australia: the Global Carbon Capture Sequestration Institute.

The Global Carbon Capture and Storage Institute is a new initiative aimed at accelerating the worldwide commercial deployment of large-scale CCS. It was set up mid 2009. The Australian Government has committed AUD100m (€62.5m) annual funding for the Global CCS Institute. This should ensure the ongoing success of the institute. GCCSI has international support, with more than 20 national governments and over 80 leading corporations, non-government bodies and research organisations signing on as foundation members or collaborating participants.¹⁴ The goal of the GCCSI is to “*draw together information, knowledge and expertise to (...) play a pivotal role in facilitating the development and deployment of safe, economic and environmentally sustainable commercial-scale CCS projects*”.

There is a broad base of international interest in carbon capture storage, because the G8 countries have committed to the development of 20 large-scale CCS projects, to be in operation by 2020. This provides a base of confidence to take CCS forward thus limiting the risk of setting up of such a large-scale centre. The Global CCS Institute aims to play a vital role in developing the partnerships needed to make demonstration projects a reality. GCCSI puts particular importance on capacity building activities in emerging market economies. A practical goal of the institute is to realise demonstration projects. The projects of GCCSI are thus highly applied and the number of research institutions limited.

Already a range of organisations is working in collaboration with the GCCSI. Close collaborative partnerships are already established (sometimes involving financial commitments) with large international organisations first, such as the International Energy Agency (IEA), Carbon Sequestration Leadership Forum (CSLF), World Bank, and The Climate Group. Once these partnerships are in place, the Global CCS Institute will begin building strategic alliances with other stakeholders.

The Global CCS Institute

¹³ Department of Innovation, Industry, Science and Research, 2009. Programme guidelines. Co-operative research centres program.

¹⁴ The impressive list of (foundation) members of GCCSI is downloadable at: <http://www.globalccsinstitute.com/downloads/The-Global-CCS-Institute-Foundation-and-Legal-Members.pdf>

In Canada, a stronger focus on internationalisation recently emerged. To broaden the collaborative scope and increase the scale of opportunity on a global scale, the Networks of Centres of Excellence (NCE) has expanded its international focus and extended its reach to the international science and business community. To this end, the NCE has developed the International Partnership Initiative (IPI), allocating \$3.5m to this initiative. This is used to provide the CRCs with additional support to develop and enhance linkages with equivalent organisations in the rest of the world. The Networks of Centres of Excellence Program is launching a pilot initiative to expand the international reach of the Networks of Centres of Excellence of Canada. The International Partnership Initiative is to provide the existing NCEs with additional support to develop and enhance linkages with the best centres of excellence around the world. The NCE IPI supports the partnering of Canadian Networks and Centres with foreign organisations to address issues in areas of mutual strategic importance. The partnerships are expected to operate at the level of CRCs and not at the individual level.

The Canadian IPI aims primarily at human resources and acquiring new sources of knowledge through international co-operation. The goals of IPI are to enable the Networks and Centres to:¹⁵

- Raise Canada's profile on the world stage and ensure that Canada is part of international cutting-edge initiatives;
- Provide a richer training environment to develop highly qualified people with skills and awareness critical to Canadian productivity, economic growth, public policy and quality of life;
- Stimulate or reinforce partnerships with foreign organizations to develop large coordinated and concerted efforts leading to economic and social impact;
- Enhance the sharing and dissemination of knowledge, resources and technology to Canada.

Furthermore, in the programming documents of the centres of excellence there is attention to international collaboration. A goal of the Centres Of Excellence For Commercialization And Research programme is "to develop relationships with major international centres and research programs, and brand Canada as the host of internationally recognised centres of excellence."¹⁶ Unfortunately, no assessment or evaluation of the internationalisation of the NCE programme was found.

The US Engineering Research Centers (managed by NSF) seem up to the last few years hardly involved in explicit internationalisation activities, although ERC evaluation studies and strategic Programme documents suggest that international collaboration worldwide should be part of the Next Generation ERC programme. Generation Three of the ERC that has started in 2008 does indeed state as an aim that ERCs will partner with foreign universities. An eligibility requirement for ERC proposals is that *"At least one but no more than three foreign universities are required to be partners in research and education and post-award their support must be provided by foreign governments or other non-NSF sources.* This means that the programme itself will not fund the foreign partners. According to NSF it is at this moment too early to assess

¹⁵ The IPI-website has been updated at the end of this study. We have implemented the most recent version of December 9, 2009. http://www.nce-rce.gc.ca/Competitions-Competitions/PilotPrograms-ProgrammesPilotes/InternationalPartnership-PartenariatsInternationaux_eng.asp

¹⁶ The Networks of Centres of Excellence programme consists of 4 sub-programmes: the Networks of Centres of Excellence, the Centres of Excellence for Commercialisation and Research, the Business-Led NCEs and the International Research and Development Internship programme.

in how far this internationalisation requirement is successful or not.¹⁷ A first review of the progress of the new centres is to take place in December 2009 so there has been no inventory yet of the international activities. Information at this stage suggest that one of the largest difficulties is to ensure that the partner organisation outside the USA receives research funding from their national funders for the defined collaborative work.

From these comparisons with non-European CRC-programmes we can learn that it is often only in the second or third generation of these programmes that the explicit internationalisation requirement is emerging as an integral part of the programme. Mostly the partnerships promoted are with individual partners (mostly foreign universities and public research centres) with the exception of the Canadian NCE. In these examples we also see that funding of the foreign partners is not included in the national programme: it should be matched by funding coming from the country of origin of the foreign partner.

Thus the emergence of internationalisation in CRCs in Europe is rather similar to the developments in Australia, Canada and the USA. Internationalisation came on the agenda only recently. In Canada and Australia, however, international co-operations are not explicitly mentioned as an indicator of the success of a CRC. Furthermore, no evaluations of the internationalisation were found. Little is known from existing literature yet on the effects of these international collaboration activities nor on the way the programme manages these specific internationalisation tasks.

¹⁷ Telephone discussion with Lynn Preston, Deputy Division Director, ERC programme.

3. Internationalisation in CRC programmes

3.1 The role of internationalisation in CRC programmes

According to our interviews with CRC programme managers, national or regional ministries and agencies often do not have an explicit internationalisation strategy¹⁸. In these cases, the programme officers do not have a guiding internationalisation policy to build the strategy of their CRC programme on. As a result, the CRC programmes are not specifically aimed at internationalisation; CRCs are aimed to boost the national or regional competitiveness. Therefore, internationalisation is not a goal in itself. Figure 3 summarises the strategies towards internationalisation. Despite the deficiency of strategies for internationalisation, the attitude at programme level towards internationalisation is generally positive. In Flanders for instance, the innovation agency IWT is very open to international co-operation, and both formal and informal international co-operation is encouraged.

Obviously, countries with a more explicit internationalisation strategy, offer more possibilities for international partners. Countries with a more explicit internationalisation policy are Germany, Austria and recently Sweden. In the strategy of the Swedish VINN Excellence Centre programme it is pointed out that the CRCs should lead to international competitive environments that attract foreign R&D. This stronger international focus is reflected in the openness of the programme; international partners can join a centre on equal basis as national entities. An international dimension is also taken up as an evaluation criterion. In Germany, the national policy¹⁹ argues that the Kompetenznetze should be opened up for foreign involvement, in order to boost the competitiveness of the German networks. In Austria, opening up the CRC programme is a general policy goal. As a result, the Austrian Kplus programme is already opened up to some extent, i.e. the share of *funded* international partners may not be higher than 25%. In the Austrian COMET programme internationalisation has even become an evaluation criterion for evaluation of proposals.

¹⁸ In the survey of VDI 59% of the responding CRCs indicate that strategy processes take place in their region. It is however not indicated whether a strategy paper is available.

¹⁹ BMBF, 2008. Deutschlands Rolle in der globalen Wissensgesellschaft stärken

Figure 3 Summary of national and regional internationalisation strategies.

Country	Summary Strategy and Programming	Possibilities for international parties
Austria	Ministries and agencies do not have a clear policy for internationalisation. However, there is a common idea that internationalisation is important. The programmes are open to some extent (in the past Kplus) or fully open for international partners in today's programme.	Kplus: the total contribution of funded international partners cannot be higher than 25%; no restrictions for non-funded partners. COMET: international partners are treated equally as Austrian parties.
Basque Country	The CRC programme in the Basque Country is mostly aimed at oriented basic science. No explicit strategies towards internationalisation exist.	International parties cannot take part.
Flanders	The strategic research centres are publicly funded CRCs that aim at the development of knowledge that should lead to valorisation. The Competence Poles are strongly aimed at strengthening the (competitive) position of the companies in each particular field. Internationalisation is encouraged, but in an informal and implicit way.	Competence Poles: foreign actors can have access to the activities in the Competence Pole and become in most cases a member; funding only via subcontracting.
Estonia	The CRCs are aimed at enhancing the international competitiveness of the entrepreneurs, through enhancing the co-operation in strategic R&D activities. Internationalisation plays a small role in the CRC programme.	International partners join a centre on equal basis as national entities
Germany	Internationalisation has priority at the highest policy level. In the national strategy, the Kompetenznetze and Cluster initiatives are seen as good instruments to boost the internationalisation of German research and innovation.	Networking model: foreign partners can be member of the networks but, as a general rule, this does not include public funding.
Northern Ireland	The CRC programme is focussed on the establishment of excellent CRCs. Internationalisation is not an explicit route in this strategy. Recently the programme has been changed drastically; as a result the CRCs have only just started. Therefore there is not much attention for international co-operation.	The programme is not opened up for international parties.
Norway	Internationalisation is important in the national research strategy. International cooperation is a criteria for evaluating a successful CRC. CRCs are also expected to make it attractive for international companies to perform R&D in Norway. The CRC programme does not at present foresee formal cooperation in the form of joint calls with other countries.	Calls are open to foreign partners in the centre consortium, both research institutions and corporate partners. The host institution must however be Norwegian and potential for value creation in Norway is the major criteria for selection of new centres.
Slovenia	The CRC programme is focussed on the establishment of excellent CRCs. The strategy towards internationalisation is to take part in EU programmes. There is also specific attention for mobility of researchers (Marie Curie).	As internationalisation is organised in EU projects, this is not an issue.
Sweden	Swedish internationalisation policy at the governance level is relatively well developed. In Sweden there is a broad range of CRCs. This is also reflected at the lower level; CRC programmes (e.g. VINN Excellence) see international co-operation instrumental to attract foreign R&D investments, and to develop markets.	VINN Excellence: international partners are treated equally as Swedish parties.
Valencia	The goal of the CRC programme is to enhance regional competitiveness: boosting R&D and Innovation in enterprises. Internationalisation is encouraged by several measures at CRC level. These measures are aimed at making the Valencian companies take part in foreign programmes. Also, inward researchers mobility is stimulated.	International parties cannot take part.

Interviews Technopolis Group & COMPERA information sheets

CRC-programme management rarely co-operates internationally in a formal way. Within the COMPERA network, we did not find co-operations such as joint CRCs other than the activities within the framework of COMPERA. However, there is co-operation in more informal ways. These informal co-operations are aimed at joint learning and include mutual visits, such as joint visits of the Swedish, Austrian, Norwegian and Estonian CRC programmes. This kind of co-operation is taking place on a rather ad hoc basis.

Concluding, internationalisation at the CRC programme level is emerging, but is not a general feature yet. Especially in countries where the CRCs are in the phase of establishment, internationalisation is relatively unimportant. The newer programmes are strongly focussed at the national and regional level, in order to get the CRCs established. In countries where internationalisation plays a larger role in the strategy – such as in Austria and Sweden - the CRC programmes are open for international partners. The case studies also show that while internationalisation is not always very explicitly stated in the goals of the programme, it is supported by the programme managers when CRCs engage in for instance EU-programme activities. As EU-projects are funded by the European Framework Programme, cross-border funding is not a policy issue.

3.2 Barriers

There are a number of barriers at the programme level that hamper the internationalisation of CRCs.

- *Absence of policy incentives to co-operate internationally*

A number of the interviewed programme managers indicated, in some cases there is limited support to internationalise the CRC programmes, at the highest policy level. An absence of a sense of urgency for internationalisation is the main reason. Because the goals of CRC programmes are oriented at the national level – i.e. boosting local innovativeness – the programmes are primarily focussed on national issues. The absence of a push towards internationalisation from the highest policy level stems from the political undesirability to let tax funds flow to other countries, or from a fear of losing competitive advantage (see below).

- *Funding*

It is difficult to find funding for actual co-operations. In several countries funding of foreign partners is against regulations. In most countries it is not possible to use national funding or European Structural Funds (SFs) for international partners. Programme managers whose CRCs were funded with Structural Funds indicated that it was not allowed to fund activities outside their region/country. Other programme managers indicated that for Structural Fund activities each partner has to go through an application process in their own region or country. Moreover, it is in nearly every country considered politically undesirable that national or regional funding flows abroad. This means that it is difficult to set up multinational funded CRCs and or projects, unless very detailed agreements are set up that regulate the funding flows. Therefore, multinational funded CRCs, or co-operations between CRCs are mostly part of bilateral agreements that take a lot of time to establish.

- *Fear of losing competitiveness advantage*

One reason for the lack of support for internationalisation is that internationalisation can be seen as a threat for the partners. As foreign actors can benefit from the co-operations, internationalisation can be perceived as a loss of IPR and competitive advantage. This is for instance the case in countries, where a lead position in specific technological fields is assumed and in this context, no or only little potential benefits of international cooperation is anticipated. Co-operation would then lead to undesired spill-overs to competitors. This contributes to the lack of resources to establish actual co-operations.

This same issue plays at the level of individual CRCs. CRCs are very careful in choosing their partners. The CRCs often have a mechanism, such as international advisory boards that are carefully selected because they are afraid to share too much knowledge.

Individual actors also play a role in this. Especially large companies do not want to co-operate with other large companies that can be a potential competitor. For smaller companies, this is often a driver to involve international companies. International counterparts are often not direct competitors.

- *Different national framework conditions*

National differences in the governance of the CRCs can hamper internationalisation. IPR regulations are often different from country to country, meaning that IPR rules have to be reconsidered. Seemingly, it is hard to find a situation that fits all the actors involved. The different stakes of the actors involved make it difficult to come to an optimal solution. Companies, research institutes, universities try to maximise their individual benefits, whereas the policy makers try to defend the national interests. Moreover, legal issues make IPR negotiations an even tougher job. In most cases CRCs do not represent a legal body, so they cannot make agreements, nor sign contracts.

National differences in the focus of the CRCs can also be an obstacle. In Flanders for instance, the Competence Poles work much closer to the market than the CRCs in Sweden and Norway. Therefore, the Flemish CRC programme only seeks for co-operations with an impact at company level. As a result many other CRCs are not suitable as co-operation partners.

- *Practical*

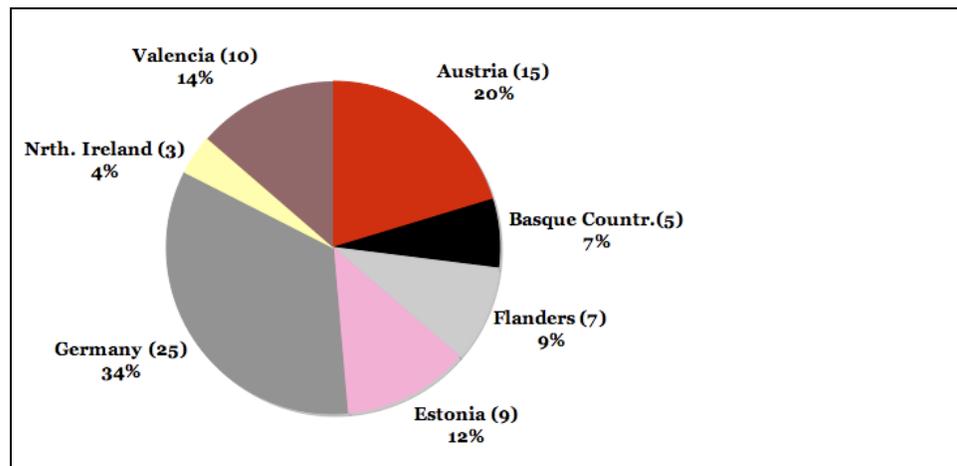
Very practical reasons such as the proximity to suitable partners form a barrier. Practical issues such as travel expenses and time can make it more difficult to establish contacts and actual co-operations. This is for instance the case for CRCs in Northern Ireland; travelling from Northern Ireland to continental countries often takes a day. The programme officer reckons that international visits, meetings abroad and et cetera, take quite an effort. Obviously this does make contact with foreign partners more time consuming and expensive.

4. The characteristics of CRCs

A survey amongst all CRC managers associated to the participating COMPERA partners²⁰ was conducted to obtain insight in the current practice of CRCs. This chapter gives an overview of the types of CRCs that responded to the survey, and what national differences exist.

In total, we received 74 responses to the survey.²¹ One-third of the total amount of responses comes from German networks (see Figure 4); other large contributions to the survey are Austria (20%), the Valencia region (14%) and Estonia (12%). Not all surveys were fully completed (54 out of 74). The main reason for this was that not all questions were applicable to the situation of the respondents. A number of CRCs were just started up or in the process of starting up; questions about actual co-operations or results of co-operations did not yet apply to them. Several respondents pointed out that they did not belong to the target group, as they were a loosely connected association or cluster: they could not answer several questions.

Figure 4 Country/region of residence of the CRCs in the sample, giving the absolute number of respondents, and the share of the total sample.



Technopolis Survey; n=74

4.1 Type of centres

A CRC can be shaped in many forms. The CRC can be a 'physical' centre, i.e. a centralised centre, where the majority of the research is carried out and the research is bundled on one of more specific locations. But also many CRCs have the structure of a 'virtual centre', referring to those centres where the research is carried out at various locations, most often in the research sites of one of the participating players. In addition, combinations of this approach occur, where a part of the research is carried out at a central location, while a share of the research is outsourced to the partners.

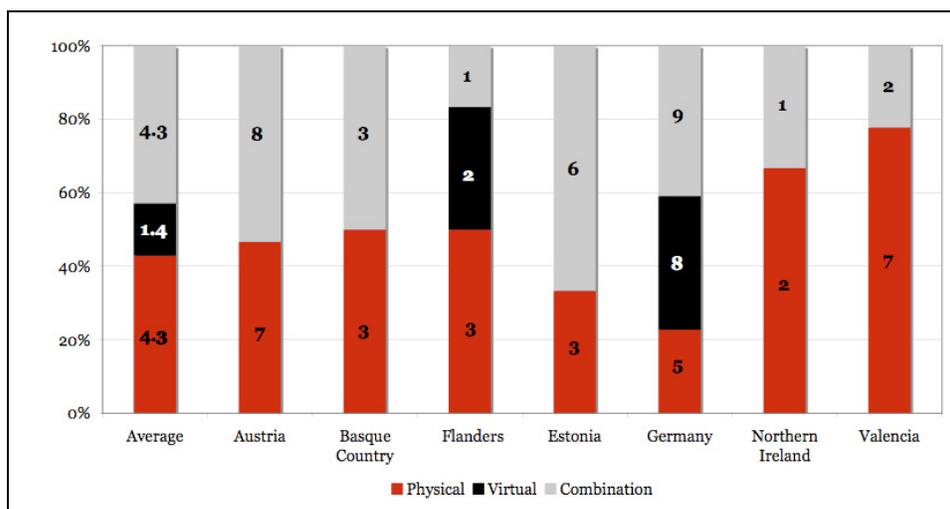
The most frequently occurring structures in the COMPERA sample are the physical centres (43%) and mixed-type centres, combining physical and virtual aspects (43%).

²⁰ i.e. Austria, Basque Country, Flanders, Estonia, Germany, Northern Ireland & Valencia. Sweden supported this study, but Swedish CRC managers were not surveyed because a similar survey was conducted recently by VINNOVA.

²¹ Appendix B.1 elaborates on the response rate and Appendix B.2 shows the list of respondents. The earlier survey of centres by VINNOVA included responses from 33 CRCs.

²²A relatively small share of CRCs is virtual (14%). The virtual centres are mostly found in Germany and Flanders. The German sample consists of network-like structures. In Flanders, there are two types of CRCs in the sample. The first type is the “Competence Poles”; these Competence Poles are designed to accumulate knowledge for a relevant industry in Flanders, in order to facilitate innovation. The Competence Poles are designed to foster valorisation²³ of knowledge by (open) innovation. The second type is the strategic research centres; these centres aim to produce strategic research, and bring excellent research to the interface with industry. The Competence Poles in Flanders are often virtual centres; they have no laboratory and the competences are accumulated at the locations of the their members, the strategic research centres are either physical (IMEC) or a combination of both (IBBT). The Valencian CRCs are most often physical CRCs (78%). The Swedish CRCs tend to be physical centres.

Figure 5 Structure of the centre per country (absolute number in the graph)



Technopolis Survey; n=70

4.2 Thematic focus

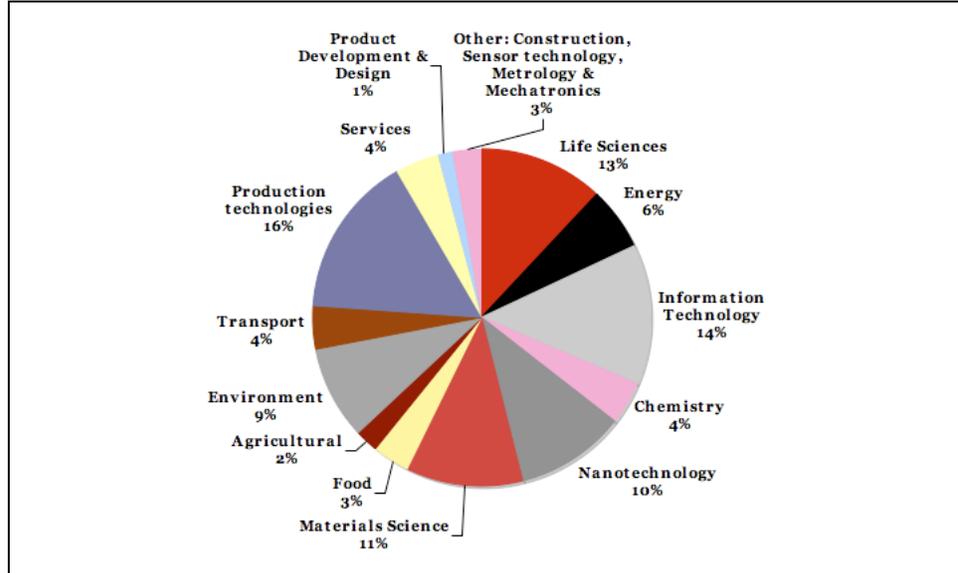
The CRCs focus on a broad range of technological domains. Figure 6 (next page) shows the range of thematic focus of the CRCs. Production technologies is the largest field of application of the CRCs. Other fields that are often addressed by the CRCs are ICT, life sciences, material technologies, nanotechnology and environment. The other themes addresses by the CRCs are smaller. A rest category (3%) consists of more specialised themes, such as mechatronics, construction and sensor technology.

Figure 7 displays the thematic focus per country. It shows that there are large thematic differences of the respondents per country. In Estonia for instance, more than 50% of the focus is on ICT and life sciences, but the large differences are to a large extent explained by the differences in response rate. Estonia and Northern Ireland show deviating thematic focus, but the number of responses in these countries were rather small. When the samples of a country are larger, it seems that the countries all have CRCs aiming at the same thematic issues.

²² In the survey the centres have been asked to characterise their own organisation as virtual, physical or a combination.

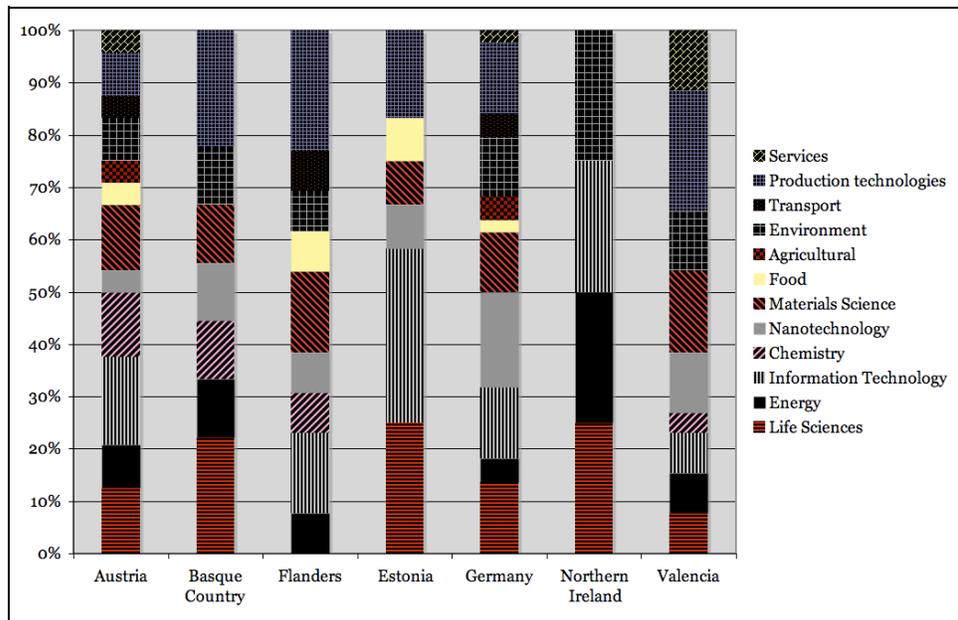
²³ The translation of research into commercial products and processes or products and processes that have societal added value.

Figure 6 Thematic focus of the CRCs.



Technopolis Survey; n=74, multiple answers possible

Figure 7 Thematic focus per country.

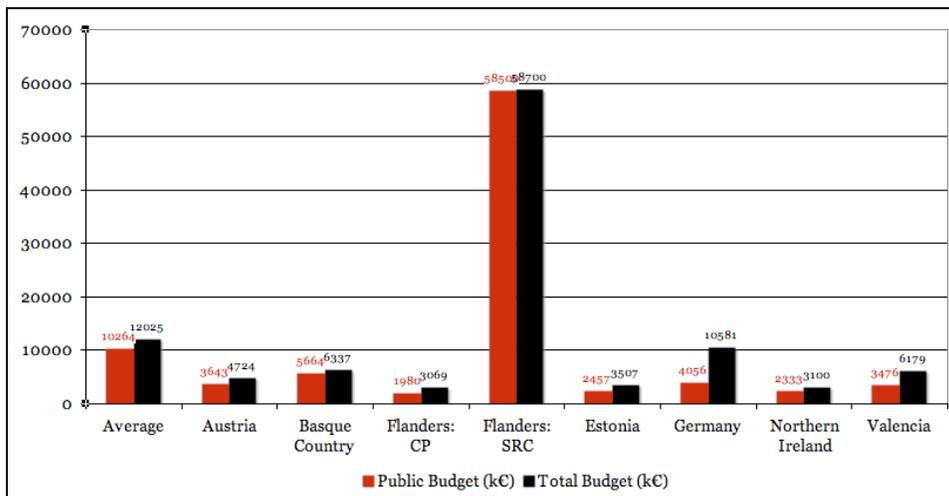


Technopolis Survey; n=74, multiple answers possible

4.3 Size of the CRCs

We have asked the CRC managers for the public research budgets and the total research budgets, including private investments. The average annual research budget of CRCs is €7.9m; 76% of its research budget is acquired through public channels, 24% is a contribution of private investments by the industry and research institutes. There are striking exceptions in the size of the budget of the different CRCs (see Figure 8).

Figure 8 Annual average research budget per CRC, per country (k€).



Technopolis Survey; n=57

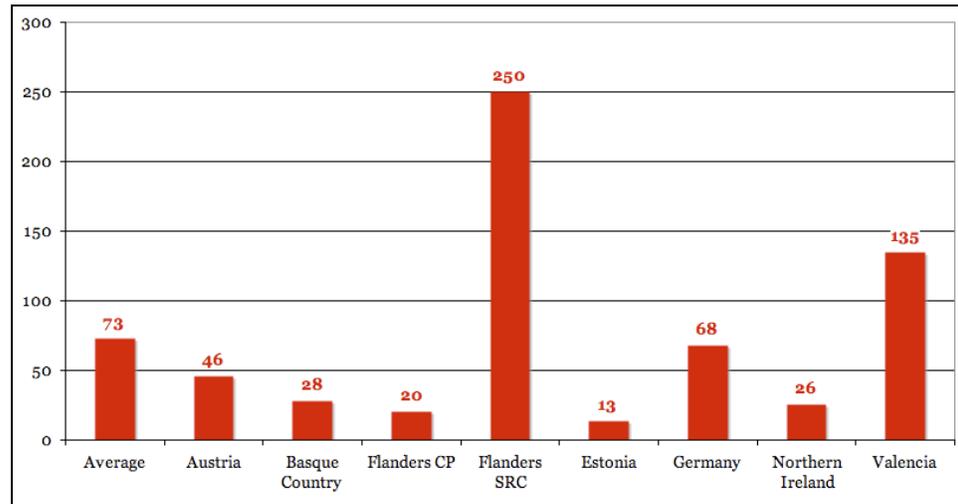
The most apparent anomaly is the budget of the Flemish CRCs. As indicated in paragraph 3.1 there are two types of centres, Competence Poles (CP) and Strategic Research Centres (SRC). The Strategic Research Centres receive a much larger public budget in comparison with the Competence Poles so we have described them separately. Whereas the public funding quota in Austria officially ranges from 45%-60%, the private share in the total research budget is much smaller, according to the CRC-managers in the survey.

The share of private investments varies largely between the countries. In Germany, the public contribution to the CRCs is less than 50% of the funding. As said before, the German sample consists primarily of network-like structures. Many of the networks only receive small public budgets; they acquire private funding via membership fees and payments for services. In Flanders, the private contributions are remarkably small. This is due to the large public budgets of the strategic research centres, they acquire only 1% of their budget from private sources; the Competence Poles receive 30% of their funding from private sources.

The average number of partners of the surveyed CRCs is 59. Geographic differences are visible. The Flemish Strategic Research Centres have a large number of partners (250 on average). The surveyed Flemish Competence Poles have a smaller number of partners; 20 on average²⁴. In Valencia the total numbers of partners is also very high. This is mainly caused by AIJU, this CRC has over 500 partners. Seemingly, these partnerships are very loose; the partner list consists of a very high number of SMEs.

²⁴ Data from IWT suggest that the full set of Competence Poles have 100 members on average

Figure 9 Average number of CRC partners per country (national and international).



Technopolis Survey; n=70

There is a weak correlation between the amount of funding of the CRC and the number of partners. Institutions with a large amount of funding tend to have many partnerships, but also the smaller CRCs often have large partnerships (see Appendix D.1). The association AIJU for instance has a lower budget than average, but still ranks among the CRCs with the most partners.

The small number of case studies confirms that there is no clear relationship between the absolute size of a CRC and its international activity. Relative size is related to the thematic area in which a CRC operates (some have very narrow focus, others much broader) and the public funding mechanisms available in their country or region.

4.4 Focus on academia and industry

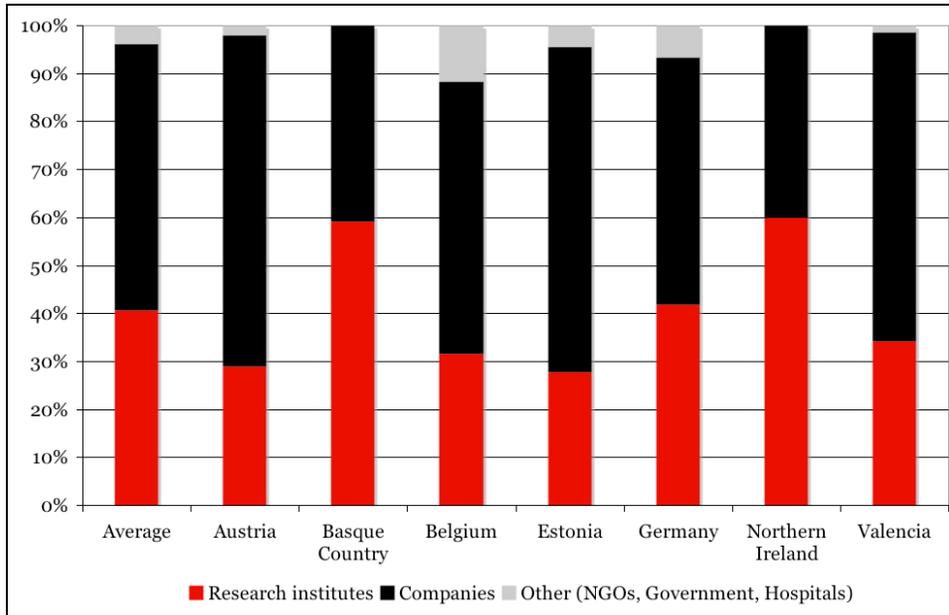
In the survey we asked the CRC managers to indicate what share of the activities aimed for a specific type of actor. To make a clearer distinction between the actors groups we grouped the categories into research institutions (universities, public and private research institutes), companies (SMEs and large firms) and a rest category (consisting of government, NGOs, etc). If CRCs aim mostly at research partners, this indicates that the CRCs aim to develop (academic) knowledge production. If the activities of the CRC are more aimed at industry, this indicates that the CRC is more oriented towards valorisation through technology transfer and more applied science.

On average, the CRCs tend to have the strongest focus on the industry, 55% of the activities are aimed at companies (see Figure 10). About 40% of the activities of CRCs are aimed at research institutions. There are large national differences with regard to the focus on research institutes or industries. Austrian (70%), Estonian (69%), Valencian (65%) and Flemish (57%) CRCs are more focused on industry, whereas the Basque country (58%) and Northern Ireland (59%) have stronger focus on research institutions.

From the case studies we learn that there are huge differences in terms of the focus on more applied research that address technological issues for specific companies, to more medium term research with a focus of 3-5 years from the market to a focus on basic research with a time to market of more than 5 years. Many centres combine these research types: e.g. ViF has the whole range of research types and separates its direct contract research work outside of the CRC framework. Questor has a specific unit for technology transfer and commercialisation activities that is also separated from the medium to long-term research activities. The AIDICO Centre from Valencia, with a user community mostly in a non-R&D environment, is much more centred on

applied research and innovation activities. Given that the Centres each have a different combination of the whole range of activities we can not differentiate the results in terms of ‘applied’ versus ‘fundamental’ research focused CRCs.

Figure 10 The average share of focus on actors (research, industry and other institutions) per country



Technopolis Survey: n= Austria: 12; Basque Country: 4; Flanders: 4; Estonia: 6; Germany: 14; Northern Ireland: 2; Valencia: 7.

5. Internationalisation in the practice of CRCs

This chapter discusses to what extent CRCs are active in international co-operations. Furthermore, it elaborates on the drivers of international co-operation and the barriers that hamper international co-operation of the CRCs. Internationalisation in CRCs.

5.1 Actual co-operations

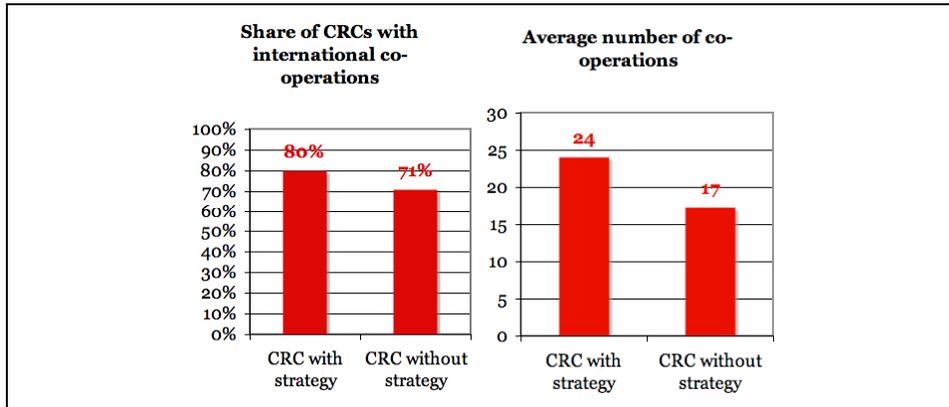
5.1.1 Strategies

The importance of internationalisation in the CRC programmes is ranging from high to not important at all. Almost half of the CRCs (47%) responding to the survey have a strategy towards internationalisation of some sort. We requested a copy of the strategy towards internationalisation of CRCs; only 4 CRCs were able to send us a strategy. A similar response was found in the survey of VDI TZ on internationalisation practices and strategies of clusters around the world²⁵; about half of the respondents indicated that they had a strategy paper; but none of the strategies was made available. However, in most cases these are not explicit strategies (not formalised or codified) and most of the strategies are tacit. Moreover, several CRCs indicate that the strategy is for internal use only. The strategies are not very detailed and aim at an operational level: the strategies sum up straightforward goals. Typical goals are to connect to other players in the world and to extend the networks of the CRCs. Aim of these connections is to benefit from mutual learning, and to define project proposals. One of the strategies aims at making use of the Marie Curie programme.

Despite the absence of a larger number of explicit strategies, many of the CRCs of the COMPERA countries have international co-operations of some sort: 76% of the surveyed CRCs indicate that they co-operate internationally. However, CRCs with an internationalisation strategy have a stronger international focus. As Figure 11 shows, a larger share of the CRCs with an internationalisation strategy do actually co-operate internationally (80%) than the CRCs without strategy (71%). Of this group of CRCs that do co-operate internationally, the number of co-operations is higher, if the CRC has an internationalisation strategy. The Swedish survey indicates that VINN Excellence Centres typically reach out internationally through a scientific committee, mobility and brand-building measures.

²⁵ B. Hausberg, S. Stahl-Rolf, J. Steffens, 2008. Entwicklung von Kompetenzclustern und –netzen zu internationalen Kompetenznetzen: VDI TZ, Düsseldorf.

Figure 11 The share of CRCs with and without actual co-operations (a) and the average number of co-operations (b), set out against having a strategy or not.



Technopolis Survey; n=64

The case studies confirm this result: even the most highly internationalised CRCs do not always have an explicit internationalisation strategy. Nevertheless, the most active ones have international cooperation as an integral part of their core strategy and/or in their governance structure (particularly BalticNet-PlasmaTec, ViF, Questor, GigaHertz). Internationalisation does not depend on the fact whether there is a codified internationalisation strategy or not. In all cases the CRC-manager or director understood the necessity for moving the centre a step further up the development ladder through international collaborations. Nevertheless, an explicit declaration of international ambitions in the centre’s mission and dedicated actions by the CRC-management help to underpin the internationalisation of the stakeholders.

5.1.2 Typology: modes of co-operations

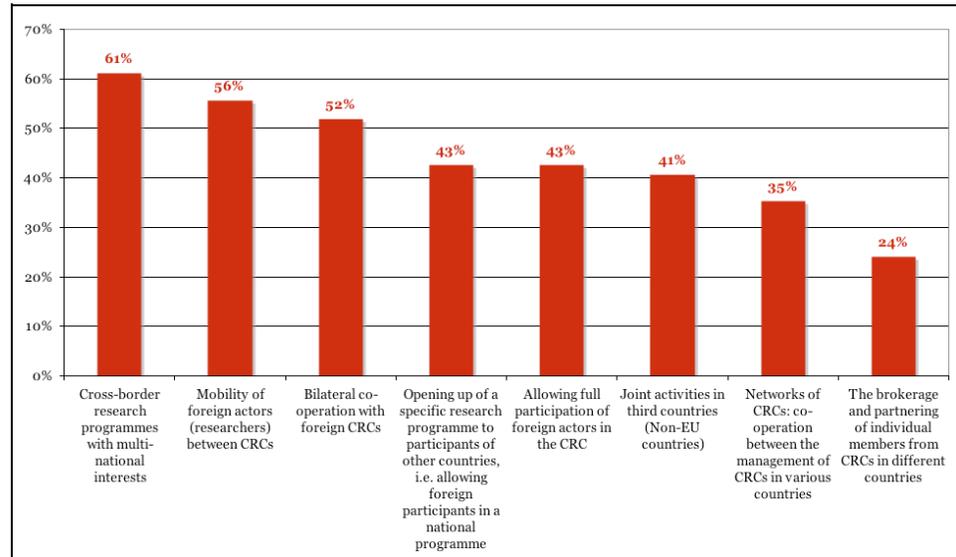
There are a number of ways in which the CRCs can co-operate. Based on the limited pool of literature²⁶ on internationalisation and the praxis of CRCs, we have compiled a typology specially aimed at CRCs. This was also used to design the survey.

The CRCs that co-operate use a several modes of international co-operation. The most often used mode of co-operation is **cross-border research programmes** with multi-national interests (see Figure 12); 61% of the CRCs that co-operate internationally take part in cross-border research programmes. CRCs are involved in multi-national research projects, for instance in EU research projects, or in multilateral or bilateral research programmes. A second form of collaboration is through the **mobility of people**. Often, CRCs with international co-operation have at least one foreign researcher in their organisation, or have sent a researcher abroad; 56% of the CRCs with international activities use mobility of foreign actors. Many countries offer possibilities for mobility of researchers in their research policy; in addition the EU’s Marie Curie programme offers similar possibilities. It can be assumed that these programmes are used for mobility of researchers between CRCs. The other modes of operation occur less. In order of occurrence the other modes of co-operation include **opening up of research programmes, bilateral co-operation between CRCs, allowing full participation of foreign actors, networking of CRCs, joint activities in third countries and brokerage and partnering** of individual members from CRCs. The case studies support this range of collaboration modes used in practice.

²⁶ A study of VDI sets out a broad toolbox of internationalisation measures. See: VDI, 2008. Entwicklung von Kompetenzclustern und –netzen zu internationalen Kompetenznetzen, pp.19-21.

Active international membership in CRCs has a larger impact for the case studies than in the wider population of CRCs. In the case of Questor (Northern Ireland) both research centres and industry are members with full voting rights. The same holds true for ViF (both companies and universities) and GigaHertz (for companies only). In BalticNet-PlasmaTec membership is more non-committal but its international membership (20 organisations) has some influence on the strategic direction of the network as they are members of the General Assembly.

Figure 12 The modes of operation of international co-operations of COMPERA CRCs.



Survey Technopolis Group; n=54

In the VINNOVA CRC survey, bilateral projects and EU-projects are mentioned as the most important modes of operation for international co-operation. This is in line with the results of our survey, as these are cross-border research projects. Mobility of researchers and network activities is also in the VINNOVA survey the next most important mode of operation (see Appendix E.2).

A study of VDI TZ²⁷ that discussed internationalisation practices worldwide identified a somewhat broader range of potential activities aimed at fostering internationalisation, mainly because the study focuses on the internationalisation of clusters: there is focus on instruments that are not strictly forms of S&T co-operation but that are likely to result in co-operation. For different world regions, VDI TZ ranked the most often used instruments and also assessed the perceived benefit of the instruments. One of the main outcomes is that the most often used instruments are not necessarily those that are considered as most useful

In the German sample of the VDI TZ study, the most often used instruments are communication instruments (rank 1), According to the study, the second most often used instrument is the identification of gaps in the value chain (2). After that, several typical instruments follow, that fit within the results of our study on modes of co-operation, such as the development of international clusters and networks (3) and being linked into international networks (4). The mobility of students ranks also high (5). Taking part in cross-border programmes (EU projects (8)) and opening up of national programmes (10) are on the following ranks.

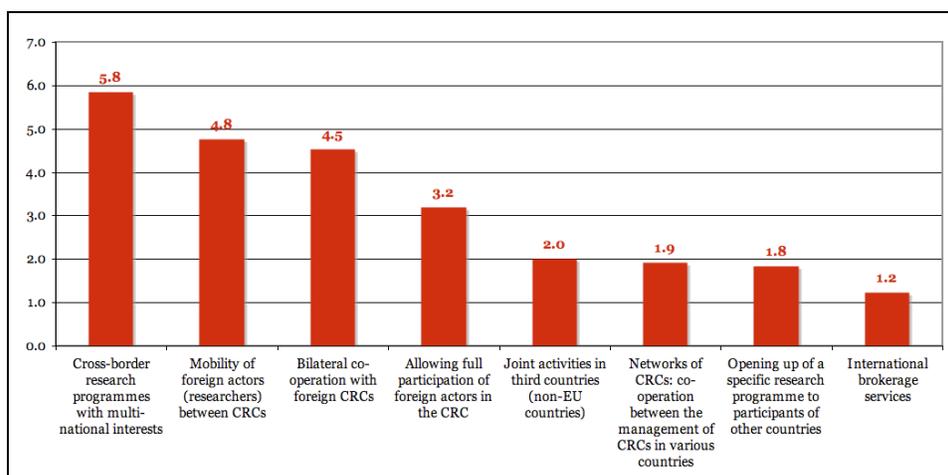
²⁷ B. Hausberg, S. Stahl-Rolf, J. Steffens, 2008. Entwicklung von Kompetenzclustern und –netzen zu internationalen Kompetenznetzen: VDI TZ, Düsseldorf.

In Sweden, international activities focused on networking with academics abroad, mobility schemes and in a small minority of cases international industrial partnerships.

In our survey, we also asked whether the different modes of operation are open to all actors. Most of the modes of co-operation are open to all actors, except the mobility of foreign actors and the full participation of foreign actors. Mobility of foreign actors is mostly allowed for researchers from public research institutes. Following our interviews, this might have two reasons. The interviewees state that individual researchers from large foreign companies are considered with caution, due to confidentiality issues. Secondly, as the research at CRCs is more basic science compared to industrial research, researchers from companies are considered less suitable to work at the CRCs. Companies are more often welcomed to take part in well defined research projects and to contribute to (projects of) the CRCs. In this case, the companies can function as useful sources of knowledge, or as potential customer for the knowledge developed.

The survey asked the CRC managers how many co-operations they had, per mode of operation. As aforementioned cross-border research programmes is the most frequently used mode of collaboration. On average, the CRCs that co-operate internationally have 5.8 cross-border research projects (see Figure 13). Mobility of researchers is also often used as a way to co-operate; the CRCs have an average of 4.8 mobility co-operations. Bilateral co-operations with foreign CRCs exist on average 4.5 times per CRC. The other modes of operation are used significantly less frequent. The *opening up of a specific research programme to participants of another country* is a mode of operation that many CRCs use, but only with a limited number of occurrences: programmes can be opened up only once.

Figure 13 Average number of international co-operations per CRC.



Survey Technopolis Group; n=54

5.1.3 Determinants of the degree of internationalisation

From our survey we have ran a number of comparative analyses in search of aspects that might determine the degree of internationalisation.²⁸ We use the number of co-operations per CRC as an indicator of the degree of internationalisation.

²⁸ Please note that we do not assume that the relations are causal: we do not have theoretical and statistical evidence to assume they are.

- **Size of CRC.** We have determined the relation between the budget of CRCs and the average number of co-operations. The correlation between budget and number of co-operations is very small: it is not very likely that there is a relation. Furthermore, the slope of the relation is insignificant: larger CRCs do not have more co-operations (see Appendix D.2). The case studies would confirm this: amongst the most internationally active CRCs were both large and small centres.
- **Type of CRC.** Physical centres tend to be more international. The share of having international co-operations or not is higher for physical CRCs (84%) than virtual CRCs, or a combination of both. Also, when physical CRCs are co-operating, they have a higher number of co-operations. The small number of case studies does not allow a generalisation on this matter, as a majority were physical or a combination of physical and virtual.

Figure 14 The share of CRCs with and without actual international co-operations (a) and the average number of international co-operations (b), set out against the type of CRC.

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Technopolis Survey; n=49

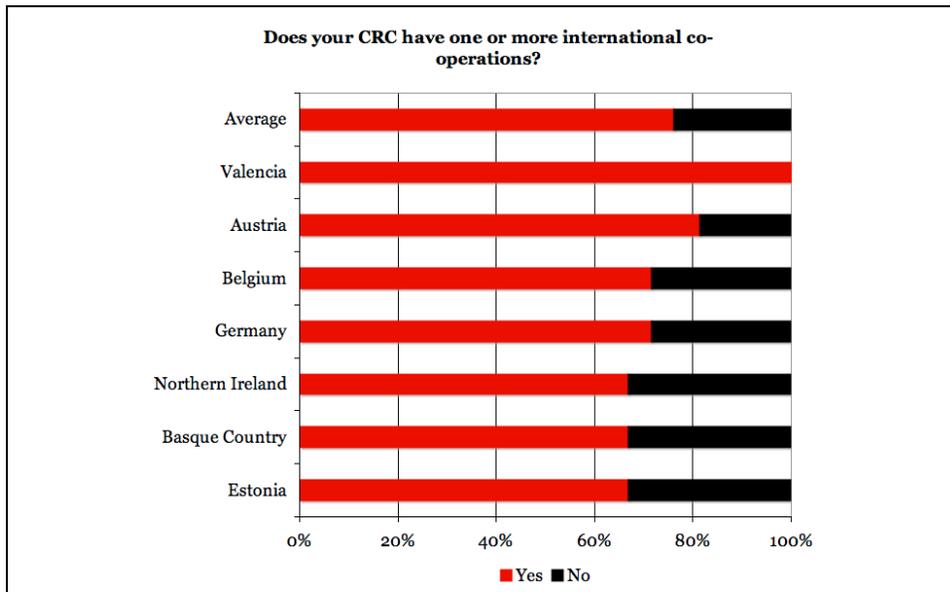
- **Geographic location**

The degree of internationalisation differs from country to country. The average share of CRCs that co-operate internationally is 76% (see Figure 15). The region where international co-operation occurs the most is Valencia. All of the surveyed CRCs have developed international co-operation of some kind. A large share (82%) of Austrian CRCs also has one or more international co-operations. This does however not tell that the CRCs in these countries are more internationalised: the picture gets rather inconsistent when analysing the number of co-operations per CRC. The average number of co-operations per CRC is fluctuating largely per country; no trends exist (see Figure 16). The average number of co-operation of the Flemish CRCs is remarkably high. One of the strategic research centres claims to have more than 300 co-operations (primarily joint-programmes, mobility of researchers and CRC-CRC co-operations), thus boosting the average of the Flemish CRCs²⁹.

From the case study we have learned that a relative peripheral location in relation to European markets and key research centres can provide a stronger driver for active internationalisation activities. This was for instance brought up in interviews for the case studies of BalticNet-PlasmaTec in Greifswald and Questor in Belfast.

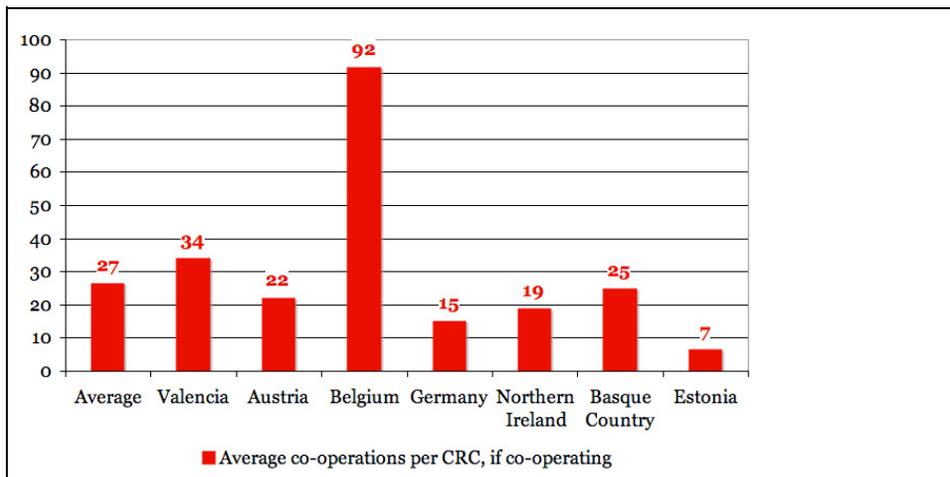
²⁹ It is however plausible that the strategic research centre has a much higher number of co-operation as it is very large in terms of funding, human resources, projects, and it has an outstanding reputation. For comparison purposes: when ignoring the 311 co-operations of the strategic research centre, the average number of co-operations per CRC is 19.

Figure 15 The share of CRCs with and without actual international co-operations, set out against the country of residence.



Technopolis Survey; n=70

Figure 16 The average number of international co-operations per co-operating CRC(b), set out against the country of residence.



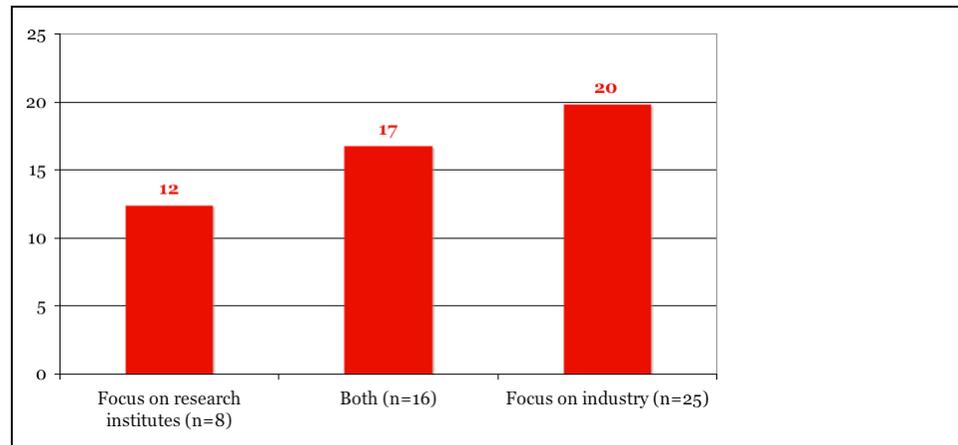
Technopolis Survey; n=50

CRCs with focus on industry tend to have a higher average number of international co-operations. Figure 17 shows the average number of international co-operations of CRCs with focus on research actors, industry or a combination of both. It appears that CRC with focus on industry have averagely 20 co-operations; those focussing on research institutes have averagely 12 international co-operations. The correlation between focus on industry/research institute and the number of co-operations is however weak, primarily because only 8 CRCs focus on research institutes, see Appendix D.3 for an explanation. Nevertheless, the CRCs with focus on industry have more co-operations on average. CRCs are often set up on the interface between science and industry; where only a couple of research institutes cover the whole field of research, a larger number of companies (ranging from multinationals to SMEs) cover the industrial area. It is plausible that the co-operation projects with industrial parties

abroad are smaller bi- or multi-lateral projects with industrial projects. Moreover, especially when SMEs are largely involved in the CRC, it is well possible that there is a larger need for international collaborations³⁰, whereas the research institutes are much more embedded in an international arena, thus having a need for fewer co-operations³¹.

VINNOVA’s internationalisation study found that existing links were largely researcher-to-researcher. They focused on Europe and the USA, followed at a considerable distance by China and Japan. The number of actual and desired links outside these countries were small.

Figure 17 Average number of international co-operations of CRCs with focus on industry, research or both. ³²



Technopolis Survey; n=49

5.2 Drivers (needs and opportunities)

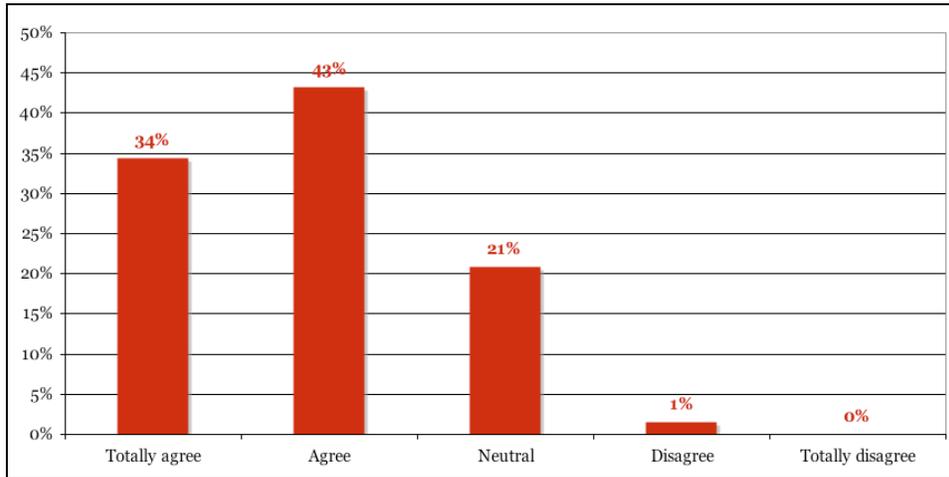
The previous chapter showed that in most countries, the CRC programmes do not explicitly stimulate the internationalisation of CRCs with strategies or programming documents that steer towards internationalisation. Nevertheless, CRCs do find their national programme officers supportive of internationalisation (see Figure 18). Apparently, the support in informal and implicit ways of the programme officers is perceived to be strong. This is again confirmed in the case studies where explicit or implicit government support is given to the internationalisation activities. In the Valencian case of AIDICO internationalisation, and particular achieving access to European funding, is part of the remit of the organisation. In BalticNet-PlasmaTec internationalisation was built in from the very start of the initiative, as was the case with Questor in Belfast. In other cases the international collaboration activities emerged over time but were not hampered by the lack of government support.

³⁰ Possibly a large number of smaller projects.

³¹ Possibly with larger budgets.

³² We considered a CRCs focused on research partners, when at least 60% of their activities are aimed at research actors, i.e. universities and research institutes. Similarly, the group “CRCs with focus on industry” dedicate at least 60% of their activities at actors from industry, i.e. SMEs and large companies. The rest category “Both” consists of those CRCs that have dedicate not more than 60% of their activities to one group of actors.

Figure 18 CRC managers' comments to the statement "Our national (or regional) CRC funding organisation is very supportive of international co-operation of our CRC."



Technopolis Survey, n=69

5.2.1 Drivers of international co-operations

From the literature and experiences with CRC programmes we identified a range of drivers for international co-operations. These are:

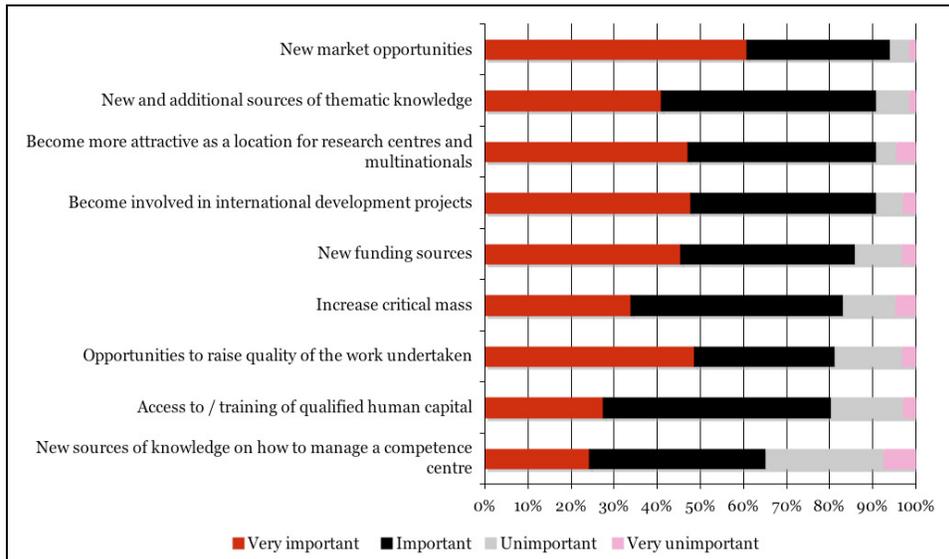
- **New market opportunities.** Co-operation with organisations that establish a route to explore new markets. Cross-border user-producer interaction can lead to innovations that guarantee new sustainable supply and demand relationships. Especially when taking into account the supply chain of industries (e.g. the automotive or microelectronics industry), co-operations could lead to new supply-demand relations.
- **New funding sources.** Finding foreign partners that are willing to invest in the CRC is a way to enlarge the available budget. For some programmes –such as the EUs Marie Curie programme or Framework Programmes – co-operations are a requirement to be eligible for funding.
- **Become involved in international development projects.** International development projects can be a secondary goal of a countries research policy.
- **Become more attractive as location for research centres for multinationals.** International co-operation leads to higher visibility and is an indicator for success. A higher international network and higher prestige will attract excellent research centres and companies.
- **Raising the quality of the work undertaken.** International co-operation is a way to gain knowledge from international partners.
- **Increase critical mass.** An increasing the number of foreign partners makes the relative importance of the CRC higher, and thus increases the competitive advantage of the CRC.
- **New and additional sources of thematic knowledge.** The inclusion of foreign partners is a way to explore new sources of knowledge.
- **Access to human capital.** In many countries, there is a deficit of required scientific personnel. This can be a reason to attract foreign researchers, in order to find enough, well-equipped researchers.
- **CRCs might be interested in co-operations with other CRCs in order to gain strategic knowledge on the governance of CRCs.**

The survey asked the CRC managers to value the above-mentioned drivers. Opening up new market opportunities is the most important drivers for international co-operation, 95% of the managers call this an important or very important driver. New additional sources of knowledge (92%), increase of attractiveness (91%), and becoming involved in development projects (91%) are also mentioned as very important or important drivers. However, nearly all of the identified drivers are seen as important (see Figure 19); 80% of the CRC managers see all the drivers as important or very important, except the drivers to find new sources of knowledge on how to run a CRC (65%). Interesting is also the deviation in some answers.

The case studies give a more consistent picture of the key drivers:

- In the majority of cases the important driver behind seeking international collaboration is to find complementary knowledge and expertise that will strengthen the portfolio of research and knowledge that can be offered to the local members;
- In a small number of cases (AIDICO, BalticNet-PlasmaTec) an important driver is finding additional R&D resources outside the own region, particularly from the European Commission. These cases tend to be the government-induced type CRC initiatives rather than the industry driven CRCs;
- In the more industry driven cases (ViF, GigaHertz, Questor) the search for foreign industry partners follows business logic: it is beneficial for the local industrial partners to have major foreign firms involved for strategic alliance and business opportunities. In the case of ViF and Gigahertz the membership of foreign companies fulfil the specific role in the value chain and provide the technological knowledge that are connected to their parts of the value chain. Here vertical co-operations have proved to work best;
- Improving attractiveness of a centre and/or a network is a more indirect driver that needs a long-term approach. The Basque case of biomaGUNE shows that in emerging sectors this can be achieved in a relatively short time, while other centres needed more than 5-8 years to become more visible for foreign partners and researchers;
- Although the creation of market opportunities is the most frequently mentioned driver, it has proved difficult to establish clear examples of business opportunities directly stemming from participation in the CRC: most R&D activities in CRCs are far from commercialisation phases thus translation of CRC research into innovation does not occur within the CRC-organisation. Exceptions are activities in Questor and AIDICO that are geared to commercialisation and SMEs.

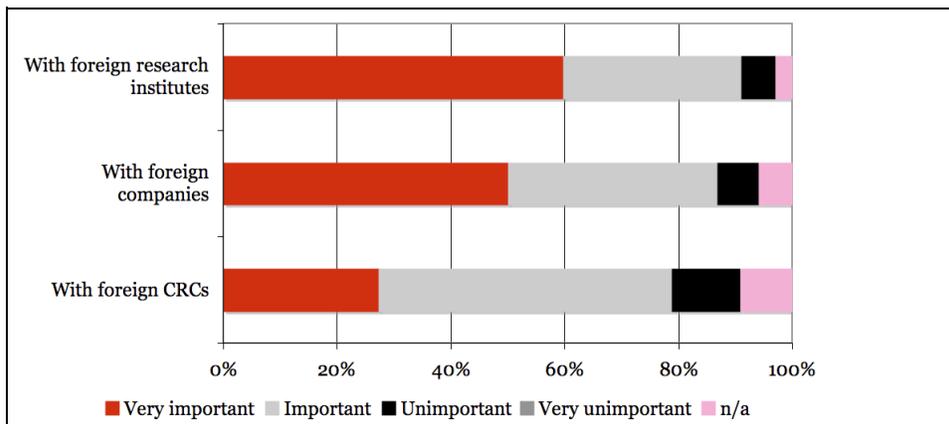
Figure 19 Drivers for international co-operation.



Technopolis Survey; n=68

The CRC managers were asked in the survey with what type of actors they would wish to co-operate. Despite the fact that new market opportunities are valued as most important driver, other research institutes are seen as the most favoured type of partner; 60% of the CRC managers indicate that they see this type of partner as very important to co-operate with (see Figure 20). About 50% of the CRC managers want to co-operate directly with companies. Co-operations between CRCs is favoured to a lesser extent. Only 26% of the CRC managers gives co-operation high priority.

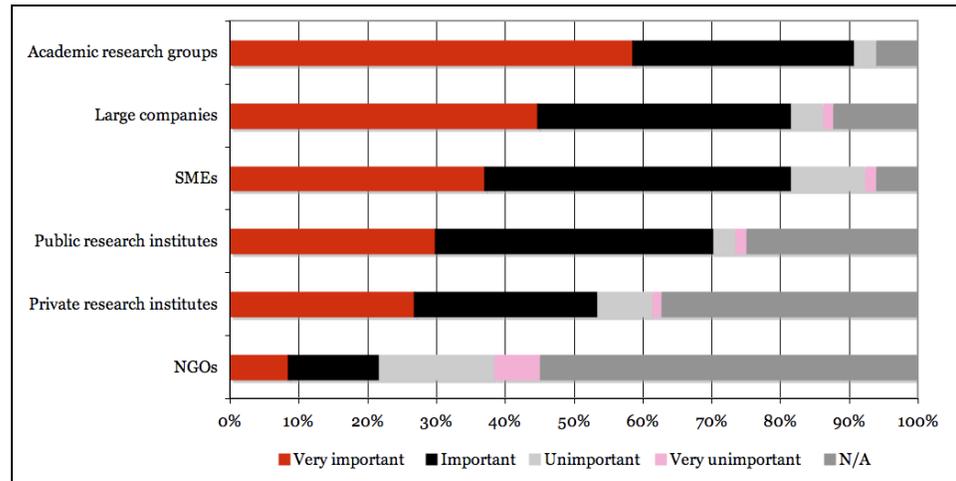
Figure 20 The importance of different types of international co-operation partners.



Technopolis Survey; n=68

The CRC managers were asked how important international co-operation is to their own stakeholder. If we focus in at the level of the members of a CRC, the academic research groups are perceived to be the group for which co-operation is most crucial (see Figure 21). 58% of the CRC managers indicated that for academic research groups, co-operation is very important, and 33% regard it as important. A second group of stakeholders for whom collaboration is important are SMEs followed by large companies. As an interviewee stated CRCs are important for SMEs to find partners, because they have smaller strategic departments. Furthermore, large companies are often already internationalised. Nevertheless, the CRC managers think that co-operation is of importance for the large companies.

Figure 21 The importance of international co-operation to the partners of CRCs



Technopolis Survey; n=64

According to CRC managers, motivations for international co-operations via CRCs are threefold for *universities* and *research institutes*. First of all, universities can become more attractive to co-operate with. International co-operation via a CRC is a way to increase the reputation and visibility of academic research groups, and the university as a whole. As a result, this can attract top researchers to the universities, which thus increases the quality and reputation of the university. Also, international co-operation can help attract additional research funding, which could lead to increased quality, reputation and visibility.

Specific motivations for companies are the extension of networks, which could lead to new markets, to new sources of knowledge. SMEs have more difficulties to find international partners and they require help in finding partners, establish contacts and eventual co-operations.

5.2.2 Needs for future co-operations

5.2.2.1 Planned modes of co-operations

Whereas 76% of the CRCs currently have international co-operations, all CRCs that responded to the survey plan to establish international co-operation in the next five years. This illustrates the trend towards internationalisation also takes place at the level of CRC managers. In the survey, CRC managers were asked which kinds of co-operations they plan to develop within the next five years (see Figure 22, next page).

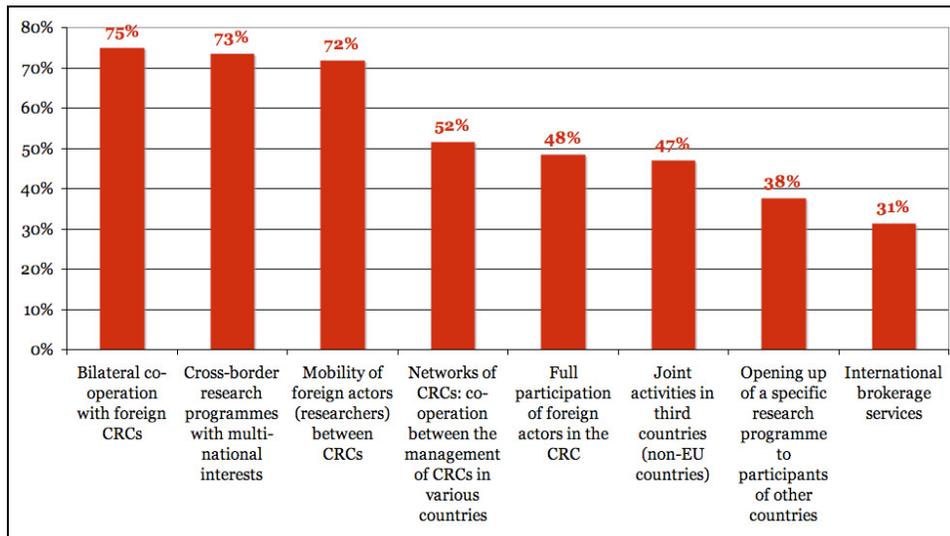
There is a clear preference for three sorts of co-operations; the CRC managers are seeking to develop bilateral co-operation with foreign CRCs (75%), cross-border research programmes (73%) and mobility of individuals between CRCs (72%). The survey does not allow us to analyse whether the planned bilateral cooperations with foreign CRCs are with the CRC organisation or with individual members of foreign CRCs. The case studies all suggest the aim is to find individual CRC partners (e.g. a particular university or firm) rather than the whole network. However it does show that foreign CRCs are a likely focal point for partner search.

Less than half of the CRCs are looking to set up full participation for foreign actors, extra-EU joint activities and networks of CRCs. Only about one-third of the CRCs foresee that its research programmes will open up for foreign participants in the next five years. International brokerage services are planned by 31% of the CRCs.

The opportunities perceived by the CRC-community that was interviewed in the case studies were along the same lines:

- Expanding the network with a number of specific ‘preferred’ partners
- Developing better opportunities for human mobility
- Taking better advantage of the network in EU-programmes

Figure 22 The kind of international co-operations the CRCs are planning to develop within 5 years



Survey Technopolis Group; n=64

The popularity of planned modes of co-operations is similar to the ones that the CRCs now have. Cross-border research programmes with multi-national interest is the most common mode of operation nowadays and is likely to be so in near term future. Bilateral co-operation with foreign CRCs is the most favoured planned mode of co-operation. Currently, bilateral co-operation with CRCs is the third popular mode of co-operation. From the case study we derived that co-operation with foreign CRCs is an interesting activity for the CRCs in their search for the right partners. Actual co-operative projects are often carried out at individual actor level. Only opening up of specific research programme scores significant lower in the planned modes of co-operation than in the currently used modes; 43% already opened up a specific programme and therefore do not plan to do so in near term future.

5.2.2.2 Selection of co-operations

Several aspects determine whether a co-operation suits a CRC or not. In the survey the CRC managers were asked to rank the most important determinants for co-operations. They could rank them by giving points: 7 points were given to the most important criterion, and 1 point to the least important criterion. Figure 23 (next page) shows the outcome of this question; the average values are displayed.

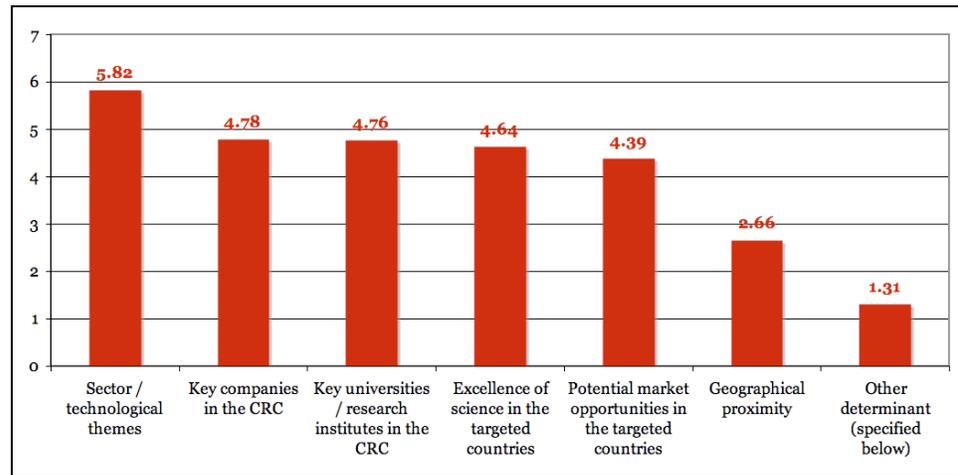
By far the most important determinant is the thematic focus of a potential partner. The CRC only want to co-operate with partners that are at close cognitive proximity: on average this selection criteria scored 5.8 points. This first selection criterion is followed by a number of criteria: key companies, key universities, excellence of the targeted country and the potential market opportunities. These criteria are based on the perceived quality of the potential partner. CRCs with a stronger focus on companies (and more applied science) value the criteria key companies, and potential market opportunities higher. Those CRCs that have a stronger focus on knowledge transfer have more attention for the criteria key research institutions and excellence of science. Geographical proximity is not so important compared to the other selection

criteria. The excellence of the research and industrial partners is favoured above the geographical proximity of the potential partners.

From case studies the dominant view is that the preferred partner is a specific research performing organisation that adds complementary knowledge and expertise (both for universities and for industrial) and/or fills a specific gap in the value chain (industrial partners). CRC-managers are mostly concerned with developing a well balanced research portfolio, often addressing multi-disciplinary themes that needs a combination of scientific and technological backgrounds.

In the category ‘other determinants’ general framework boundaries were mentioned as a criterion to select co-operation partners in the survey. This includes the (political) stability in the country of potential co-operations, as well as the local co-operation rules for the potential partners.

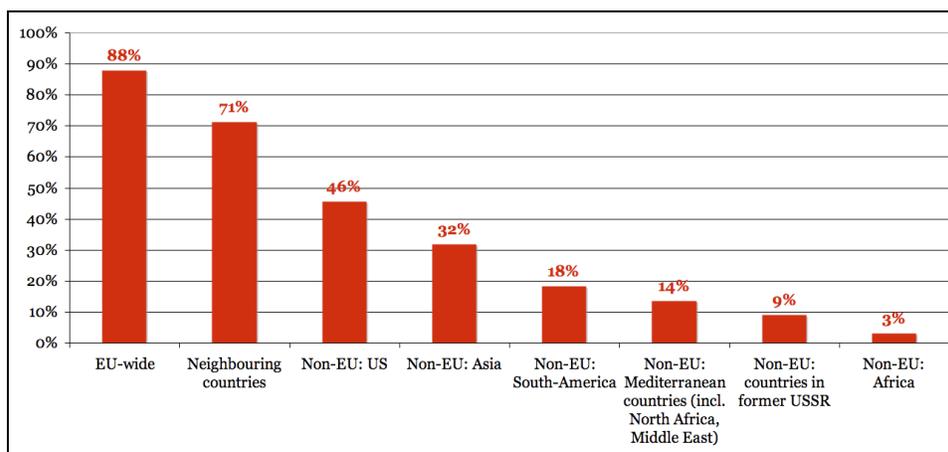
Figure 23 Selection criteria for international co-operations



Technopolis Survey; n=66

Although geographical proximity is not among the most important selection criteria for co-operations, the CRCs have several geographical preferences for co-operations (see Figure 11). Most importantly, the key geographical focus is on other EU countries; 88% of the CRCs aim at co-operations within the EU. Remarkably, geographical proximity plays a role when selecting partners, as 71% of the CRCs put their focus on neighbouring countries. A smaller number of CRCs have a focus outside the EU. About 46% of the CRCs, focus on the US for their co-operations. Also a mix of national and regional CRCs aims for Asian countries. Spanish CRCs often focus on South-American partners to co-operate with: five Spanish CRCs have a focus on South-America, against only one CRC from another country. Obvious reason for this is cultural proximity. A similar cultural proximity is observed for countries in Eastern Europe that focus more frequently on co-operation with non-EU countries in the former USSR. Focus on Mediterranean and African countries occur in a range of CRCs with various nationalities. Appendix D.4 shows the preferred geographic focus per country.

Figure 24 Geographical directions of international co-operations



Technopolis Survey; n=66

The respondents in the VINNOVA Survey had a similar geographical focus (see Appendix E.4). The main focus is on Europe (81%). In the Swedish sample there is more focus on the USA and Canada (73 respondents indicate co-operations with these parts are of main interest). A group of secondary importance is Japan (39) and China (36). The rest of the world is perceived to be less important, such as South East Asia (20), India (20) and Australia and New Zealand (17).

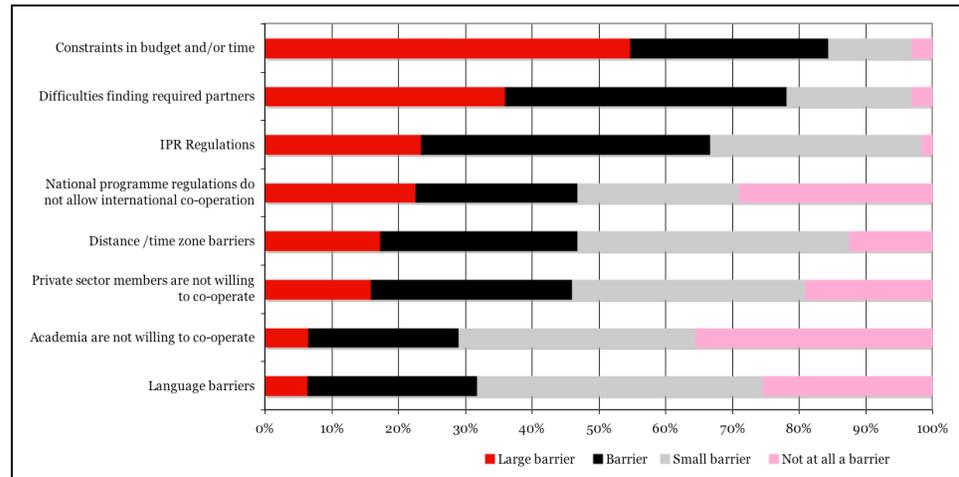
5.2.2.3 Policy needs

The VINNOVA survey asked the sample of CRCs which policy support they desire (see Appendix E.3). The survey showed that the CRC have a need for economic support that is especially aimed at international co-operation. The current structure of the programmes and subsidies does not allow the CRCs to dedicate funds to international co-operations (see section 6.3). Not surprisingly, the need for economic support is mentioned by 41% of the respondents as the most important need. The second largest need also links to availability of resources: 22% of the CRCs need co-financing and support to EU projects. Support to establish relations with other players and funding institutes is mentioned 11%.

5.3 Barriers to cooperation

In addition to the barriers that are identified at programme level (see 3.1), the survey analysed the existence and importance of barriers at CRC level (Figure 11).

Figure 25 Barriers to international co-operation of CRCs



Technopolis Survey; n=66

- As was already identified at programme level: acquiring funding for international co-operations is a difficult hurdle to take. Constraints in time and money are seen as the most important factor hampering the development of international co-operations: 85% of the CRCs experience this is a (large) barrier or to co-operations. For only 3% of the surveyed CRC managers funding is not a barrier.
- Finding required partners is the second most important factor hampering international co-operations. Apparently it is not easy to find the right partners in terms of research topics, with sufficient scientific quality, and who are willing to participate in co-operations.
- The danger of spilling knowledge through international co-operation, thus losing a competitive advantage also plays an important role at the level of CRCs. IPR regulations are an obstacle to deal with; two-thirds of the CRCs see this as a large barrier.
- The practical barrier of proximity that was already identified at programme level is confirmed to be a problem for individual CRCs as well. Distance or time zone barriers exist for 48% of the CRCs.
- National programme regulations that do not allow co-operations are also a (large) barrier for 47% of the CRCs. On the other hand almost 30% of respondents say that national programme regulations are not considered a barrier at all. It is remarkable that even respondents in countries which have a climate conducive to internationalisation, still appear to have large problems with programme regulations when trying to set up co-operations.
- The willingness of members to co-operate and issues with language are only moderate barriers. Apparently, it does not often happen that partners hamper the internationalisation, and if so, these are mostly private sector members. For private sector members, co-operations with potential market competitors form a threat. Therefore, larger companies will not always tolerate co-operation with other large companies. Language does not seem to be problematic, English is a common language in research and business.
- The barriers to internationalisation we identified at the programme level are very similar to those retrieved from the individual CRCs. The most notable hurdle to take to foster international co-operations is acquisition of funding. At programme level, no budget is available to fund co-operations, because of a lack of financial incentives from national policy makers.

- Fear of losing competitive advantage is again a shared barrier at programme and CRC level. IPR regulations hamper the co-operations at CRC level, while national programmes are often not opened up because of the fear to spill competitive advantage. In addition, the political decision to protect national programmes and to exclude foreign partners is a barrier identified at programme level and at the level of individual centres.

The VINNOVA Survey identified a similar set of barriers to the establishment to global links. The most often-mentioned barrier is a lack of economic resources (84% of the surveyed CRCs mention this barrier). A closely linked barrier is that the funding that the CRCs receive is not to be spent on global links (27%). Also problems with the bureaucracy of EU projects, and the demanding eligibility criteria exist (24%). General issues, such as a lack of time and priority in the CRC and bureaucracy are regularly mentioned (see Appendix E.5 for a full overview of barriers).

5.4 The effects of international collaboration

The case studies reveal that in most CRC cases it is too early to assess the effects of international co-operation as this has only been a recent development in the life cycle of the centre. Across all cases no benchmarking, monitoring or evaluation is done systematically to assess the progress or effects of internationalisation.

The most internationally active CRCs do have a number of indicators on which they assess the success of their international collaborations:

- The increase in the number of partners due to the larger international coverage of the CRC. ViF and Questor can see a direct link between their international collaborations and the increase of (local) membership;
- The increase in visibility and reputation, which leads to a more prominent position in European activities (e.g. leading EU-consortia, organising international symposia), attracting foreign researchers to the centre or in the network;
- New market opportunities for the member companies through their networking activities and strategic alliances. These type of effects are hardly monitored by the CRCs, but did come out as anecdotal evidence from the company interviews conducted in the case studies;
- New funding sources, particularly international (EU) funding and a higher level of member fees as a result of broadening the membership.

6. Conclusions

6.1 International cooperation strategies

Internationalisation at the CRC programme level is emerging, but is not a general feature in CRC programmes yet. Especially in countries where the CRCs are in the phase of establishment, internationalisation is still relatively unimportant. The newer programmes are strongly focussed at the national and regional level, in order to get the CRCs established. In countries where internationalisation plays a larger role in the CRC strategy – such as in Austria and Sweden - the CRC programmes are open for international partners. The case studies show that while internationalisation is not always very explicitly stated in the goals of the programme, it is supported by the programme managers when CRCs engage in for instance EU-programme activities, where cross-border funding is not an issue.

The survey found that the majority of CRCs do not have a codified internationalisation strategy. The most CRCs in our case study sample do not have an explicit internationalisation strategy either. However the most active ones have international cooperation as an integral part of its core strategy and/or in its governance structure (BalticNet-PlasmaTec, ViF, Questor, GigaHertz). Internationalisation does not depend on the fact whether there is a codified internationalisation strategy or not. In all cases the CRC-manager or director understood the necessity for moving the centre a step further up the development ladder through international collaborations.

An internationalisation strategy could help the CRC to become more selective in their choice of partners and the type of collaboration that would add value to the local members. Pushing internationalisation as a goal in itself does not seem a sensible way forward. The CRC-managers that have been successful in achieving successes have been cautious about what partners to involve and have devoted time to trust building with those partners. Thus too large international networks in relation to the size of the CRC and its local network will face the problem of not being able to embed the foreign partners in more strategic alliances with the CRC.

A clear and explicit international strategy at the CRCs-programme level (e.g in Sweden, Austria) does help to push the internationalisation activities a step forward and allows the centres to overcome practical barriers such as allowing some forms of cross-border funding.

6.2 The role of CRC-CRC cooperation

While the survey showed that bilateral cooperation with foreign CRCs is high on the agenda, the case studies clearly show that CRC-management and partners are in search of specific partners (research organisations, industry) that bring a particular technological expertise, take a specific position in the value chain and have proven to deliver high quality work. Working with other more networked CRC-centres is not high on the agenda, with some exceptions of finding a similar partner to enter into EU-projects with. Due to the networked nature of the CRCs, it is also considered difficult to find a similar CRC organisation with a similar/or complementary thematic focus. The thematic focus of each of the cases is highly dependent on the expertise of the partners involved and also shifts in the course of the time.

The CRC-managers do see the potential merits of CRC-CRC cooperation in terms of focusing on a particular geographical area (with strong competences in a thematic domain or strong markets) and working together with another CRC in that area to link the individual members of these CRCs (universities, research institutes and companies). The CRC managers are in principle very customer focused and their first consideration is whether a link with another CRC brings either additional scientific and technological expertise or market access to their companies. As time and

management means are scarce (the key barriers according to the survey) this should be a focused effort rather than a more general networking activity.

A clear example of where cooperation between CRC-management was beneficial can be found in the Questor case where participation in the US NSF-programme for industry/university CRCs formed a valuable learning ground how to organise the governance of the CRC and to open the centre for strategic alliances with foreign partners. Nevertheless, today the need for such CRC-CRC collaboration is seen as less urgent for Questor.

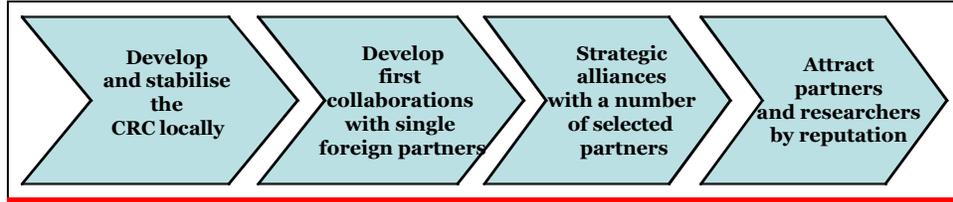
6.3 Factors of success for international collaboration

A conclusion that can be drawn from the cases (ViF, Questor, GigaHertz) that have active partnership from foreign companies is that governance models are chosen where the foreign companies have a say in the research programming, can acquire the benefits from the research that is conducted, but are considered to contribute to the research funding in cash or in kind. This reduces the sensitivities of national/ regional funding going directly to private sector members abroad.

There is a clear pattern in all cases considering the development cycle they undergo in terms of engaging into international cooperation. This life cycle is graphically illustrated in Figure 26 below. CRCs in the first development phase are occupied by building up the centre locally, ensuring to get the partners on board, building trust relations and working methods. These CRCs do not yet have international collaboration high on their agenda. The focus is mainly on developing a working mode with local partners, perhaps because the markets are very national or the industrial partners want to have a tight control over their international cooperation directly and not through the CRC. A case that typically fits this stage would be FMTC in Flanders. There are cases where international collaboration was built in from the very start, such as Questor and BalticNet-PlasmaTec. However, in both cases one can see that this collaboration is held at low key in the first few years. It is only after a few years of building critical mass that these foreign relations are truly activated.

A next step up is to establish international relationships with single foreign partners, often through the European research programmes or other cross-border programmes such as Interreg. In more science oriented CRCs, such as biomaGUNE, researcher mobility is a mode of collaboration that appears to have a relatively low threshold. Finding the appropriate partners was put forward as a barrier by many interviewees. The European programmes are a good way of exploring potential working relations with partners. The cases of AIDICO and ELIKO are good examples of centres in this phase of development. It is only the centres with some maturity (e.g. Questor), or operating in sectors that have a strong tradition of international S&T cooperation (e.g. ViF, GigaHertz) that are able to engage in long term strategic relationships with particular universities or research organizations or R&D-oriented companies. They take part in the governance structure of the CRCs and have an active contribution to the strategic orientation of the CRC. One can see a development where the CRC starts to coordinate large European consortia in their field. Once the centre has grown in critical mass and gained international reputation through the work it has conducted, it builds up such a strong reputation that international partners will ask to join the CRC. The CRC will have led international symposia on the research topic and be recognized as a key player in the field in Europe at the least. In the sample of the case study perhaps only ViF fits in that category in the very specific niche in which it is operating. In each of these development phases the set of needs of CRC-managers are different. CRC-programmes could provide a different type of support in different phases.

Figure 26 Life cycle of internationalisation at CRCs



The support of CRC-programmes and CRC-CRC cooperation could be different in different phases.

In the first phase when partners are mostly building partnerships locally, creating awareness of the importance of international networking, the advantages of having international partners on board and providing CRCs with a clear mission to have at least 1-3 foreign partnerships at the end of their launching phase (say 3-5 years) would be beneficial to prepare the mind set of the CRC-management. A general rule is difficult to establish here as some technological domains are so intrinsically international that one should expect international linkages from the start. CRCs that work with predominantly industries that are part of an international value chain should from the outset look how the CRC-cluster can hook up with key players abroad. A CRC-programme manager could also provide incentives for the starting CRC to attract foreign researchers to the CRC and to advertise posts internationally instead of only locally. With more foreign staff the international outlook will become more obvious.

The second phase where the local CRC has become more stable and trust has been built between the local partners, CRC-programme managers could support the CRC by stimulating bilateral partnerships with key partners, for instance financed through European Framework Programme funding. Schemes or organizations that help identifying potential partners, appropriate calls in the Framework Programme and support the proposal preparation could be mobilised by the CRC-programme. Such organizations or national service providers often already exist in countries so it a matter of creating a link with other government agencies or service providers rather than developing a CRC-dedicated effort. CRC-funding organizations such as Innovation Agencies in two or more countries could develop dedicated Interreg programmes that can support CRC-type organizations to come with proposals for cross-border cluster initiatives.

When in the third phase the CRC is well established and has built a pool of competences and research and innovation outputs it is likely that the CRC will look for more strategic partnerships with key players in their domain. This could involve the permanent membership of the individual foreign partners in the CRC, it could also mean a strategic link with similar CRC-initiatives to form an agenda-building platform in Europe. The European Technology Platform initiative is a good example where individual partners but also CRC-type organizations that represent a wider stakeholder group have together develop strategic research agenda's to influence the programming of the European Commission's Framework Programme. CRC-programme managers could help individual CRC-managers to set up governance, funding and IP structures that help the closer involvement of international partners in the CRC. It could also support a CRC to market and brand the centre better at international events. CRC-CRC cooperation could support the partner searching process as well as lead to a certain division of labour between centers in terms of building up state-of-the-art knowledge in specific domains.

In the fourth phase when a CRC has already established international reputation support could be geared to international marketing, the support of benchmarking a centre or cluster with similar CRCs in other countries.

6.4 Some examples of good practice

The case studies have showed that there is no single 'good practice model' for international collaboration as too much is dependent on the particular context of the CRC, the sector it works with and the scientific and technological focus areas. In addition as described above CRCs in different stages need to address different types of barriers. International collaboration needs experience and time for trust building so should be seen as an activity that needs to be developed in time. So good practice in international collaboration is linked with good practice in overall management of the CRC.

Examples of good practices can be found in the Austrian ViF for instance:

- Experience: the experiences gained in international co-operation since 2005 have shaped ViF's co-operation strategy as well as its implementation;
- Research capacities and capabilities: ViF did not start from scratch when it became a COMET K2-centre in 2008 but it could move on from what its predecessor, a K-plus-centre and a K-ind-centre had achieved;
- A clear and efficient model for including new partners: the standard co-operation agreement provides the rules and the framework for any new partnership. These rules make sure, the consortium can be expanded while at the same time protecting the interests of already existing partners.

The Questor case is also interesting from a viewpoint of CRC-management and international collaboration:

- The deliberate decision to include foreign academic partners that have a complementary expertise base, thus improving the added value of the centre from the perspective of the members
- The research programming and selection processes, which is on the one hand very user oriented (member choose the topics) and provides equal opportunities to the foreign academic partners to take part in the activities.
- The opportunities that are provided for local companies to develop strategic alliances with foreign and non-local companies
- A well thought through IPR and commercialisation framework that is satisfactory to the members
- The linkages that have been established with NSF and the additional opportunities this offers in terms of partnerships and in terms of learning from best-practices how to manage collaborative research centres

For CRCs in the first stages of development, entering the international collaboration arena through EU-programmes shows to be an appropriate first step to get acquainted with foreign partners, to adjust to cultural differences, learn the specific management aspects of cross-border collaboration, etcetera. Thus activities of most CRCs to help their partners to enter into international and cross-border programmes can be considered as good practice. The cases in Valencia and the Basque regions, Eliko in Estonia and BalticNet-PlasmaTec in Germany, but also the more internationally advanced CRCs are all examples where applying for EU-funding provided a first stepping stone for international collaboration.

For Centres that operate in the third development stage, incentives to help them shape the international research arena can be helpful. GigaHertz has benefited from a small 'globalisation grant' from VINNOVA, which has allowed it to set up the European Radio and Microwave Interest Group (EuRaMIG). This has a core group of 16 European university, institute and industry research groups but is open to anyone in Europe researching in radio and microwaves. The chairman of the GigaHertz Steering Board chairs EuRaMIG, whose primary purpose (apart from networking the research

community) is to influence the direction of the Framework Programme through generating consensus and road maps.

The 'globalisation grant' that was used in the GigaHertz case (see 7.3) is part of the Global Links programme that was launched by VINNOVA in September 2008, aiming to fund 10-20 'strong research and innovation milieus' that involved university-industry cooperation in R&D and that had at least two years funding remaining in one of the Swedish centre-based R&D funding schemes.³³ The purpose of the programme was to establish a process for research and innovation milieus and for VINNOVA to work more systematically with international challenges.

Short-term impact goals were:

- 10-20 strong R&I milieus in Sweden to have during 2009 produced strategies for internationalisation and be contributing to the strengthening of their global competitiveness and attractiveness.
- R&I milieus wanting to work more strategically on internationalisation to have been afforded the opportunity through the programme to exchange experiences and learning in this work.

Longer-term impact goals were:

- 10-20 strong R&I milieus in Sweden to have built up competence and working methods which provide the capability to exploit internationalisation in a more strategic fashion operationally.
- Some of VINNOVA's efforts to be adapted to effectively stimulate R&I milieus' capacity to work strategically with international collaborations and global links.

The programme was very permissive in what it would fund. Examples of activities mentioned in the Call for Proposals were

- Systematic benchmarking of Swedish R&I milieus in relation to global equivalents. This means actual benchmarking of entire milieus rather than individual research groups or companies. A key aspect is assessment of the R&I milieus' own attractiveness as partners for both investment and recruitment.
- Overall strategies and action plans adopted by the players in the respective R&I milieus for global positioning, branding work and establishment of links to global players with complementary skills, knowledge, technology and other resources.
- Swedish players' (R&D financiers, researchers, companies, regions etc) capacity to take co-ordinated and proactive action in the development of strategic global alliances. Amongst other things, there is a great need to strengthen the collaboration and presence outside of Europe and North America. Special support efforts may be needed here (funding, competence development, IP strategies, export promotion, investment promotion etc.).
- Marketing of Swedish R&I milieus on a global market.
- Efforts to support young, knowledge-intensive companies' international alliances and exports.
- An enhanced focus on integration of an international perspective in R&D programmes and projects from the outset. Not least of all, value added through participation in the EU's Framework Programme needs to be given a greater role in the planning of R&D activities.

³³ Vinnova, Strategies for global links for strong research and innovation milieus, 15-5-2008.

Grants under the scheme could be up to 10 MSEK (about €1.1m). Various elements of such a scheme could be an interesting ‘accompanying measure’ for any CRC programme.

6.5 Barriers for international collaboration

There are a number of barriers at the programme level that hamper the internationalisation of CRCs as was pointed out in our interviews with policy makers:

- Absence of policy incentives to co-operate internationally
- Funding
- Fear of losing competitiveness advantage if foreign competitors are involved
- Different national framework conditions
- Practical reasons such as the proximity to suitable partners form a barrier.
- The case studies which included interviews with stakeholders from industry pointed out that the fear of losing competitive advantage is not a major concern for them. Companies are more and more used to working in a networked model and good contractual agreements ensure that a fair treatment of the results of the collaborative work can be arranged.

The survey amongst all CRCs gave a clear top-3 in terms of barriers: 1) budget and time constraints, 2) difficulties in finding the right partners and 3) IPR regulations. Difficulties with national programme regulations came next. The case studies that were chosen partly because they were already very active in international collaboration put forward different types of barriers. Funding for foreign partners is indeed an issue for many of the cases. However, this is a bigger bottleneck for CRCs who work with foreign SMEs than with large companies who are expected to fund a considerable part of the research themselves. In the cases with a strong political support for cross-border collaboration (Austria, Sweden, Northern Ireland, the Nordic area) a limited level of funding for foreign partners was not considered a major issue.

Most CRCs in the case studies do indeed have problems finding the right partners, except for those that work in very specific niche areas with larger players such as in the automotive and in the micro-electronics cases where the user community is quite well known. This is a barrier where a network of CRCs could add value to provide more transparency on who is who and to conduct more active brokerage activities. However, real cooperation takes place between people who have developed trust between each other and have an interest in the expertise the other party can add. So brokerage can contribute mostly to first contacts on which cooperation can be built.

The survey shows that IPR is a major bottleneck. However, the cases with active involvement of foreign companies do not report any major issues on this front, as they have dedicated professional resources to settle these issues and provide good contractual frameworks. It seems the disseminating good practice to CRC-managers on how to settle IPR and contractual arrangements in an international collaborative setting is an issue where more can be done by a COMPERA-type network. Centres that have experience with involving R&D-companies from abroad (ViF, GigaHertz, Questor) have developed in-house expertise to deal with the contractual and IPR side of managing international collaboration. They have understood the importance of on the one hand clear and transparent contractual arrangements, while on the other side the flexibility and expertise to draw up case-by-case IPR agreements for specific projects and companies.

6.6 Effects of international collaboration

As stated in Chapter 5 the case studies reveal that in most CRC cases it is too early to assess the effects of international co-operation as this has only been a recent development in the life cycle of the centre. Across all cases no benchmarking,

monitoring or evaluation is done systematically to assess the progress or effects of internationalisation. Four effects were reported in the case studies:

- The increase in the number of partners due to the larger international coverage of the CRC. ViF and Questor can see a direct link between their international collaborations and the increase of (local) membership;
- The increase in visibility and reputation, which leads to a more prominent position in European activities (e.g. leading EU-consortia, organising international symposia), attracting foreign researchers to the centre or in the network;
- New market opportunities for the member companies through their networking activities and strategic alliances. These type of effects are hardly monitored by the CRCs, but did come out as anecdotal evidence from the company interviews conducted in the case studies;
- New funding sources, particularly international (EU) funding and a higher level of member fees as a result of broadening the membership.

6.7 Possible roles for a COMPERA type network and recommendations for further action

An obvious role for a COMPERA-Type network is to keep promoting, within their national and regional policy arena's, the importance of internationalisation in today's globalised world. In that sense the companies attached to the CRCs are often much further ahead on the internationalisation agenda, compared to the national policy makers. The study shows that a supportive national policy framework gives the centres an additional push and helps overcome specific budget issues. However it is neither a major bottleneck for those centres that have, from their own strategic objective, decided to enter into collaborative agreements, nor is it a sufficient condition for CRCs to become more active on this front.

This leads to the following more concrete recommendation:

1. Funders of CRC programmes should establish clear guidelines as to what level of international involvement of foreign partners in a CRC is on the one hand expected and acceptable;
2. CRCs that have a certain maturity should be asked to define more explicit internationalisation goals and develop activities to achieve this. This could be integrated in their performance indicators. However, this international cooperation should not become a goal in itself but a means to create added value for the stakeholders of the CRC;
3. National and regional CRC-programme managers could develop a flexible 'internationalisation' package that CRC-managers can apply to in a competitive mode. The Vinnova 'globalisation grant' could be an example of such a scheme. As internationalisation activities are different for each CRC and in various development stages, the types of activities funded should be defined flexibly;

As was described above CRCs go through certain development stages. Any policy support to internationalisation should take into account at which phase in this development a CRC is situated and what particular bottlenecks are likely to occur.

As second role which is related to one of the major bottlenecks that came up in various stages of the CRC development is the difficulty in finding appropriate partner organisations, irrespective of their geographical location. This might not be the case for CRCs operating in narrow and well defined niches, but certainly in emerging domains, domains with a broad disciplinary knowledge basis and domains where the key industrial actors are not yet concentrated in a limited set of large companies. Providing more transparency in the competence base of various centres, by thematic area and by sector would be a simple first step for a COMPERA-type network to undertake. This would need to be followed up by much more active dissemination and

brokerage type of actions to bring together the right people and organisations. Supporting CRCs to enter into European programmes is another route that could be actively followed and here a COMPERA-type network could also support partner search.

The more concrete recommendations that derive from this are:

4. As a European CRC-programme network provide a dissemination platform for CRCs on a thematic basis and link these with existing national platforms for CRCs and thematic cluster initiatives to make the activities and competence areas of CRCs more visible;
5. Use the COMPERA type network to provide more active broker services to CRC-managers seeking specific partners in other countries. This could involve the support of a more active CRC-CRC collaboration, for instance through CRC-management exchange programmes where CRC-managers select a desired partner region or CRC to visit;
6. Explore as ERA-NET potential exchanges of experience and possible bilateral co-operation agreements with similar CRC-programmes in for instance the US, Canada and Australia;
7. Develop more explicit links between the national CRC-programme and existing national services for acquiring EU-funding, export support and agencies responsible for attracting foreign investments to match their activities with the specific needs of the CRCs;

Thirdly the study also shows that good practice in international collaboration is closely linked with experience and overall governance and management skills in the centres. The example of Questor showed that experience from the American NSF-programme formed an inspiration to set up governance and management practices in Northern Ireland. Given the variations in development stages of CRC-programmes and CRC centres across the European countries and regions, support of management learning could help to spur good ideas, also in the area of international collaboration. This is not the same as building fixed CRC-CRC alliances, but more customised management support between peers in the wide CRC community on common issues such as designing the research programme procedures, dealing with contractual issues with foreign partners, and monitoring the effects of international collaboration.

8. Develop short and focused CRC-management training modules on topics such as “how to involve foreign companies in my CRC-organisation”, “good practice in IPR management”. Given that time constraints were a major bottleneck these training modules should be very professionally organised. They could build on the experiences of ‘peers’: the managers of CRCs that have shown to be successful in their international cooperation activities.

7. Case studies

The following Chapter has the full description of the eight case studies conducted. Each of the cases starts with a short introduction, a characterisation of the centre a discussion of its international strategies and a description of actual international collaborations. In addition the barriers and needs are discussed. The cases conclude with good practices and a conclusion summarising the relevance of the case.

7.1 Germany: BalticNet-PlasmaTec

7.1.1 Description of the CRC

BalticNet-PlasmaTec is a network organisation for plasma technology in the Baltic Sea area that fosters technology and market oriented co-operation. It is member of the initiative of the German Federal Ministry of Economics and Technology (BMWi) “Kompetenznetze Deutschland” which brings together the best-performing innovation networks in Germany.

BNPT aims to connect research and industry in the field of plasma technology and plays a coordinating role in international marketing and R&D projects. The international network should lead to implementation and dissemination of the low-temperature plasma technology. BalticNet-PlasmaTec is in particular a tool for its members to:

- Increase the visibility of plasma technology in the Baltic Sea region;
- Create "critical mass" in plasma technology;
- Coordinate joint efforts in research, education, and technology transfer;
- Create a platform for collaboration between academia, public institutions, private businesses, and individuals;
- Create a platform for dialogue with supra-national institutions.

The idea to establish BNPT was born in 2003, in a meeting of institutions and politicians on the initiative of the Scientific Association of Mecklenburg Vorpommern. The initial driver for the establishment of the association was to foster the (economic) development of the German state Mecklenburg Vorpommern. The BNPT was initiated as a co-operative action of politicians and prominent actors from science and industry. Because low-temperature plasma technology was already a well-developed technology in the region, this domain was chosen as thematic focal point. Right from the start it was decided that BNPT should have *international focus*; the network aims at actors from the Baltic Sea region³⁴.

Several phases can be distinguished in the lifetime of BNPT. In the preparatory phase (2003-2004) it was investigated how the BNPT should work, who would be potential partners, and where funding for the association could be obtained. Already in this initial phase, the international plasma arena was explored. In the foundation phase of BNPT (2004-2005), the most important issue was to acquire the right legal status. The BNPT is a not-for-profit association: it does not have to pay taxes, but obtained a legal

³⁴ Statutes of the BNPT: “*The association BalticNet-PlasmaTec is a network for establishing technology based on physical plasma within the meta-region comprising Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Sweden, Germany, Norway, North-West Russia, and Belarus.*”

status that allows the organisation to take part in projects. Furthermore, the first activities were quickly set out, leading to first R&D projects in 2005. Up from 2005, a consolidation phase was entered. In this phase new members were welcomed to the association. At the same time, organisational learning took place: new routines and standards were developed by learning-by-doing. At the moment, BNPT reconsiders a strategy for the future. One of the major goals of the association is to gain an international reputation and visibility. This should lead to the entrance of excellent members, which, in its turn, would reinforce the reputation of the association. One of the issues BNPT currently deals with is the prevention of fragmentation. The association consists of many members that all have their specific demands and priorities. The main problem is that the different groups are defining their own projects; there is a lack of coordination between the members. In order to gain critical mass, the BNPT tries to define a research agenda with research institutes and industry.

At the moment, BNPT has 38 members. The members consist of different types of actors: academic research groups (30%), public research institutes (20%), SMEs (40%) and large companies (10%). BNPT strives for a 50-50 share of companies and research, project management support, et cetera. The thematic focus institutions. BNPT is managed by the Executive Board and controlled by the General Assembly. The Executive Board is elected by the General Assembly; the Assembly consists of all the active members of BNPT. The association manager carries out day-to-day management. The Executive Board's main task is to outline the strategy of BNPT. The annual meetings of the General Assembly are used to align the goals of BNPT with the members, and to define needs and new strategic lines. The focus of the research is fixed by the General Assembly of the association.

BNPT carries out three types of activities:

- Initialising and managing research projects. BNPT supports joint research projects of its members, by supporting the writing of proposals, connecting the right partners of the projects is on low-temperature plasma technology. Within this domain, there is a focus on three fields of application:
 - Plasma&Environment; currently, the research focuses primarily on development of environmental applications; it accounts for 60% of the current research projects and proposals.
 - Plasma&Bio; plasma research with application in the biotechnology sector is the second largest strand of research. Currently only one bilateral research project is up and running in this domain, but a number of research proposals are written for this domain.
 - Plasma Vacuum Applications the last thematic focus is on vacuum applications of plasma technology; this is the least developed strand of research. It is primarily used for the production of new materials.

Research projects last for 2-3 years. The projects aim to transfer knowledge from academic groups to the industry; the projects focus on the cutting-edge between research and industry. Two kinds of research projects can be distinguished. The first type of project is aimed at the longer term. These are often publicly funded projects that have a clear scientific relevance; the projects have a time-to-market of about 6-10 years. Also shorter-term projects are conducted, with a clearer focus on industry. These projects should result in prototypes that can be further developed by the involved industry.

- Marketing. Another activity is the marketing of the network. BNPT increases the visibility of the members of the association, by presenting at fairs, conferences, et cetera. Furthermore, BNPT organises meetings and conferences itself to present the association to the outside world. At the same time, these meetings stimulate the networking within the association. The role of BNPT is to represent its

members, to extend the network of the members, and to manage events for the association.

- International basic and advanced training. BNPT stimulates training, by organising a summer school for plasma scholars. Also, BNPT plays a role as a hub and stimulator in the set up of mobility of researchers, such as staff exchange, exchange of (PhD) students, et cetera.

As BNPT is a network organisation and not a Competence Research Centre, co-operation is at the core of the organisation. The management, planning and initiation of the research activities are organised by BNPT, but the individual members often execute the activities. BNPT does not carry out research; the members of the association do this. The organisation of activities that stimulate networking and marketing are carried out by BNPT. For such events, BNPT operates on a “no cure, no pay” basis. The members of the association do not pay a member fee; they only pay for the solutions that BNPT offers. When the association organises a workshop or project, the member pays for the expenses of the efforts, e.g. the workshops have admission fees.

BNPT has a strong international focus, foreign parties should meet the same framework conditions as national (or regional) members: international parties are fully equally treated as national parties. BNPT is a network organisation; so all the listed activities aim at co-operation, or are developed in co-operation. The marketing and learning activities are ways to induce co-operation. The research is carried out in co-operation between the individual members. BNPT does not conduct research, but is involved in writing the research proposals, broking between potential co-operative partners and research project management.

7.1.2 Internationalisation Strategies

7.1.2.1 National background

In 2008, the German Federal Government has approved a new strategy for internationalisation of Science and Research. In its chapter on talents, cooperation, markets and global responsibility it focuses on the following levels:

- Strengthening research cooperation with global leaders
- International exploitation of innovation potentials
- Improvement of the co-operation with developing countries.
- Tackling global challenges

7.1.2.2 Network level

The BNPT does not have a separate internationalisation strategy; it is captured in the overall strategy, as internationalisation is at the core of BNPT. This is displayed in the main statutes of the organisation:

“The association BalticNet-PlasmaTec is a network for establishing technology based on physical plasma within the meta-region comprising Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Sweden, Germany, Norway, North-West Russia, and Belarus (..)”

Right from the start, BNPT is directed towards international co-operation. Interesting similarities with surrounding countries such as Poland, and the fact that BNPT resides close to the border made the international focus obvious. In principle, the Baltic Sea area is the main focus. However, if other interesting co-operation opportunities are identified, the cluster will pursue to take the opportunity. As a result, several members of BNPT reside outside the Baltic Sea area, and also projects have a wider geographic focus. BNPT has for instance members in Italy and The Netherlands and BNPT

currently has joined projects in Israel, Rumania and the Czech republic. However, the main focus of the activities of the network is on the Baltic Sea area.

The main strategy of BNPT is that it should coordinate existing partnerships and activities as well as stimulate the creation of new ones. BalticNet-PlasmaTec is a mediating and coordinating network without own authority. Its strength depends on the strength of the individual network partners. Goals of the network are:

- To increase the visibility of plasma technology in the Baltic Sea region;
- Attract capital and human resources;
- Initiate and facilitate the creation process of "critical mass";
- Coordinate joint efforts in research, education, and technology transfer;
- Create a platform for collaboration between academia, public institutions, private businesses, and individuals;
- Create a platform for dialog with supra-national institutions.

The constituent actors have developed the strategy of BNPT in an early phase, but the strategy is open to improvement. In the annual meetings of the members, suggestions can be made to update the strategy. Furthermore, the manager of the network identifies needs in the network by consulting the members. In the General Assemble, propositions can be made to define the strategy. The Executive Board can also take strategic decisions. On important matters, voting in the General Assemble ratifies ideas. The process of strategic decision-making is thus oriented to the needs of the members; members are involved in the whole process of strategic decision-making.

Although the network manager did not directly point towards the Federal strategies, there is a clear alignment between the cluster's strategy, and the strategy at national level. All the strategic decisions of BNPT fit the internationalisation strategy of German Federal Government. Furthermore it was pointed out in interviews that governance bodies played a consulting role in the strategic development of the cluster. The initiative "Kompetenznetze Deutschland" and the internationalisation department of the BMBF in particular provided practical and strategic support in the definition of strategies. Also, the BMBF is part of a monitoring committee of the BNPT.

The EU R&D policy as such does not play an important role in the strategy of the cluster. However, the policy is highly important because it is a main source of funding for (research) projects. An implicit strategy of BNPT is to obtain resources from the EUs Framework Programme and Structural Funds; this kind of funding is crucial for the execution of international research projects.

The BNTP strategy is:

- To increase the visibility of plasma technology in the Baltic Sea region;
- Wider geographic scope for excellent partners;
- Create a platform for dialog with supra-national institutions;
- Coordinate joint efforts in research, education, and technology transfer;
- Create a platform for collaboration between academia, public institutions, private businesses, and individuals;
- Attract capital and human resources;
- Initiate and facilitate the creation process of "critical mass";
- Focus on the whole Baltic Sea Area; including North-west Russia and Belarus.

- Focus on applications for the environment and health care in the research strands PlasmaplusEnvironment & PlasmaplusBio

7.1.3 International co-operation activities

7.1.3.1 Actual international co-operations

BNPT cooperates with several network organisations. In several activities, co-operation is sought with organisations such as BioCon Valley, a branch association in Mecklenburg Vorpommern; INPlas, a network organisation for plasma technology for thin films and the Europäische Forschungsgesellschaft Dünne Schichten, the European thin film research society. In India BNPT co-operates with a competence centre for joint workshops. The main focus is at high-level, it does not often involve joint research projects, but merely joint workshops, consultation and fairs. The co-operation focuses on finding synergies and new ideas. Drivers of co-operation with CRCs are:

- Increasing the visibility of your clients;
- Establish mutual learning;
- Transfer of knowledge from technology domain to technology domain
- Especially co-operation with CRCs and clusters with complementary expertise is favoured. This yields the highest chance to come to new ideas and synergies, the so-called new combinations of technological applications (Neue Kombinationen).

At the levels of individual actors, currently 20 foreign actors are engaged in the cluster, they are full member (i.e. no specific exceptions apply to foreign members). Apart from memberships, other kinds of co-operations are also carried out. Figure 27 lists the types of co-operations, the involved actors and the number of co-operations.

Figure 27 International co-operations of BNPT

Type of co-operation	Involved actors	Number of co-operations
Opening up of a specific research programme to participants of other countries	Academic groups and SMEs	2
Full participation of foreign actors in the network	Open for all kinds of actors	20
Cross-border research programmes with multi-national interests	Academic groups, Public research institutes and NGOs	4
Mobility of foreign actors (researchers) between CRCs	Open for all kinds of actors	3
Bilateral co-operation with foreign CRCs	Open for all kinds of actors	2
International brokerage services	Open for all kinds of actors	5
Joint activities in third countries (non-EU countries)	Open for all kinds of actors	1

Technopolis Group: COMPERA survey

Full participation of foreign actors, i.e. memberships of the association, is the most important way to co-operate internationally. Furthermore, BNPT co-operates in the organisation of international brokerage services (e.g. workshops, conferences et cetera). At the moment 4 joint research projects are carried out; these are the large projects that are carried out by a group of research institutes that are member of BNPT. Mobility of researchers currently takes place between several members of BNPT; three researchers are exchanged between partners. There are two research programmes being executed at the moment in co-operation between foreign university groups and SMEs and several research proposals are set out at the moment.

The manager of the network has several projects he considers good practice, which he will try to follow-up in near term future, such as several workshops, symposia and

summer school, organised in conjunction with other network organisation and a CRC and the joint German and Polish project within ERA-NET MARTEC.

7.1.3.2 Effects of international co-operations

The main effects of BNPT are network effects. BNPT is looking for synergies, both within the network, as with outreach activities. If potential synergies are identified, this leads to opportunities to write research proposals. In competitive calls, the proposals are appraised; actual research projects are thus an indication of success for BNPT. Since its start, the network has won a number of projects. Recently, a €2.8M research project started, aimed at exhaust gas cleaning. But also smaller projects (often within the network) are results of the network effects of BNPT. Many members of BNPT mention that smaller projects emerged between the individual members of the network, which would not have taken place without BNPT. An SME points out that it has won several assignments via the network. A research institute states that it has grown rapidly because of the projects it had won via BNPT.

A secondary effect of the activities of BNPT is that the members have increased their publication output, and several tested prototypes are patented as follow-up of the research projects obtained via BNPT. This is an indication that the quality and/or quantity of research has increased. The interviewees signify that their quality of research activities have improved, because they were able to find the most required partner, and because joining a network increases the status. A new laboratory has been funded at a Polish research institute; BNPT helped in applying for the funding and due to this the proposal gained status.

The manager of BNPT reports that their members are generally satisfied. In our interviews, the members indicate the following results:

- Increased reputation and visibility of the companies. For instance, BNPT offers represents its members at meetings/conferences/fairs;
- Creation of networks, leading to:
 - Knowledge exchange;
 - Finding new research partners (research institutions) and new markets (companies);
- Creation of synergies and projects; due to the network effects, the quality of the involved partners is higher, and thus the quality of research is higher. This should pay off in increased reputation for the research institutes and more innovative products for the companies involved;
- Development of critical mass; SMEs indicate that they now are able to apply for larger projects (e.g. EU projects). Normally they would not have the opportunity to apply for these projects. Also knowledge institutions point out that they believe that because of BNPT, their chances have grown.

7.1.3.3 Opportunities

The main opportunity for BNPT is to expand its network. Two types of actors would add value to the network; excellent partners from the plasma community and partners from other technology domains that could apply knowledge of the plasma technology, or that could supply knowledge to enhance plasma technology. For the future, BNPT does not seek for new kinds of co-operation, but it tries to expand the number of co-operations as listed above. Especially inclusion of excellent partners to the network is important. This would lead to better performance on almost any objective. It increases reputation and visibility, and therefore it would be easier to obtain new funds for projects.

BNPT and its partners see broadening of the application scope as an important opportunity. Currently, BNPT focuses on the development of biotechnology-related applications. This would develop a pathway to new partners and new projects.

Several interviewees see opportunities in the Scandinavian countries. The scientific level of the Scandinavian countries appeals to the BNPT members. The Oresund region for instance is rich of competences that would benefit to the PlasmaplusBio strand of research. The members BNPT and its manager see individual firms or knowledge institutions as the most important actors to focus on. Especially when it comes to concrete projects, these actors have the most to offer.

A very specific opportunity within the network is the growth of trust in relationships. Interviewees emphasise the importance of trust in successful co-operations. Because BNPT is a sustainable network, the relationship of the members is long lasting allowing the growth of trust. Because the members know each other quite well, it is clear that the competences of the partners are complementary and not overlapping. This takes away the suspicion that research partners might compete.

7.1.4 Barriers and needs

The manager of BNPT and its members are rather satisfied with the functioning of the network. There are no large barriers to its activities, and the governance bodies support the BNPT. Minor barriers are constraints in resources, and minor institutional barriers.

The most apparent barrier to international co-operation in research projects is finding resources. BNPT does not have subsidies available for research projects. For larger projects BNPT is depending on large R&D programmes at national and EU level. In itself, there are enough sources of funding at national and EU level for longer-term projects. However, according to the network manager, the time frame of the competitive funding at the German ministries and EU programmes is often too long. It takes about 1,5-2 years from the initial defining of research projects to the actual start of the project. In R&I environments where competition is severe, such as the plasma technology, this is a very long time. Therefore, it is a challenge to define projects that are still interesting after 1-2 years, especially when industrial partners are involved in the projects. This endangers the application of knowledge, as the acceleration between science and application can come too late.

Finding resources for international co-operative research projects can sometimes be difficult, when the projects are very applied. For short-term research less sources are available. The grants of the BMWi are restricted to Germany. Especially for more applied science, there seems to be a perceived danger in Germany that IPR and knowledge is lost in co-operation. There is ample money for networking activities, but when it comes to funding for actual R&D co-operations it is much harder to find funding. The BMBF offers internationalisation grants aimed at the preparation of international activities which go up to a maximum of €30,000³⁵.

The European sources to international co-operation projects on applied science are rather small. For international co-operations, the programmes often have large administrative burdens. For several schemes (ERANETs, INTERREG and bilateral agreements) applications for an international project have to be made at national level; each partner in the project has to apply at his own national programme manager to make a chance to acquire funding. This means that the co-operation projects need to be cut down to national work packages and a national application has to be made. This makes the application for international projects difficult. The projects are subject to different sets of criteria and a number of decisions at national level. Also, it could

³⁵ see: <http://www.internationales-buero.de/de/3310.php>

mean that the co-operation is funded in one country, but not in the other. The possibilities for bilateral funding are scarce, and it is hard to obtain them.

Nevertheless, the European Union has set a certain standard in regulations at national level. The network manager and members believe this makes inter-EU co-operation easier; co-operation with third countries involves many more legal and cultural issues. In the preparation and execution of non-EU co-operations more hurdles have to be taken and which involves more explaining, negotiating and time. Because of the standards and similar working of the institutions, inter-EU co-operation is easier and requires fewer resources.

7.1.5 Good practices and success factors of international cooperation

International co-operation has been to the core of the BNPT since its start. From the interviews and the desk study it can be concluded that this was realised rather easily, because right from the start BNPT had strong support of governance bodies at regional, national and international level. Although we did not conduct a full fletch evaluation, it can be concluded that the international co-operations of BNPT function rather well. It succeeded in finding international partners in surrounding countries, it obtained budgets for international research projects and it carried out several international marketing and training activities and its members are rather satisfied with the network. BNPT thus showed that it is not necessary to first establish a nationally anchored cluster, before one can operate internationally. It should however be noted that several aspects make this case unique when compared to other cases. BNPT resides close to the border; the closest neighbouring university is actually a foreign university. Furthermore, BNPT is a network organisation and not a physical Competence Research Centre. There are basically no risks to join BNPT in the first phase, as membership is free of charge or any obligations.

Good practices of BNPT include joint organisation of workshops, fairs and seminars, together with international partners. Recently a co-operation with an Indian CRC has been established, joint workshops are organised. This allows the BNPT members to find required partners in India. This is good for the marketing of the network members.

7.1.6 Conclusion on BalticNet-PlasmaTec

BNPT is an association that aims to foster the development of Mecklenburg Vorpommern and Germany as a whole. BNPT is focused on plasma technology; within this technological domain, three fields of applications have been identified.

The case of BNPT shows that it is possible to have an international focus from the start. To foster economic development, an international focus has been taken right from the start of the cluster: BNPT focuses on the Baltic Sea Area, but is not restricted to this area. Interesting co-operations with excellent partners outside the Baltic Sea area are considered and taken. Both international parties as national parties have equal possibilities and opportunities in the network. There is no explicit strategy towards internationalisation, because the network as a whole is directed towards internationalisation. The strategy of BNPT aligns with the internationalisation strategies at national level. Federal governance bodies have supported the formulation of the BNPT strategy.

BNPT has a range of international co-operations, the relation with its 20 foreign members being the most obvious one. Further interesting co-operations are the joint research projects and workshops BNPT organises. BNPT does co-operate to a limited extend with other CRCs and network organisations. Being a network organisation, the results of the cluster are network effects. The co-operation via BNPT has led to several joint research projects, also, members indicate that they have easier access to knowledge and to markets.

The main opportunity for BNPT is to expand the network, especially when excellent actors join. Barriers to internationalisation are institutional and financial, and not easy to deal with. It seems that BNPT is supported quite well and not many barriers remain. The existing barriers are the scarcity of resources and institutional barriers. A main problem hindering the R&I performance of BNPT is that it takes so long before projects are granted and can actually be started.

Overall BNPT is an interesting case because as a network type organisation it started with an international perspective from the start. More interestingly, now the cluster is operational for about 5 years, there is a need to become a more CRC-type of organisation³⁶, in order to prevent fragmentation of the partners, and to improve the reputation of BNPT.

7.2 United Kingdom, Northern Ireland: Questor

7.2.1 Introduction

The Questor Centre is a cooperative research centre founded in 1989 and attached to Queen's University Belfast. The Centre was one of Invest Northern Ireland's Centres of Excellence programme (2002-2008) centres, and is focused on environmental research. This case study describes the strong international linkages, which Questor has established over the past years. A specific characteristic of Questor is the fact that it is recognised as an international partner in NSF programme for Industry/University Co-operative Research Centres (I/UCRCs). The case study will start with a description of the centre, discuss the current internationalisation activities, the barriers and opportunities and subsequently the best practices and conclusions.

7.2.2 Description of the CRC

7.2.2.1 Thematic focus

The thematic area of the centre is environmental research, with a focus on remediation technologies, water and waste-water treatment, soil treatment, renewable energy and environmental monitoring and modelling. The research in the centre is highly interdisciplinary. The Centre started with a focus on water treatment, and cleanup technologies, but has gradually broadened its fields of expertise to research on renewable energy such as biomass. The aim is to expand the focus in the near future and incorporate a competence centre for renewable energy. For this purpose more departments of QUB will join the centre's activities and new partners could be added.

The centre was founded in 1989 as a centre at Queens University Belfast, but its international academic partnerships mainly took off after 2002. The Centre's own description of its position is: "*An international partnership between industry, government agencies and academia for industry driven multi-discipline environmental research with a clear emphasis on technology transfer and exploitation.*"³⁷ The centre's philosophy is strongly based on the applicability of its research activities. The Centre has a strong focus on industry, in addition the centre also involves environmental regulators and policy makers in its organisation.

The physical and operational part of Centre is quite small with a staff of about five people.

³⁶ i.e. more centralised, with an own identity and own resources.

³⁷ Presentation Wilson McGarel, director Questor.

7.2.2.2 Structure and finance

Although the centre is based in Queen’s University Belfast (QUB) it operates as a combination of a physical and virtual centre. Research equipment and facilities are based at QUB and many of the contributing researchers are also from various departments and schools at QUB. However researchers of all partner universities and research centres can take part in the research projects funded by Questor.

The Centre has academic, industrial and public sector partners. While based in QUB the academic partners of Questor are mostly from abroad and two are from outside Europe. The following Figure gives an overview of the academic partners involved.

Figure 28 Academic Partners Questor

	Country	Year
Queens University Belfast	UK	1989
Dublin City University	IRL	2005
Stevens Institute of Technology	US	2006
Dalhousie University	CA	2007
University of Duisburg Essen	DE	2007
The Institute for Water Research	DE	2007
Cranfield University	UK	2008

The industrial partners and other non-academic members also have a varied background and geographical origin, but they are mostly from Northern Ireland. An interesting aspect of Questor is that it contains the ‘triple helix’ of academia, industry and government in its organisation. Some of the members are government organisations responsible for environmental regulation, waste management, environmental cleaning of land and so forth. Examples of such organisations are Belfast City Council and the Northern Ireland Environment Agency. The fact that government organisations are involved is particularly important in this area of environmental research. Public bodies are often the ‘problem owner’ of environmental (e.g. water waste, water and soil pollution) and contamination issues. The Northern Ireland Environment Agency (NIEA) is responsible for regulation on these issues in the NI area.

NIEA considers its Questor membership as very helpful to assess what type of regulation is feasible given the technological solutions available, thus collecting empirical evidence on specific contamination or toxicology issues. Taking part in Questor Industrial Advisory Board allows the organisation to speak with the companies that actually have to execute the environmental projects, but also with the research organisations, which can provide awareness of state-of-the-art solutions. Membership supports ‘smart regulation’ but also prioritisation of technological issues. The level of research actually procured through the Agency is very small and does not involve Questor researchers. As the Agency is very dependent on executing European legislation and regulation the international focus is mostly on Europe. Cross-border collaboration mostly happens with the Republic of Ireland. For other cross-border activities the Department of Environment, Food and Rural Affairs (DEFRA) takes the lead. For companies having the regulator on board in Questor is very useful to obtain a prospective view on the regulatory approach to environmental issues in Europe. This also creates potential business opportunities. Questor also tried to get the Republic of Ireland regulator (Environmental Protection Agency -EPA) on board as a member, but as EPA is also a major research funder a potential conflict of interest prevented this.

Questor started with a strong Northern Ireland basis although large companies from abroad, (Exxon) and from the rest of the UK (BP, Shell Global Solutions) have been a partner from a very early stage of the centre. The initial acceptance of Questor as an NSF-partner centre supported this attraction of larger companies.

Figure 29 Origin Industrial Members

Northern Ireland	Northern Ireland (cont)	Outside Northern Ireland
Applied Silicate Technologies Ltd Alpha Environmental Group AWP (Ireland) Ltd B9 Energy Ltd Bombardier Aerospace CDE Ireland Ltd Central Chemical Supplies Ltd Chemvite Ltd Cleanfield Technology Ltd Coca Cola HBC N.- Ireland EdaPhon S-oil Tec Ltd Glenfarm Holdings Ltd Just Farm Energy Ltd Kedco Energy NI Ltd McAllister Brothers Ltd	MacNabb Brothers Waste Management Ltd Marengo Natural Energies Ireland Ltd NI Water Ltd Northern Innovation Ltd Norlect Engineering Ltd P&A Quinn Energy Ltd Powertech Ltd Precision Processes Services Ltd RSK Ireland Ltd Simpro Ireland Ltd Williams Industrial Services Ltd Wilson's Country Ltd Whiteford Geoservices Ltd	BP (UK) Shell Global Solutions (UK) Modern Water Ltd (UK) Exxon Mobil Research & Engineering (USA) Enva Ireland Ltd (IRL) Astellas Ireland Ltd (IRL) T.E. Laboratories Ltd (IRL)

Each member is represented on the Industry Advisory Board, which is a key governance body that sets the broad thematic areas of research in bi-annual meetings. Votes on the priority topics are developed in two-day meetings where the partners can argue their preferences and come to an agreement with other interested parties. The members also have an important say in the selection of projects.

The research conducted in Questors varies from applied to fundamental. An essential element of how the centre functions, is the research programming process, which is based on a close involvement of the paying members and the partner universities. The contributing members (mostly the industrial members) define in a collective meeting what the research priorities for the coming years should be. Each member has a number of votes in relation to their fee level (dependent on size of the company or organisation). At the start of the year these priorities are communicated to all academic partners who are invited to write proposals for research projects. These can be PhD projects or much more short term and applied projects. In this public-private partner mode, most proposals come from single research partners, and at this moment a majority of proposals still comes from QUB, but the foreign partner organisations are more and more involved in the centre's research activities. A normal pattern would be that out of 24 proposals, 5-6 projects per year are funded which on average last 3 years.

In addition to the activities that are funded by membership fees and non-earmarked resources the Centre has entered into various European projects and consortia (funded by various programmes such as the CIP and Interreg), often with a number of European Questor partners.

7.2.2.3 Finance

In the early years pump-priming funding for the QUESTOR Centre came from the International Fund for Ireland, administered along the lines of an NSF Centre grant by the Northern Ireland Industrial Research and Technology Unit. Additional funding came from the European Community STRIDE programme for developing the infrastructure for R&D in Northern Ireland. The Centre received €2.74m from the European Union-funded TDP programme, the successor to the STRIDE programme. This funding built the clean technology side of the research programme and also installed a major demonstration facility that is used to show current remediation and clean technologies to members and also industry in general throughout Ireland. In addition, the International Fund for Ireland made a further grant of €1.06m to the Centre to develop an outreach programme to facilitate environmental technology transfer to industry throughout Ireland, paying particular attention to small and medium- sized enterprises. Industry contributions to the Centre come from its

members, which range from manufacturers of pharmaceuticals, chemicals, instruments, textiles, and beverages through suppliers of electricity and water.³⁸

Questor is formally attached to Queens University – and has to adhere to university regulations, e.g. for technology transfer - but is financially completely self-sufficient. Funding for Questor comes partly from membership fees (approx. 17% of research funding), partly through subsidies and grants from public R&D programmes (approx. 83% of research funding). The annual research budget is around €1.5 million, the total budget around €2 million. There is no basic funding for the centre from the university, nor from any government organisation.

While in the past Questor was not very active in European Framework Programmes, it has recently been awarded a coordinator role in a Marie Curie Initial Training Network focused on waste-water. The approved funding for this project is €3.5 million, a large increase of the current budget. The MC network has academic partners: QUB, Dublin City University, Cranfield University, The University of Duisburg Essen, The Institute for Water Research (attached to the University of Essen); and industrial partners NI Water, TE Laboratories Ltd and the Questor members. Attempts have been made to include the non-European partners in EU projects but the administrative burdens of arranging this were considered to be too large.

7.2.3 Internationalisation Strategies

7.2.3.1 Internationalisation in Northern Ireland

Questor was part of the Northern Ireland Centre of Excellence programme launched by Invest Northern Ireland, a programme that is now succeeded by a Competence Centre programme that is aimed to be more selective and have fewer but larger centres.

- In the previous CoE programme internationalisation was not explicitly promoted. Nevertheless, the Invest NI Centres of Excellence programme demonstrated the government's commitment to internationalisation. Proposals were assessed against the extent to which the proposed centre demonstrated the potential to establish an international reputation and form synergistic relationships with similar centres through participation in European Community / International research programmes and networks. In addition, assessments considered the extent to which the Centre would stimulate mutually beneficial collaboration between organisations, sectors and regions resulting in economic benefit and recognition of Northern Ireland as a vibrant R&D centred knowledge-based economy. There is however no explicit internationalisation strategy at the level of the government departments involved with the competence centres. Northern Ireland's commitment to internationalisation and research excellence may be best reflected in the Regional Innovation Strategy which includes assurances to;
- Encourage Northern Ireland business and universities to be more outward focused and raise their profiles internationally;
- In developing applied research proposals for external funding from the EU's Seventh Framework Programme (FP7), the UK Collaborative Technology Programme and similar national and international initiatives University activities will be proactive in encouraging participation by local companies and supporting them
- The universities will develop and promote participation in collaborative R&D and innovation in national, all-island and international initiatives, programmes and

³⁸ <http://www.nsf.gov/eng/iip/iucrc/directory/questor.jsp>

networks with the aim of establishing up to 10 major research infrastructure investments.

An important rationale for research and business in Northern Ireland is the relative peripheral location within the UK and Europe. In addition the region has only two universities: Queen University Belfast and the University of Ulster. Thus establishing networks outside the region is key to become more visible and to have a broader expertise basis.

Invest NI looks for a balance from the perspective of NI: funding only goes to international partners, if the balance is positive for NI. In the case of Questor the foreign industrial members contribute to the research fund by means of a fee, thus no national funding is directly used to fund foreign firms.

The new Competence Centre programme was launched in 2009 and proposals are now in the assessment phase. There are a number of differences between the programmes:

- CoEs didn't have to be a collaboration between different parties; now in the CC programme at least, four different parties have to be involved;
- The CCs need to be industry led;
- Although Universities and Research Organisations can be involved, it must be demonstrated that the research agenda is industry led;
- It is anticipated that the CC programme will be on offer for the next five years. Questor is at the moment in the bidding stage to become a centre in the CC-programme.

7.2.3.2 Internationalisation at the Centre level

At the very start of the Questor centre in 1989 the Centre the centre was made part of the US National Science Foundation's (NSF) programme for Industry/University Co-operative Research Centres (I/UCRCs), which includes approximately 30 research centres. This was arranged through the personal relations of the founder of Questor, prof Jim Swindall, with US research organisations and NSF staff and a willingness of the US to invest in US-Irish relationships.

The Questor Centre was the first environmental centre outside the United States to use the National Science Foundation (NSF) model for industry/university co-operative research. As a non-U.S. centre, Questor is unique in having an NSF Centre Evaluator. This means that QUESTOR-management takes part in the annual science assessment meeting in the United States. All directors of the NSF-Centres take part and this is a unique opportunity to share best practice on how to run an industry oriented competence centre. It also means that an NSF-evaluator comes to the Questor annual meetings. Questor as a centre is highly ranked (in top 5%) in the NSF-I/UCRC assessment exercises.

Questor still is the only Centre outside the US to take part in the programme. In the period between 1989 and 2002 this membership of NSF was more or less a bilateral linkage. The Questor management was invited to take part in annual NSF- I/UCRCs assessment meetings, staff of QUB could take part in projects but not receive any NSF funding. The main benefit from this membership is that Questor management could learn from the NSF model and see how the public-private partnership was operated in practice. It formed an inspiration to develop such a partnership model with Northern Ireland and UK based industries using a similar governance model. It was only in 2002 when the current director took a deliberate decision to start including foreign academic partners, as the competence base of Questor and QUB in environmental research was considered too narrow to satisfy the broader needs of the industrial partners.

The search for partners started with Dublin City University, supported by contacts through InterTradeIreland. Through the NSF connection, the next partner Stevens

Institute of Technology in New Jersey joined. The search for partners was done through a combination of pragmatic and deliberate choices. Cranfield University was asked to be involved because they have an excellent environmental research group. The German partners were found through contacts with a regional consultancy company in the region of Nordrhein-Westfalen rather than through the specific search for a certain partner.

7.2.4 International co-operation activities

7.2.4.1 Actual international co-operations

CRC-CRC co-operation

The gradual extension of the Questor Centre to include more international partners has focused on finding specific research partners (universities, research institutes) that could add value to the centre's own research portfolio. The experience shows that it takes quite some time and effort to build up trust and to involve the foreign partners in the rolling research programming. Thus at this moment in time there is no explicit intention to build partnerships with similar CRCs abroad, except perhaps for the formation of consortia for European funded projects. In addition, given the multidisciplinary character of Questor it will be difficult to find a matching CRC with similar portfolio's in other countries. As the main rationale has been to selectively build a balanced research portfolio, greater added value is seen in building co-operations with specific institutes adding complementary expertise. CRC-CRC co-operation could be envisaged in the future, but not yet in this stage of development of the Questor Centre. Another challenge is to attract more business partners from abroad, once the centre has gained more critical mass and recognition.

Nevertheless, the NSF-affiliation provides the opportunity to learn from best practices from other CRC-directors and has proved to be an inspiration for the management of the Questor centre.

7.2.4.2 Effects of international co-operations

According to the director of Questor "... *opening the centre to international partners was the best decision we ever made*".

The effects of the expansion of Questor to include international partners has been very visible and clear, without any formal assessment of it being made:

- The international partnership has allowed Questor to broaden its expertise base and to include disciplines and technologies that were not available from the knowledge base at QUB;
- For the member companies it is much more attractive to be able to tap into the knowledge of a number of research institutes. Through the research proposals from the foreign partners, this expertise is directly employed by the companies. In the last few years after international expansion industrial membership has increased to a threefold and has changed the critical mass of the initiative substantially.
- The international exposure and visibility and collaboration experiences have allowed Questor to become a more credible partner for European research projects. This has for instance allowed the Centre to win and coordinate a large Marie-Curie Initial Training Network worth €3.5 million;
- The international exposure has allowed the centre to provide additional services to the members such as an international company visit tour to the US with meetings at Stevens Institute of Technology.

For the participating industrial members the international partnership has allowed them to address a wider set of technological options that they would not be able to

obtain from only one university or a national centre. One of the SME partners of Questor uses the centre to keep informed of state-of-the-art technological developments. The company itself, with 180 employees and a €40 turnover does not have in-house R&D capacity and has no tradition of doing in-house technological development. In previous years the company bought all its knowledge and services from other suppliers through licences or through off-the shelf solutions. The company has no 'own' product. Three years ago the company has taken the decision to start developing its own discrete products and services, in order to become more competitive and to offer custom made solutions to their mostly Northern Ireland clients. The membership of Questor is for the company a very effective way of knowing what the state-of-the-art solutions are for particular problems related to water waste treatments. In the words of the company director "we want to know what is global leading edge technology and we can't find everything ourselves". It also is interesting for the company to meet with other (international) member companies to develop joint solutions or to partner for commercial projects. It helps the company to decide in what areas they would need to invest in in-house technology developments. The company director took part in the international company visit to the US to develop relationships with Stevens Institute and has also tied up with the German academic partner with the help of Questor. Through the networking the company has generated more business outside Northern-Ireland by means of the linkage with like-minded businesses in other markets. The fact that the centre has foreign companies and also very large companies involved is seen as an asset and not a threat. It allows the company to establish relationships with large R&D intensive companies, which would never enter into strategic alliances with them outside the CRC-framework.

The company does not actively take part in the research projects but when the projects are moving towards their commercialisation phase the SME would get more involved in the development stages. Through the Questor activities the company is already benefiting from publicly funded projects in the Republic of Ireland and the region of Nordrhein-Westfalen. Thus even for a non R&D-performing SME, the international dimension of the CRC has added value. The positive effects for the SME have been:

- A better strategic culture (awareness that the company has to change)
- Good networking opportunities, both local and international which has proven to be commercially advantageous
- Providing opportunities for more international commercialisation activities

7.2.4.3 Opportunities

At this moment the centre is focused on developing the working relationships with the current members, establishing a stronger base in Northern Ireland, through the Competence Centre programme and by expanding within QUB. The aim is to get a better recognition internationally. The long term would then be to get the real 'big names' into the network. If the Centre succeeds on this more international industry partnerships are more likely to follow.

There have been discussions to develop a 'twin' Questor centre and SME network in the NordRhein Westfalen (NRW) region, through the local regional development partner (Zenit) in that region, who has helped Questor to link with the German academic partners. It remains to be seen for the partners in how far this will create networks between the local SME networks in Northern Ireland with those in NRW.

7.2.5 Barriers and needs

The main barriers

The main barrier the centre experiences at the moment is the **lack of mobility of people**. Although the research proposals are in principle open to collaboration between the various centre partners and offer opportunities to move between the

centres, in practice the researchers propose single researcher – single university projects to the Board. In addition proximity to the clients and the CRC still seems to be a positive factor: 2/3 of the competitive funding goes to QUB partners while 1/3 to the international partners. The centre aims to encourage more collaboration between the academic partners. Winning the Marie-Curie Initial Training Network will help with that issue. However this is not a solution for the partners outside Europe as it appeared to be cumbersome to have them included in the EU-projects.

A second barrier is how to fund **research infrastructures** with no basic funding going to the institute. As most funding comes in either through competitive research programmes and membership fees, there is very little funding for the ‘overhead’ activities. The link with QUB is very vital to remain well connected to the infrastructure and research staff there so that is an intermediate solution.

A third problem is identifying appropriate partner research organisations that have a similar multidisciplinary approach as the Questor Centre has. European FP-projects are used to explore potential new partners.

IPR has proved not to be a problematic issue amongst the partners. All partners are assured of at least a non-exclusive worldwide irrevocable licence to patented inventions conceived or developed with their support. This license is royalty free if the invention is used entirely within the member’s company. If the invention is to be commercially exploited then the Member must negotiate a Licence Agreement with Questor. According to an interviewee from the business perspective the environmental sector is not one where IPR plays a major role. In addition Questor has set up a separate technology transfer Unit to deal with technology contracts and IPR and a company Questor Technologies Ltd that commercialises specific project results that come from Questor projects and which are not taken up by the member companies. The revenues from these activities are transferred back to the research fund.

The current funding model used at Questor does not create many issues about public R&D-funding moving across borders. The member fees are a top-up on an increasing overall research budget of which still a considerable share goes to QUB. The added value of the international partnerships is obvious for all those involved. Some use has been made of funding from abroad, particularly in collaboration projects with the Republic of Ireland.

7.2.5.1 Good practices and success factors of international cooperation

There are a number of interesting characteristics of the Questor case that could be an inspiration to other CRCs. The following aspects are of particular interest:

- The deliberate decision to include foreign academic partners that have a complementary expertise base, thus improving the added value of the centre from the perspective of the members
- The research programming and selection processes, which is on the one hand very user oriented (member choose the topics) and provides equal opportunities to the foreign academic partners to take part in the activities.
- The opportunities that are provided for local companies to develop strategic alliances with foreign and non-local companies
- A well thought through IPR and commercialisation framework that is satisfactory to the members
- The linkages that have been established with NSF and the additional opportunities this offers in terms of partnerships and in terms of learning from best-practices how to manage collaborative research centres

7.2.6 Conclusion on Questor

A deliberate choice has been made to capitalise on the international brand of the Centre through its NSF-label and expand active membership with both foreign companies and foreign universities. This was defined in the 2004 Business Plan of the centre and explicitly developed in the years after this decision. The link with the NSF-programme proved to be an inspiration of how to manage an international and collaborative competence centre. In the case of environmental research, membership of government agencies has added value to understand regulatory approaches for the future and thus market developments.

The Questor centre has successfully built an international network of academic partners and also a number of key industrial partners from abroad. The research work is conducted by those researchers who offer the best proposal responding to the research themes defined by the industrial members, irrespective of their institutional affiliation or geographical origin. The programming method allows for both fundamental and applied research to take place. The internationalisation has also contributed to increasing the (European) funding opportunities for the Centre. It remains a challenge to develop cross-border collaborations between the partners within research projects. The time needed for trust building and proximity have an influence on this development. The lack of human mobility of researchers is an important bottleneck. The launch of a Marie-Curie Initial Training Network led by Questor is seen as an opportunity to overcome these problems within Europe.

For the local companies involved, the international character of the centres has provided better access both to state-of-the-art knowledge elsewhere and to potential new business opportunities abroad. The growing international visibility and recognition has raised the interest of other companies and membership of the CRC has increased considerably as a result of the internationalisation.

7.3 Sweden: GigaHertz Centre

The GigaHertz Centre is located within Chalmers, Department of Microtechnology and Nanoscience - MC2. It is located in a new building on the Chalmers campus that represents a major investment by the university in micro- and nanotechnology. It is jointly funded by VINNOVA, as a project within the VINN Excellence programme, by Chalmers and the industrial consortium.

7.3.1 Description of the CRC

VINNOVA characterises the VINN Excellence Centres as follows.

- Objective: promotion of sustainable growth by generating knowledge and technology that will lead to new products, processes and services
- Multidisciplinary, internationally leading research carried out in active collaboration between universities, the business sector, public actors, research institutes and other research-performing organisations
- Research programmes that are jointly formulated and implemented by the participating actors with a view to contributing to the best possible solution of important issues and problems facing the participants
- Geographical concentration with a university as organisational host of the greater part of the activities in order to ensure, for example, sufficient critical mass and to promote the connection between research, undergraduate education and postgraduate research studies
- Long-range implementation with comprehensive evaluation before a new period of agreement in order to achieve sustainable effects and international excellence
- Long-term co-financing by business/public actors, universities and VINNOVA to enable recruitment, development and retention of internationally leading experts

- Operations under the management of a director and a board, where business representatives and public actors are as a rule in the majority in order to uphold the objective of meeting the needs of the business sector and public services, i.e. problem-oriented research
- Establishment in innovative environments with effective innovation systems in order to create strong Centres of Excellence in Research and Innovation³⁹

GigaHertz is a second-generation competence centre in the sense that it builds upon the CHACH (Chalmers Centre for High-Speed Technology), created during the original Swedish Competence Centres programme. CHACH operated from 1995 to 2006 – the last year and a half without subsidy from the programme, because the consortium found it useful to continue working together. CHACH focused on components and packaging for high data rates and high frequencies for future electromagnetic communications and sensor systems. The consortium included seven companies that (sometimes in reorganised form) became part of the GigaHertz consortium. One of The CHACH members was Ericsson Microelectronics, which was sold to Infineon during the life of the centre. Through this participation, Infineon Austria became connected to the centre and replaced Infineon's Swedish branch⁴⁰ in GigaHertz.

The move from GigaHertz to CHACH represents maturation. The number of projects has been reduced from ten to four, very focused ones. The proportion of industrial contribution has increased significantly and the growth is more balanced between cash and kind. There are fewer partners (seven rather than fifteen) and these are several divisions of very large firms combined with SMEs in Goteborg and Stockholm area.

The mission of GHz Centre is to carry out joint research in selected high-frequency technologies and to bring the results from Chalmers to an industrial exploitation phase primarily through its company partners. Stage 1 of operations (2007-2008) is now complete, having involved seven industrial partners

Comheat Microwave, Ericsson, Infineon Technologies, NXP Semiconductors, Omnisys Instruments, Saab, and Sivers IMA. The total budget (in a mixture of cash and kind) was 20 MSEK (€2m) in 2007 and 22 MSEK (€2.2m) in 2008. Industry funded half the budget in these two years; Chalmers funded one third; and VINNOVA the remaining 16%.

The research plan has two themes: Microwave Power and Microwave System-on-Chip. Each theme has two projects: High-Efficiency Switched-Mode Amplifiers (SMPA), Robust and Wideband WBG Transceivers (WIDEBAND), and THz MMIC Sensors (THZ) and Frequency Generation using low phase-noise VCOs (FREQ), respectively. During the period, 53 people at Chalmers plus others at the companies were involved in the research, their combined efforts amounting to 26 full-time equivalent years.

In Sweden, competence centres are not legal persons but are defined by consortium agreements at the start of each of the planned four Stages in the centre's intended 10-year life. The governance and organisation are shown in Figure 31.

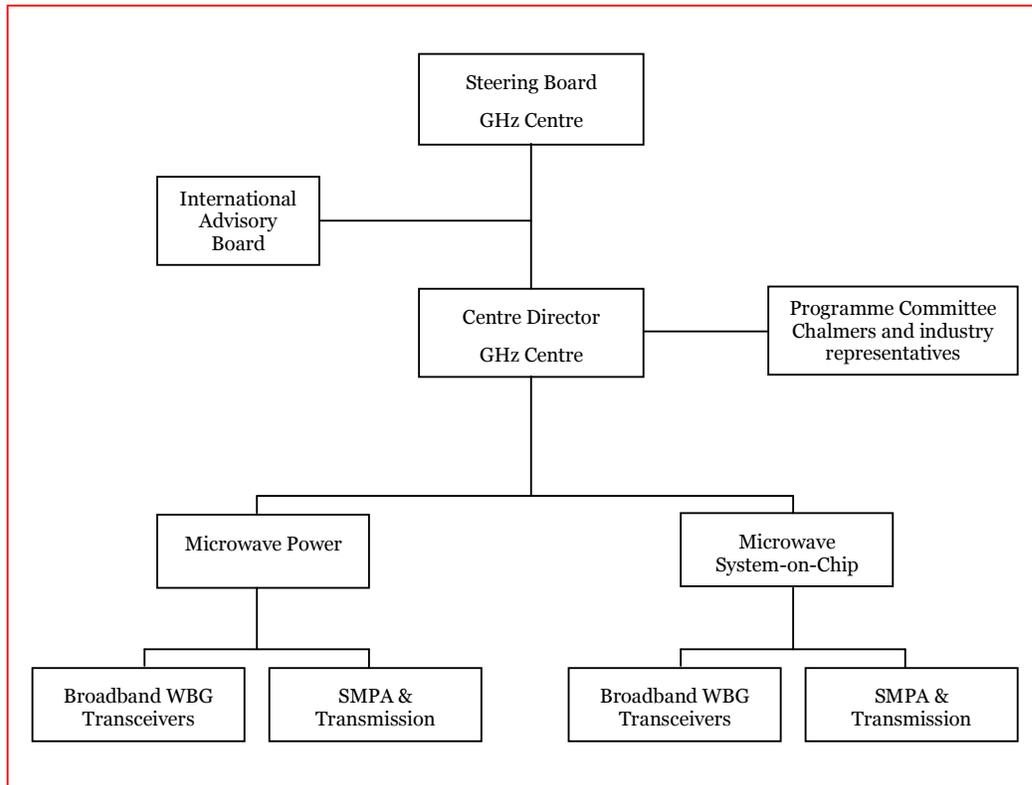
All seven industrial participants (including the two foreign ones) have seats on the Steering Board, which is chaired by a senior manager from Ericsson. The International Advisory Board comprises three leading professors from US universities and one from Japan. The task of the IAB is to review and advise the Centre Board, and its management about the standing of the Centre in an international context from the academic, industrial and management perspectives. The use of Stage-specific

³⁹ From the 2004 Call for Proposals

⁴⁰ Infineon stopped producing components in Sweden recently

agreements means the centre has the flexibility to change direction and to alter the composition of the consortium, if necessary. Since the Consortium makes up the Centre Board, it collectively governs the research agenda. Members participate in individual projects on a case-by-case basis.

Figure 30 Organisation of the GigaHertz Centre



GigaHertz is unique among the Swedish competence centres in having foreign partners: Infineon Technologies (Austria) and NXP Semiconductors -(former Philips) (Netherlands). In Stage 2 (2009-2011), Mitsubishi Electric (Japan) has also joined.. They pay their share of the costs in the same way as Swedish companies and correspondingly benefit from the state funding. Neither are any special measures in place to attract or privilege foreign participants. The research group at MC2 has extensive international contacts and works especially closely with the University of Cardiff and Telecom Bretagne in Brest. However, GigaHertz has no formal cooperations with foreign universities.

GigaHertz has benefited from a small ‘globalisation grant’ from VINNOVA, which has allowed it to set up the European Radio and Microwave Interest Group (EuRaMIG). This has a core group of 16 European university, institute and industry research groups but is open to anyone in Europe researching in radio and microwaves, in particular industrial actors. The chairman of the GigaHertz Steering Board chairs EuRaMIG, whose primary purpose (apart from networking the research community) is to influence the direction of the Framework Programme through generating consensus and road maps. (This is a style followed also by other groups, such as EUCAR, similarly aiming to establish a successful circle of influencing the Framework Programme so as to align it with their own research strategies.)

7.3.2 Internationalisation Strategies

At the time GigaHertz was established, VINNOVA did not have a formal international strategy. The de facto strategy was to participate in the Framework Programme and other European cooperations such as EUREKA and COST. Unusually for an innovation agency, VINNOVA joined the European Science Foundation recently. A merger some years ago with the organisation that maintained Technology Attachés in Swedish embassies means that VINNOVA's international contact network is very good and the agency has had a policy of trying to maintain global relationships since it started (in 2001), notably with China. VINNOVA developed and adopted a formal strategy during 2009⁴¹, with the aim of "promoting sustainable growth in Sweden through international research and innovation cooperation". The strategy was developed in an internal process among VINNOVA staff and its emphasis is squarely on improving the Swedish innovation system. Key actions are:

- Increasing Swedish participation in the Framework Programme and other relevant European initiatives
- Influence EU policy on research and innovation cooperation with countries outside Europe
- Increase the number of programmes run together with priority partner countries. (VINNOVA has for some years run programmes together with Finland and Norway)
- Establish international programmes for environment, health, centres of excellence and SMEs
- Maintaining VINNOVA's international presence
- Internationalising VINNOVA's programmes
- Studies, benchmarking, policy learning, funding research on internationalisation of R&D and improving VINNOVA's own international activities

Of especial importance is the intention that, from this point on, all new VINNOVA programmes will aim to increase the internationalisation of the beneficiaries. "VINNOVA's programmes will be opened over a period for international participation, starting with the Nordic area. This means that it will become possible to fund research and innovation outside Sweden, provided that this brings value added to Sweden."

At the programme level, neither the VINN Excellence Programme nor its predecessor has had an explicit aim of establishing international links. In practice, large companies and researchers already are well networked internationally and the competence centres are strongly motivated to establish their reputation abroad as well as in Sweden. There is no precedent for a VINN Excellence Centre to establish a direct cooperation with a competence centre abroad (beyond normal, informal contacts). Since this kind of possibility raises IPR issues, VINNOVA's legal department is working to establish how to resolve them in future programmes.

At the centre level, GigaHertz has decided⁴² to "Be active in the EuRaMIG initiative started during Stage 1 by pushing for a vision paper, a European microwave roadmap and meetings with the EU Commission in Brussels, and at the European Microwave Weeks in Rome 2009, Paris 2010 and Nurnberg/Stuttgart 2011." It also aims further to promote collaboration with foreign university partners. However, there is no plan to establish formal links to other competence centres abroad. Indeed, 'internationalisation' per se is not an issue at the centre. Two of its partners happen to

⁴¹ VINNOVA's internationella strategi, VA 2009:02, Stockholm: VINNOVA, 2009

⁴² GigaHertz Centre, Stage 2 Research Programme, Activity Plan and Budget

reside outside Sweden. EuRaMIG and the aim to cooperate more with foreign universities are very much 'business as usual' within the centre.

The extent to which GigaHertz has internationalised has a clear industrial logic. The two foreign partners are component manufacturers, with an interest in cooperating closely with actual and potential customers. This logic is perfectly normal within Framework Programme consortia and, indeed, at a national level also within competence centres.

At the level of the participants in the centre, the larger companies involved are similarly engaged in competence centres and other university-industry cooperations in many countries. They have an overview of who the potential cooperation partners are in the countries where they operate and in key markets, although participation tends to be locally decided. The consortium participants regard the international composition of GigaHertz as unremarkable. Clearly, the industrial logic for allowing such consortia can be strong. The balance of advantage, however, is high specific to the individual competence centre. It is not clear that a blanket policy of requiring international composition would be useful.

7.3.3 International co-operation activities

7.3.3.1 Actual international co-operations

There are no formal centre-to-centre cooperations at GigaHertz. The centre's cooperation ambitions focus on individual companies and (through less formal arrangements) individual universities. It is important for the centre to participate in the Framework Programme and other international arrangements because this creates contact with technological trends and reinforces relationships necessary for doing good research. More generally, Chalmers strongly promotes Framework Participation by members of its faculties.

The EuRaMIG activity is focused on Framework rather than other forms of internationalisation. From the centre perspective, EuRaMIG increases the opportunities to obtain Framework Programme funding. However, this type of platform can also play an important role in extending the centre's international networks.

7.3.3.2 Effects of international co-operations

Internationalisation in this highly international technology domain is 'common sense' and hardly asks for special attention. Opening up the centre for foreign companies to enter the arena is a necessity to complete the value chain for systems design in micro-electronics. The sector is accustomed to close international participation in European programmes and initiatives such as EUREKA. The specific benefit for GigaHerz is to add the complementary technologies from R&D-oriented companies that are not present in Sweden.

7.3.3.3 Opportunities

For GigaHertz, the opportunities for international cooperation centre on individual organisations in industry and on universities rather than centres.

The academic leadership of GigaHertz is motivated by the academic incentive system, with the production of papers and PhDs having the highest priority. Companies are interesting partners because they provide money, problems and – incidentally – a destination for graduating PhDs. Indeed, once PhDs are placed in companies, they stimulate demand for academic collaboration. Especially in Sweden, where PhD mobility tends to be limited, this means that graduates readily go and work for the local consortium partners and stimulate cooperation with their former professors. More generally, the greater companies' technological capabilities, the more interesting they are as partners. From the centre perspective, the only reason to prefer national to

foreign partners is distance, and as the GigaHertz centre demonstrates, this need not be a decisive factor.

Correspondingly, foreign universities are interesting cooperation partners through normal scientific channels, meaning that the cooperation produces intellectual benefits but there is no economic rivalry. Unless there is some economic advantage to be had, there is no real incentive to cooperate with foreign competence centres. Such an incentive could be created by European-level funding, as in the case of the EIT's KICs.

7.3.4 Barriers and needs

The formal obstacles to internationalisation of Swedish competence centres are disappearing, as a result of VINNOVA's new internationalisation strategy. The GigaHertz example itself illustrates that moderate amounts of foreign participation in the consortium were in any case not a problem under the old rules. Clearly, even under the new strategy, foreign dominance of consortia is unlikely to be accepted.

Swedish university governance tends to promote fragmentation within the universities. One of the justifications of the original competence centres programme was to combat this tendency. VINNOVA considered whether to make the VINN Excellence Centres larger than those in the previous programme but that the research community rejected idea. Despite the Swedish universities' strong overall enthusiasm for competence centres, apparently, forming **large** centres tends to be perceived as a threat to existing university structures. There is an important obstacle here both to the competence centres movement and to developing strong, specialised Swedish positions within the European Research Area, since these would necessarily have to be much larger than VINN Excellence Centres.

VINNOVA's survey of competence centres and other research milieux in Sweden shows that centres find lack of funding by far the most important barrier to internationalisation. This supports the argument that centre to centre cooperation is likely to need international funding, since it is improbable that other countries will adopt internationalisation strategies significantly more generous than that of VINNOVA. Framework or Joint Programming resources will be needed.

Other barriers to internationalisation identified by the survey were mainly the amount of bureaucracy involved. About 20% of the respondents identifies bureaucracy or IPR issues as barriers⁴³.

In the specific case of GigaHertz, it is clear that the centre has the skills needed to operate internationally. More broadly, this is likely to be the case with successful internationally orientated applied reseahers.

7.3.4.1 Good practices and success factors of international cooperation

EuRaMIG is an interesting example of building an international platform to set the international research agenda in a field. This should have useful feedbacks to the centre itself and will provide a basis for further international cooperations.

7.3.5 Conclusions on GigaHertz

GigaHertz therefore has evolved an internationalisation strategy that is now reflected in its activity plan. The presence of foreign companies has an industrial logic – they want to work with their customers also in the R&D phase, and the customers value the cooperation. For the academics, the nationality of the companies is immaterial – their objectives are knowledge, publications and PhDs.

⁴³ Source: VINNOVA

The development of an internationalisation strategy by VINNOVA makes it easier for such arrangements to develop, where the industrial and research logic allows. We can speculate that other competence centres may simply have assumed that having international partners was not possible or that it was simply ‘not done’. The new strategy will change that.

As the CHACH/GigaHertz centre has matured, so it has become more focused and of greater interest to technologically very competent companies. It seems reasonable to expect similar effects elsewhere – especially if it is possible to build the **large** competence centres inherent in the ERA vision of a more open and competitive research system in Europe based on a ‘common market’ in knowledge. However, the existing incentives are unlikely to lead to transnational centre-to-centre collaboration. International incentives are needed to move to this level. This implies changes to the Framework Programme or action through various kinds of joint programming – whether via ERA-NETs or the large joint programming actions anticipated in FP7. In the Swedish case, the existing tradition of running small joint technology programmes with neighbouring countries gives a good base for this kind of activity.

IPR remains a concern and is probably (apart from money) the most important barrier to centre-to-centre cooperation, at least as this is perceived in Sweden. VINNOVA is working to find ways to handle this. It might be useful to seek a greater level of effort to resolve this – for example, through a working group of agencies in the TAFTIE network or a Commission-sponsored study.

The EuRaMIG activity is focused on Framework rather than other forms of internationalisation. From the centre perspective, EuRaMIG increases the opportunities to obtain Framework Programme funding. However, this type of platform can also play an important role in extending the centre’s international networks.

7.4 Spain, Valencia Region: AIDICO

7.4.1 Description of the CRC

The Technological Institute of Construction (AIDICO) is a Spanish CRC that was set up in the Region of Valencia in 1990. AIDICO is focused on increasing the business capacity for innovation and quality through the development of R&D projects and advanced technological services to the construction firms.

In the Valencia region the expenditure on R&D is lower than the national average partly due to its specialisation in a few non R&D intensive productive sectors (notably textile, leather and shoes; wood and paper; rubber and plastics and other mineral non metallic products)⁴⁴. To a lesser extent, other incipient sectors are biomedicine, audiovisual, health and well-being, renewable energy, fashion design, aquiculture, ceramics, textile, toy making, steel, chemistry, logistics, transport, shoemaking and furniture.

The Regional Ministry of Enterprise, University and Science (former Conselleria de Empresa, Universidad y Ciencia, CEUC, current Consellería de Industria, Comercio e Innovación CICI) articulates all its policies, and counts on several entities that coordinate programmes oriented to business internationalization, company support, quality management and industrial real estate development. The Valencian Worldwide Foreign Trade Agency (IVEX) is the entity responsible of supporting the internationalisation of Valencian companies and helps them in the quest for new markets. The Valencian Institute of Small and Medium-Sized Enterprises (IMPIVA) is

⁴⁴ Política Tecnológica y de Innovación Empresarial en la Comunitat Valenciana, Horizonte 2011. RedIT, Red de institutos tecnológicos de la Comunitat Valenciana. Instituto Valenciano de Investigaciones Económicas. (p42)

the entity at the service of the small and medium enterprises (SMEs) which aim is to provide projects and subsidies to improve the competitiveness of the SMEs as well as their creativity, environmental awareness and information technology implementation.

AIDICO was created by the “Generalitat”, the Autonomous Government, through the Regional Institute for the Valencian SMEs (IMPIVA) as a private and non-profit Technological Institute of Construction⁴⁵ made up of companies from the construction sector aiming to encourage scientific research, technological development and innovation. The final objective is to improve quality and safety in building products and processes, in sustainability and prevention of accidents at work, as well as considering conditions of quality, safety and comfort for users of buildings or infrastructures⁴⁶. AIDICO aims to increase business capacity for innovation and quality to foster competitiveness on both national and international markets.

The current balance accounts for 12M€, with a turnover of 3,4M€. The R&D activity consists of around 50% (6M€) of the total budget and the time to market is minimum 2-3 years. Innovation type of activities (i.e training and human capital related initiatives) requires less funds. From a funding-source perspective, overall, AIDICO relies more on regional than on national support (e.g. a regional government R&D project can be around 4 million euros, while a national one is around 1,5 million euro).

Latest publicly available figures for AIDICO show that in 2007 AIDICO carried out 151 R&D projects, providing a total income of €10.1m, of which 80% were generated by R&D contracts, and the remaining 20% by internal R&D activity. Out of the €2m of public funding obtained, just 30% came from international programmes⁴⁷.

AIDICO has a team of 185 people specialised in multiple areas related to the competence of the Centre (architecture, organic and inorganic chemistry, industrial engineering, geology, physics, etc.) out of which around 35% are researchers; and with more than 570 associated companies involved in the construction process (i.e. construction companies, materials providers, quality control laboratories, engineers and architects).

It is not just a Technological Centre, but it also plays a role as the Business Association. Therefore, besides the typical activities of a Technological Center (i.e. training, marketing, observatory, technology transfer office, metrology and calibration, laboratories...) AIDICO develops its activity in two areas: Certification and R&D and innovation.

The centre promotes the technological development of the companies in the construction sector by means of the promotion and execution of Applied Research, Development, and Technology Transfer projects in areas related to raw materials, products and materials, and systems and technologies used in the construction sector. It also promotes the participation of SMEs in national and international R&D support programmes. Concretely, the main fields are: (i) Advanced and high performance materials; (ii) Reduction of the environmental impact of the construction industry; (iii) Ornamental rocks, aggregates, cements, gypsums and limes; (iv) Measurements and tests; (v) Technologies for the production of materials; and (vi) New e-working methods.

- The Materials Research Technical Unit has experts that work in different areas related with the materials research, such as: Cultural Heritage; Nanomaterials;

⁴⁵ AIDICO is registered with number 32 at the Innovation and Technology Organisations of the Spanish Science and Innovation Ministry.

⁴⁶ www.aidico.es

⁴⁷ Spanish Innovation and Technology Centres (Federación de centros de innovación y tecnología en España-FEDYT) www.fedyt.es

New cementing materials, concrete and mortar materials; Sustainable materials from industrial wastes; Thermal and acoustic Insulation materials; Composite materials, polymer coatings; Smart materials and Natural stone.

The research activities vary from basic research in collaboration with Universities and other Research Centres to applied research (i.e. product development, industrial implementation and technological transfer) and innovation (i.e process design and control mostly with business and industrial associations).

Around 95% of the work involves SMEs, so AIDICO is more active in applied research. When it comes to International cooperation in R&D most of the initiatives have been on basic research so far (as AIDICO was very active in FP kind of programmes).

Since other type of European programmes have become more important (for example, LIFE+, COST, INTERREG, Intelligent Energy Europe), the share of applied research is increasing. As success rates in FP7 are much lower compared to previous Framework Programmes the share of applied European research is increasing (65% non-FP versus 35% FP).

AIDICO has established Consortium Agreements for Research Cooperation with different research university teams from the University of Valencia and the Polytechnic University of Valencia, working in different areas of materials and Physical Sciences: sonic/ultrasonic signal processing, cement chemistry, microstructural analysis, nanoparticle synthesis, polymers, nanocomposite, or coatings.

Since 2004, AIDICO is the coordinator of the network RENAC (Network for the application of nanotechnologies in construction, habitat materials and products) that integrates more than 20 Spanish Research Groups from Universities and Technological Centres.

The two main AIDICO units working on the international cooperation are the Internationalisation Unit (with a more commercial/business internationalisation approach) and the Technology Transfer Office TTO (OTRI). The TTO aims to promote the participation of the companies of the sector by means of innovation projects in the different local, national and international R&D programmes; as well as bringing companies closer to the research results obtained by the different AIDICO areas.

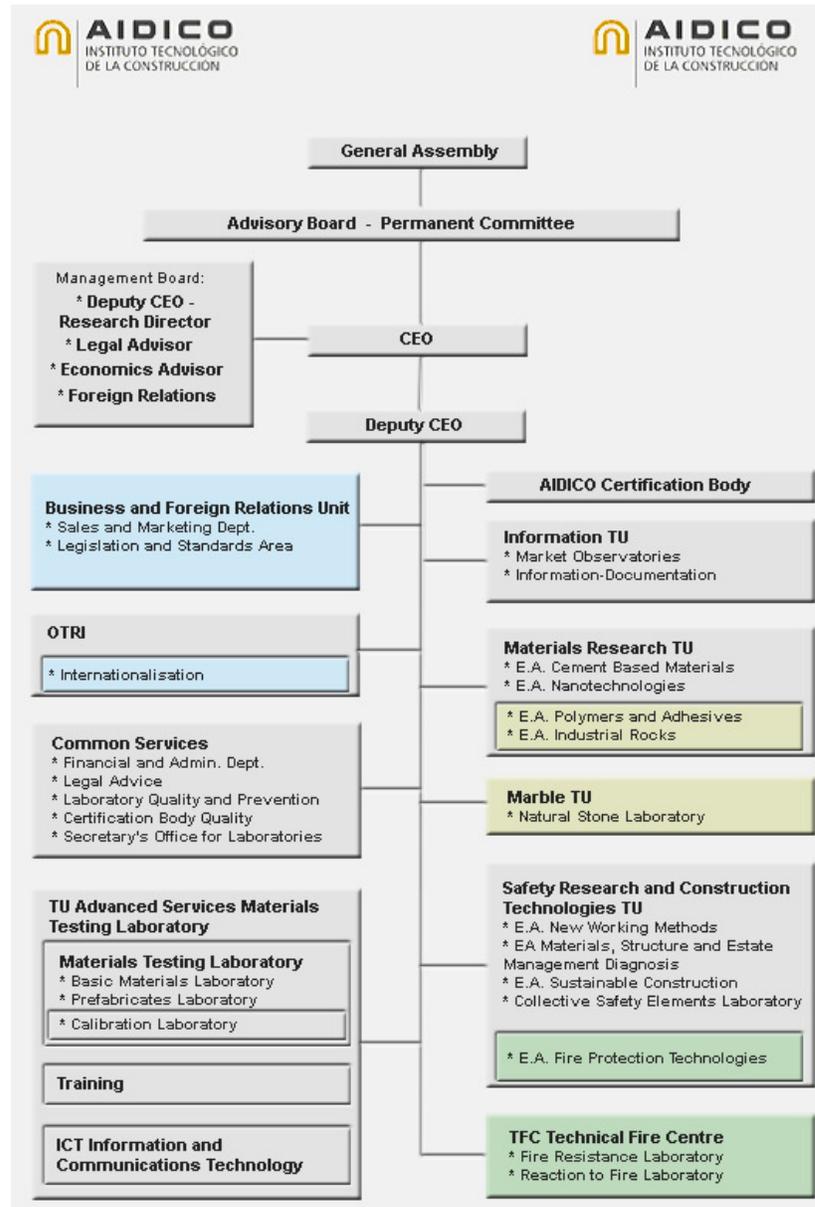
The TTO participates actively in thematic Brokerage Events where companies can meet other companies from all over Europe. Consequently, the OTRI team is in charge of establishing a direct communication line for the detection of technological needs and the search for solutions to specific technological problems and informing companies about technical events of interest regarding new trends (seminars, conferences, meetings, etc.). There is a strong cooperation with the project SEIMED⁴⁸ to detect and analyse the opportunities on the market related with the Construction sector.

Any company or physical person become an associate of the Technological Institute of Construction, by formally requesting to be accepted as such by the Advisory Board. The Advisory Board is made up of the associates willing to participate in the management activities of the Institute. The Advisory Board is comprised of a President, a Senior Vice President, a Vice President, a Secretary, the CEO, and a maximum of 22 voting members. They meet at least twice a year.

The overall structure of the CRC is presented in the organisation chart below:

⁴⁸ (<http://www.seimed.eu/impiva/jsp/General/PresentacionServicio.jsp?cs=1410&reci=&mo=0&i=0>)

Figure 31: Organisation chart of AIDICO



Source: AIDICO's official website⁴⁹

7.4.2 Internationalisation Strategies

The Autonomous Community of Valencia has full competence regarding the internationalisation strategy of the regional business sector, and notably, the international cooperation in R&D.

Since the reviewed Lisbon Strategy agreed in 2002 to raise the R&D expenditure objective to 3% of GDP, including two thirds of private sectors participation, the EU15

⁴⁹ http://www.aidico.es/categoria1.php?pagina=293&cat_id=0&idioma=3

countries would have needed to increase public expenditure 6% in average and annual basis. For the Autonomous Community of Valencia this would require a stronger effort, increasing the total expenditure in 18.63% annually and private expenditure in a 24.51%.

The real challenge in the Valencian region is, therefore, raising the private expenditure on R&D up to twice the public one. The Valencian STI system is smaller than what could be expected given the degree of economic development of the region and, at the same time, it lacks a balanced public-private intervention. According to the current public-private co-funding rates a publicly spent euro multiplies by 6 when co-funded together with the business sector; whereas it only generates 0.16eur when investing one euro in High Education⁵⁰.

In order to be able to achieve the regional strategic objective of rising investment on R&D and, notably, enhancing the role of the business, the Valencian region counts on an important CRC network placed in the centre of the STI policy, as one of the main leverages to mobilise the private sector.

IMPIVA is the entity promoting the whole network of technical infrastructures supporting innovation, which includes the Technological Institutes (CRCs) and the European Centres of business and innovation (CEEIs⁵¹).

The Technological Institutes are gathered together in the Network REDIT and include 24 centres (14 head-offices and 20 technical units) providing SMEs with services and technical means to improve their industrial innovation capacity. This, together with other initiatives carried out to foster the creation of scientific and technological spaces⁵² have been launched through the public policy of “Generalitat⁵³”.

Main objectives of this policy used to be set by the former Valencian Plan of Scientific Research, Technological Development and Innovation (PVIDI) 2001-2006. The plan established a general framework for action and proposed a set of solutions to the problems highlighted by diagnoses of the Valencian Science-Technology-Business System. The PVIDI provided an integral view of the government's action, coordinated by the Regional Ministry of Enterprise, University and Science, which used to bring a single overall perspective to the actions carried out by the different departments of the Generalitat Valenciana. It is structured in three general programmes and six sector programmes of oriented research, as well as the specific programmes developed by the Presidency and the different Departments of the Valencian Executive⁵⁴. Valencia is currently undergoing a STI policy-making transformation, in the sense that previous regional plans are about to be replaced by the new ones still under approval process. Since the approval of the law for coordinating the Valencian R&D system⁵⁵(replacing Autonomous Law to Foster and Coordinate Scientific Research and Technological Development of Comunitat Valenciana) this plan will now be split up into the General Strategic Plan for Science and Technology (PGECYT) and the Valencian Plan for Innovation and Competitiveness (2010-2013).

⁵⁰ Política Tecnológica y de Innovación Empresarial en la Comunitat Valenciana, Horizonte 2011. RedIT, Red de institutos tecnológicos de la Comunitat Valenciana. Instituto Valenciano de Investigaciones Económicas.

⁵¹ CEEIs: Centros Europeos de Empresas e Innovación.

⁵² Those are CEEIs support creation of new enterprises or diversification of already existing ones that contribute to the innovative activity of the area where will be located; the non for profit association ANETCOM was created in 2000 to foster R&D&I in the e-business and ICT sectors; and CEVALSI, a research centre analysing the social impact of ICT.

⁵³ Generalitat is the common name used to refer to the different self government institutions under which the Spanish autonomous community of Valencia is politically organised.

⁵⁴ http://cordis.europa.eu/valencia/intro_en.html

⁵⁵ Ley de la Comunidad Autónoma de Valencia 2/2009, de 14 de abril, de coordinación del sistema valenciano de investigación científica y desarrollo tecnológico

On the one hand, the General Strategic Plan for Science and Technology of the Valencian Region (PGECYT)⁵⁶ is currently also under development. The regional ministry of Education in cooperation together with a working group composed by the seven Valencian universities⁵⁷ is in charge of this task, with specific effort to maximise participation of other agents of the scientific system (i.e any other regional ministry with competences linked to R&D, Public Research Organisations (OPIs), researchers, etc).

The PGECYT will aim to adapt the region to changes derived from globalisation of the knowledge society⁵⁸, but no specific attention seems to be given to STI cooperation as such.

On the other hand, the Valencian Innovation and Competitiveness Plan (2009-2013) currently in progress, aims at making innovation the leverage for the necessary transformation of the Valencian productive structure through two main axis:

- Modernisation and transformation of traditional sectors
- Development of new processes, projects, businesses and sectors embodying a higher innovation degree and, in some cases, high-tech sectors.

The later comprises another Activation Plan for improving the participation of entities of the Valencian Community in both national and European R&D projects. For example, the specific sectoral Competitiveness Plan for Construction still ongoing dates back from 2005 and happens to be rather outdated. The new one is still under negotiations and therefore not available at this moment. Among the weaknesses identified in the previous plan “a low level of R&D and the lack of a strongly articulated R&D system” was mentioned. EU funding was considered among the opportunities. However, internationalisation of the sector and international cooperation in R&D were not even mentioned among the action lines.

The policy-making process has drastically changed since the worldwide economic crisis started. Valencia was a region highly dependent on the construction sector, where the job-destruction rate is extremely high and therefore, an indepth transformation of the economic structure shifting from traditional construction sector type of business towards more research intensive ones has become one of the main objectives of STI policy.

Nevertheless, a big effort is being made at CRC level to foster internationalisation. Since the “Integrated Actions Plan to foster and consolidate AIDICO’s involvement in International R&D activities⁵⁹” ended, AIDICO is currently undergoing a crucial moment in its internationalisation strategy, capturing further efforts since AIDICO’s re-organisation in 2007 (creation of the Internationalisation department and enlargement of the TTO). Thanks to its involvement in 12 Research and cooperation networks at European, national and regional levels, aside the work developed within the European Construction Technology Platform (ECTP) and the national mirror, Spanish Technological Construction Platforms (PTEC), AIDICO is able to establish a joint positioning and cooperation strategy together with other similar or complementary CRCs.

It is worth mentioning the Programme designed by IMPIVA “Fostering Innovation in Technology Institutes” under which annually AIDICO launches a Plan of integrated actions to boost and consolidate the Centre’s involvement in International R&D

⁵⁶ Plan General Estratégico de Ciencia y Tecnología de la Comunitat Valenciana (PGECYT)

⁵⁷ RUVI, Red de Universidades Valencianas para el fomento de la investigación, Desarrollo e Innovación / The Network of Valencian Universities to foster R&D&i.

⁵⁸ The Information Service and Scientific news (<http://www.plataformasinc.es>)

⁵⁹ This plan (Plan de acciones integradas para potencial y consolidar la participación de AIDICO en actividades de I+D internacionales”) was subsidised by IMPIVA’s Innovation Fostering Programme 2008

activities (INTERAIDICO). The programme for 2009 addresses two main issues: the dramatic hit of the crisis suffered by the construction sector in Spain, and notably in Valencia; and the consequent twofold need to open new markets: (i) in terms of looking for new products and processes and (ii) in terms of creating innovation synergies with other European entities. To this aim, the main objective of the plan is to define an Action Plan that “will place AIDICO as a leader Technology Centre in Europe in Technology innovation in the Construction sector”; and, at the same time, to create a business support structure for their internationalisation (i.e. advising them in how to get involved in EU and Public Procurement Projects).

This new strategy was motivated by the need to increase participation in European projects (both DG Research projects like notably FP7), and other EU projects (i.e. LIFE+, COST, Interreg, etc.); the need to develop R&D&I activities based on funding opportunities provided by Multilateral organisations (i.e technological assistance public procurement, etc.) and, finally, to foster synergies in R&D international projects through mobilising AIDICO’s foreign delegations.

The plan aims to, firstly, increase cooperation between companies and regional, national and European entities in the sector; secondly to increase visibility of the regional construction sector abroad and its international competitiveness; thirdly, to develop a more sustainable construction sector and, finally, to increase return of R&D investment.

AIDICO is also making an important effort through its Internationalisation Department to get involved in the Networks of Public Procurers in the areas of sustainable construction (i.e the afore mentioned E2B initiative⁶⁰) and some other areas like cultural heritage, energy, environment, metrology and promotion of innovation. However, it is still soon to draw conclusions out of this kind of international projects due to their novelty.

Besides the programme designed together with IMPIVA, the CRC does not have an Innovation Strategic Plan as such, but in 2008 AIDICO submitted a draft Internationalisation Plan to IMPIVA (updated in 2009) that was used as internal working document in order to present specific actions covering training activities for business management abroad⁶¹, trade missions, market prospective, visits to trade fairs, multilateral organisations and multiple networking activities abroad.

7.4.3 International co-operation activities

7.4.3.1 Actual international co-operations

AIDICO has carried out more than 200 R&D projects since 1998, mostly funded by Regional, National or European public authorities. They distinguish the strictly R&D type of cooperation (both basic or applied) and cooperation in innovation. In the former, AIDICO works with very experienced market oriented people, whereas in innovation type of cooperation AIDICO usually plays a leading role and those are cooperations carried out with non or just arrived Members States.

International R&D cooperation started in 1998 with the first European Framework Programme projects under FP4, where AIDICO had a very active first period. After, they were the coordinator of the FP5 European Network for Product and Data Exchange (ProDAEC, a project on e-Work and e-Business in Architecture, Engineering and Construction). This, was a first important step that led to further FP5 cooperations like PARTNER project (European Standard test to prevent Alkali

⁶⁰ <http://www.e2b-ei.eu/default.php>

⁶¹ see “Plan de internacionalización 2009” AIDICO.
(http://www.aidico.es/cms/site_0044/descargas/Plan_Internacionalizacion_AIDICO_2009)

reaction in aggregates); UDS (Ultrasonic diagnostic system to developed a non-destructive control for ornamental stones); ROADCON (Strategic Roadmap towards Knowledge Driven Sustainable Construction); and LIFETIME (Lifetime Engineering of Buildings and Civil Infrastructures). Then, under FP6 AIDICO took part of the IST project “INTELCITIES”, which dealt with the creation of an interoperable e-government service. Some other FP6 projects were, for instance, I-STONE (Re-engineering of natural stone production chain through knowledge based processes, eco-innovation and new organisational paradigms), ISSB (The Integrated Safe and Smart Built Concept), STAND-INN (Integration of performance based building standards into business processes using IFC open standards to enhance innovation and sustainable development), and CALM TRACKS & CALM ROUTES (Innovation of noise barriers: improved noise abatement for motorways and railway tracks).

After a very active period during FP5 and, to a lesser extent, FP6; the success rate of proposals has significantly decreased since FP7 started (down to 1/10 of submitted proposals), and there is currently just one FP project undergoing (MESSIB - Multi-source Energy Storage System Integrated in Buildings).

AIDICO’s adherence to the European Construction Technology Platform (ECTP) in 2005 was an important milestone in its Internationalisation process, allowing AIDICO to get in first contact with a broader and more specialised pull of CRCs, universities and business associations of the European construction sector. What is more, being part of the Advisory Group of the ECTP has allowed AIDICO to better identify global SMEs needs, mobilising enough critical mass of Valencian SMEs as to get involved in international R&D programmes and, at the same time, contributing to the knowledge creation of the construction sector. The role AIDICO plays within this European platform is bidirectional, apart from networking, looking for further cooperation opportunities and contributing to the construction sector knowledge creation, it also has to transfer know-how generated in the ETPC working groups through diffusion activities addressed to Valencian SME. The main objective of this kind of diffusion activities is to inform and rise awareness of the main trends of the sector at a broader level and, at the same time supporting SMEs to participate in European projects if they want to remain competitive in the more and more globalised construction sector.

On top of that, AIDICO belongs to several networks and European and international Technical Committees and Networks like for instance the European Network of Materials Research Centres (ENMAT), that provides them with the organisation and adequate resources for a quick promotion of results among the industrial sectors that may be interested.

As an example of the positive results that its adherence to the ECTP has brought to AIDICO, they mention a successful Joint Technology Initiative (JTI) on Energy to Build (E2BA) for which a team of ECTP members applied under the FP7. The Energy Efficient Building (E2BA) is a 91 billion European Joint Technology Initiative (JTI) covering a 3 year period, an industry-led public-private partnership equally funded by industry and the European Commission working to achieve common objectives. It works as a technology platform, focused on energy efficient buildings and with its own calls for tenders process.

AIDICO has managed and participated in some other international research projects, notably in the frame of European programmes with a few initial cooperation initiatives outside the strictly EU programming schemes. For example:

- Education and Lifelong learning programme Leonardo da Vinci.
- CEMENTINET- Cementing Training Institutions: a new approach to mobility. Together with 7 other partners from 6 different EU and candidate countries, CEIS has decided to create an innovative network of Training Institutions to respond to current needs in the cement sector throughout Europe. It is about to determine common training tools and to deliver the same trainings at the same period in different countries.

- EUROENEFF – Development of a Guide for energy efficiency renovation of Buildings.

Some examples of other European funded type of programmes where it has slowly introduced are:

- EUREKA! - ITEA2: EASY Interactions - An Enhanced Approach for human – System Interactions; BESTPRODUCT TENEEEST – Through a European Network on Environmental Engineering Sciences and Technologies
- TEN-TELECOM: EUROpean network for reAL-time Limitation of Environmental polluTION levels
- COST: NMC - Composites with novel functional and structural properties by nanoscale.
- INTERREGIIC: PERSPECTIVE2013 – Waste Management - Development of strategies for the reuse of Cathode Ray Tubes
- LIFE+: ECOSTONE – Sustainable and Ecological management of Stone resources

Aside the strictly EU funded projects, AIDICO has started innovation type of cooperation with non European countries driven by the interest to open new markets (i.e Russia and China) and, to a fewer extent, support developing countries like for instance Congo and Angola, where in April 2009 AIDICO signed a collaboration agreement with the authorities of those two countries in order to implement urban modernisation plans; and with Mauritania, where AIDICO offers Measurement services to local companies and training sessions on the topic since 2007.

Cooperation agreements signed between the CRC with some regional governments in China and Russia since 2008 (i.e Voronezh and the State University of Architecture and Construction) set the basis for future joint-research projects as well as knowledge sharing activities (i.e training sessions and technical assistance). Through agreements like the one signed between AIDICO and the Federal Centre in April 2009, for example, they acknowledge AIDICO'S certification power, so that any Russian organisation interested in obtaining public procurement services from a Spanish company will be addressed to AIDICO to crosscheck the required certificates are in order. Furthermore, since 2008 AIDICO works in the organisation of commercial missions for the Valencian construction firms in cooperation with the Spanish Institute of Foreign Affairs (ICEX) and the Spanish Federation representing Technology Centers (FEDIT). In the same line, AIDICO has already developed some first cooperation activities in China, that resulted in bilateral agreements and the opening of two delegation offices in Shangai and Pekin in 2010.

After more than 10 years of international cooperation, experts from the Technology Transfer Office in AIDICO consider the most successful experiences have always been the ones where partners had some complementary skills. In the purely R&D cooperation projects, the best is, as was stated by interviewees, to build up a team able to cover all the research process phases.

Allocating effort and resources to networking activities is also crucial, but they need to come together with some solid specialisation. In the case of AIDICO their added value is based on the long experience in the construction sector (more than 16 years) coming from a very construction intensive region. Besides, AIDICO'S value also comes from associated companies of the sector (currently 570) and many national and international industrial associations that provide them with a high mobilisation capacity.

7.4.3.2 Effects of international co-operations

The first main effect of cooperating with foreign partners is the **increase of visibility** and the higher exposure of the Centre. This can result in either a positive or a negative publicity, depending on the degree of success of the cooperation. So far,

AIDICO has managed to be one of the most active members of the ECTP. Making a strong effort to make the visibility issue play in its favour, by rising awareness of national partners, and notably, SMEs of the considerably higher quality standards required when working at international level. When opening to international markets and, notably, when applying through European public procurement schemes, they face a wider competition and they need to build a reputation that, at a first instance, they did not have.

A second important effect is the **opening of new markets**. When joining other international partners, choosing them based on complementarities of their competences, they end up being involved in sectors that, in its own, AIDICO would not be able to enter. For instance, the cooperation with the Valencian Pyrotechnic sector has deal the opportunity to work together with regional government in Russia⁶².

From an Insider perspective, AIDICO has taken great advantage of this kind of cooperation. Their working methodology has necessarily changed towards more result oriented and with a broader international perspective. A new internationalisation department was created two years ago. This also had a direct impact on the recruitment policy of the CRC, taking the command of languages as a mandatory requirement. In fact, the only negative experience in international cooperation was due to communication problems because of a poor English level of partners involved.

Successful stories

The most fruitful cooperation started with involving technical people of AIDICO in the ECTP's specific groups to promote SMEs involvement, taking active part of the SMEs Advisory Group (AG-SME). This allows AIDICO identify SMEs needs and, at the same time, establish new interesting links with potential international partners.

The afore mentioned Energy Efficient Buildings Joint Technology Initiative (B2BA) project was one of the successful results of getting involved in the AG-SME, aiming to reduce CO2 emissions through new building methodologies⁶³.

There is no specific evaluation or assessment system focused on AIDICO's international cooperation, but some of the benchmark studies mentioned during interviewees were annual report of the Spanish Innovation and Technology Centres (Federación de centros de innovación y tecnología en España-FEDYT) and some specific reports produced by the National Centre for Development of Industrial Technology (CDTI) on Energy and NAP (nanotechnology) programmes.

The annual FEDIT report is based on a survey launched among all technology centres and provides some insight on the main figures and activities carried out by each CRC. To a final extent, this provides an aggregate picture of CRC's evolution and their role in the Spanish Innovation System.

7.4.3.3 Opportunities

AIDICO claims to be active in most of the areas of its interest already. According to the Action Plan, main strategic lines for 2009 will focus on 7 topics:

- Towns and Buildings
- Sustainable Construction
- Cultural Heritage
- Materials

⁶² For further information, see

<http://www.diariocriticocv.com/noticias/pirotecnicos/espanoles/rusos/not308302.html>

⁶³See http://www.aidico.es/cms/site_0044/descargas/Boletin_NA__23, p.22

- Infrastructure networks
- Support to SMEs' participation in FP7
- ICT

Main aspects AIDICO takes into account when making the selection of partners are, on the one hand, their specialisation on the topic or, at least, on part of the subject of the project. On the other hand, it is important partners are experienced and efficient in managing this kind of cooperation projects, notably when the project is EU funded, because formal requirements have to be closely followed up. As a result, AIDICO often tends to choose partners with whom they already had positive cooperation experiences in the past.

Overall, best R&D cooperation is always the one based on complementary clustering, where each partner has a clear role and gets a clear advantage out of the cooperation.

However, international cooperation on R&D is, under whatever formula, a positive initiative as it means investing in worldwide competitiveness.

7.4.4 Barriers and needs

One of the main barriers to cooperation is the short deadlines often set for both, preparing proposals (if it is an EU funded project) and carrying out the R&D cooperation project. This links to the constraints in trying to get SMEs onboard, because research cooperation projects do not always show results in the short term, on the contrary, time to market tends to be between 2 and 3 years, which is a rather long wait for a return on an investment (not only strictly monetary, but also in terms of effort and resources) made by an SME.

Interviewees highlighted the important support received from the regional Government, allocating more funds to international R&D cooperation and, when necessary, extending deadlines in order to attract as many partners as possible. However, it would be advisable to allocate some extra resources to developing a clearer communication strategy on all available national, regional and European funding schemes supporting this kind of cooperation. Although many tools to detect opportunities exist (i.e. technology platforms, technology observatories, etc.), the management of this information and the diffusion channels used do not seem to be the most appropriate ones. In consequence, SMEs receive too much information from many institutions (e.x. chamber of commerce, councils, institutes, industry associations...) that they are not able to absorb it all. Developing some kind of centralised diffusion platform or interactive tool could be good investment to, on the one hand, address more specific information to SMEs, CRCs, etc. that might be interested on the topic; and, on the other, rise awareness of the opportunity that international cooperation may be in terms of opening new markets and fostering innovation environment among SMEs.

In non EU funded projects, like cooperation agreements signed in Romania, the main barrier to R&D cooperation is the lack of funding or the extremely slow funding schemes, that make almost impossible getting SMEs involved because of their low critical mass capability. In these cases, AIDICO also found a lack of specialisation of their counterparts, so that they ended up organising training sessions (on management of EU projects, technology transfer, etc.) instead of the originally planed R&D cooperation.

At CRC level, it is suggested to create a new specialised technology international cooperation department that would gather both technical knowledge of the construction sector, as well as communication and managerial skills.

It would be useful to provide the TTO with some extra resources as to foster international management skill within the SMEs (i.e. international management skills, technical support in preparing good offers, business language courses, etc.)

7.4.5 Good practices and success factors of international cooperation

Among the R&D cooperation initiatives developed by AIDICO during the last decade, two were specifically mentioned as successful experiences in entering what at that time were new R&D&i environments. The first one was a project carried out on the “Homogenisation of waste recycling processes” together with SINTEF, the Norwegian Research Centre. This was the first of many other cooperation projects with that team.

The second one was a cooperation carried out in 2007 with the University of Sicily, the Cultural Heritage domain.

Among the currently ongoing European projects interviewees highlighted the cooperation initiatives arose from the ECTP, like for instance projects carried out with leading institutes like Fraunhofer-Institut für Bauphysik (IBP), SINTEF, CSTB (Fr). One of the projects carried out with the building division of the Danish Technology Institute (DTI), resulted in strong sustainable links that AIDICO managed to reinforce through the ECTP and brought one to nine months post-doctoral internships exchanges under the programme “high specialisation” launched by the regional ministry of innovation through IMPIVA.

Some other links are very theme specific, like for instance the cooperation carried out with the University of Gent, which is a leader on nano-materials. The ENMAT network was created together with the university as a result of a contact AIDICO made during an Infodays session and end up with a new COST project won.

AIDICO maintains good relations with other private and public CRCs not directly linked to European networks. It is worth mentioning the cooperation agreement recently signed with the Romanian Research Centre, ICECON, as a result of previous networking activities carried out in Romania during 2008. This agreement will provide AIDICO with local structure for technology transfer projects, within the thematic areas identified as strategically interesting in Romania. In return, AIDICO will share its knowledge of management of public funding (national and European) for the development of R&D projects of common interest.

A first requirement for getting to a successful cooperation is belonging to networks, where you can, not only meet potential partners, but see their way of working within the network. At the same time, the advantage of a network is the facility to get third part's references, from people that may have already worked with your potential partners before.

The IPR regulation is no longer a barrier to cooperation, thanks to the development of European IP protection formulas. This used to be a problem, especially when working with Spanish Universities that used to impose their own over-protecting contractual conditions. What is more, it was even mentioned as an advantage of EU funded projects the fact that all contractual agreements are already standardised, obliging all the partners to join them.

At business level, it is especially difficult to find Spanish experts with an acceptable **English level**; which obliges the CRC to closely follow up from the preparation of the proposal, through the contractual and administrative requirements to the further implementation of the project, once the proposal is accepted. Except for the cooperation projects carried out with technology base companies (i.e spin-offs, etc) where researchers do usually have an international profile. However, the percentage of technology base companies in Valencian region is very low.

7.4.6 Conclusion on AIDICO

Although not gathered in a single strategic document, AIDICO's Action Plan quite fits into what could be considered a Internationalisation Strategy. The Action Plan has received an important boost from both sides, regional Government and AIDICO itself, as a way out to the crisis for regional SMEs of the construction sector.

AIDICO started internationalising in the 90's with the first European Framework Programmes, when international cooperation was based on basic research. After a progress towards other kind of European projects (i.e COST, LIFE+, Energy, etc.) most of international cooperation on R&D is nowadays on applied research and innovation.

AIDICO, in line with its twofold role as Technology Centre and Industry Association, has also contributed to opening new non European markets through R&D type of cooperations.

AIDICO's experience has shown that best STI cooperation experiences often start with making a good choice of complementary partners, whose competences complement AIDICO's ones resulting in the most competitive project team.

7.5 Austria: Virtual Vehicle Competence Center (ViF)

The subject of this case study is the Virtual Vehicle Competence Center, "Kompetenzzentrum - Das virtuelle Fahrzeug Forschungsgesellschaft mbH" in German, abbreviated "ViF"⁶⁴. ViF is a research centre with 135 employees, based in Graz / Austria, and it is funded as a so-called K2-Center (see below) through the COMET⁶⁵ programme, which is managed by the Austrian Research Promotion Agency (FFG) on behalf of two ministries financing the programme, namely the Federal Ministry of Transport, Technology and Innovation (BMVIT) and the Federal Ministry of Economics, Family and Youth (BMWFJ).

7.5.1 Description of the CRC

The history of the ViF is closely linked to the history of CRC funding programmes in Austria. In order to understand the history of the ViF centre it is therefore helpful to briefly sketch the history of CRC programmes in Austria: The first programme in support of Competence Research Centres (CRC) in Austria was the K-plus⁶⁶ programme, launched in 1998 by the BMVIT. Soon after this, the BMWA opened the K-ind/K-net programme. Both programmes aimed at establishing medium- to long-term strategic R&D co-operation between partners from science and business, but with different focuses. While K-plus emphasized the establishment of physical research centres jointly governed by their partners from academia and industry, with a clear institutional identity, high research standards in pre-competitive research and a dominating multi-firm-approach, the K-ind/K-net programme was more oriented towards (individual) industrial needs, with industrial leadership of the centres and networks funded. Both programmes funded CRC for up to seven years, positive interim evaluations provided.

- After the end of the first full funding period of seven years the ministries decided to launch a single follow-up programme: COMET. This programme comprises three different lines of funding: (i) K-projects, (ii) K1-Centres, and (iii) K2-Centres. The K-projects mainly serve as a "training ground" for science-business co-operation involving several companies (multi-firm). The K1-Centres can be compared to the old K-plus- as well as K-ind-centres in terms of objectives, conditions and structure; their scope is mainly national. K2-centres have to be more ambitious in their research programme than K1-Centres; they are expected to tackle particularly challenging and risky fields of research and – most important for this case study – they explicitly have to work internationally and involve foreign partners. Like its predecessors, the COMET programme is open to all topics of research, but every single project or centre must have a clear thematic

⁶⁴ Information about the ViF is provided on the centre's website <http://www.v2c2.at>

⁶⁵ COMET is an acronym for "Competence Centers for Excellent Technologies"

⁶⁶ "K" stands for "Kompetenzzentrum" = Competence (Research) Centre

focus. K2-Centres are funded for 10 years with a stop-or-go decision after a mid-term evaluation.⁶⁷

The origins of ViF go back to the early days of the K-plus and K-ind programme: a K-plus-centre already named "Virtual Vehicle" and a K-ind-centre named "Acoustic Competence Centre" were established at Graz. The Graz area was and is the location of numerous suppliers of vehicle components, particularly for cars, and Graz is also home to the Graz University of Technology and the public research institute Joanneum Research. These research institutions together with the key companies in the area were the main drivers behind the setting up of the two CRC, supported also by the provincial government of Styria. The two centres were both active in vehicle technologies, albeit with different specialisations. The ViF of today resulted from a fusion of the two CRC in 2008: their key partners had decided to join forces and reach out for the ambitious status of a K2-centre, which was finally granted to the enlarged ViF in the first call of the COMET programme.

All COMET centres must have a clear thematic focus. ViF has its focus in the field of application-oriented vehicle development and sustainable vehicle technology and it investigates and develops new technologies, which will be implemented in future automotive and drivetrain concepts. Research is organised in five thematic areas:

- Thermodynamics
- Mechanics
- Noise, vibration, harshness and friction
- Vehicle electrics and electronics, and embedded software
- System design and optimisation

The scope and content of research at and by ViF is outlined in its research programme, which is implemented through research projects jointly carried out by ViF and its scientific and industrial partner as well as by ViF alone.

Two modes of research dominate the centre's activities: strategic research performed in-house at ViF (i.e. basic research), and precompetitive applied research in multi-firm consortia involving at least two industrial partners, one scientific partner and ViF itself. Single-firm projects are possible, too, but their volume is restricted to 20% of eligible costs, which underlines the establishment of a new culture of co-operation as one of the key programme objectives. To a smaller extent, ViF offers contract research and R&D services to companies, and it participates in funding programmes other than COMET, mainly the European Framework Programmes for R&D, and other national funding schemes, e.g. thematic programmes in the field of mobility and transport.

ViF's budget as a COMET K2-centre amounts to €65m for the first five years. In autumn 2009, ViF had 135 employees (approx. 120 full time equivalents), 118 of these are active in R&D. The ViF management plans to increase staff to approx. 175 employees, a growth which is expected to be financed mainly through services and contract research.

At the time of this case study, ViF had no less than 80 partners linked to the CRC through a co-operation agreement (see section on governance below), 45 industrial partners and 35 scientific partners⁶⁸ from different countries. Among the industrial partners, the shareholding companies play a key role as well as the large German car manufacturers (OEMs) Audi, BMW, Daimler, Porsche and Volkswagen. Most other industrial partners are suppliers to the car industry. The most important scientific partner is ViF's largest shareholder, Graz University of Technology; other leading

⁶⁷ Information about the COMET programme is provided online <http://www.ffg.at/content.php?cid=340>

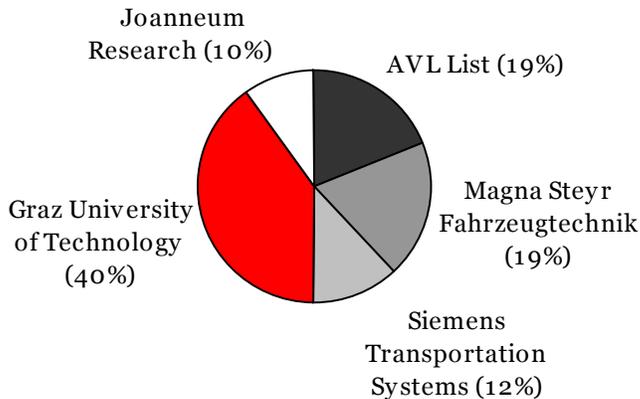
⁶⁸ mainly university institutes, representing 13 universities and academies

research partners are the Universities of Technology in Vienna (AT), Munich (DE), and Kaiserslautern (DE), the KTH Royal Institute of Technology in Stockholm (SE), the Katholieke Universiteit Leuven (NL), as well as the Austrian and the Slovak Academy of Sciences.

7.5.1.1 Structure

ViF's legal structure is a limited company jointly owned by five shareholders, one university, one public research institute, and three companies:

Figure 32 Shareholders of ViF



Approx. 80% of ViF's activities and funding are governed by its status as a K2-centre, which is the main focus of this case study; the remaining approx. 20%, the so-called "non-K-area"⁶⁹ comprises contract research (mainly from single-firm projects), income from services, and R&D funding from sources other than COMET.

The K2-centre is financed from three sources: public funding (50%), scientific partners (5%), and industrial partners (45%). Industrial partners have to contribute at least half their share in cash.

7.5.1.2 Governance of co-operation

Co-operation among partners of the COMET K2-Centre ViF is governed through a co-operation agreement, which is signed by all partners and ViF. This agreement is open to new partners and since ViF's official launch in 2008, the number of so-called agreement-partners has grown from 55 to 80 in autumn 2009⁷⁰.

For ViF, like for every other K2-centre in Austria, international co-operation is not an option but an obligation and foreign partners are fully equal to Austrian partners. Partners work together in individual multi-firm R&D projects. Companies do not receive direct financial funding but they own the intellectual property created through the research projects they participate in; industry contributes at least 50% of each project's cost in cash and (up to 20% of their share) in-kind. Universities and research institutes participating in the projects are funded and have to contribute at least 5% of each project's costs. ViF participates in all R&D projects. Each proposal for a new R&D project is first submitted to the Programme Committee. The Programme Committee is responsible for the description of the content and for the scientific quality of each project; it assesses the proposal and makes a recommendation to the Strategy Board,

⁶⁹ Non-K-area is a term used in Austrian CRC funding programmes to define a CRC's activities outside the regime of the CRC programme.

⁷⁰ Without counting institutions ViF co-operates with on a project basis, e.g. in EU-Framework Programmes

which takes the final decision. The Strategy Board is **the** central body in all issues related to the quality and content of research at ViF.

7.5.2 Internationalisation Strategies

7.5.2.1 Internationalisation at the policy and programme level

Although no explicit strategy for internationalisation exists in Austrian R&D policy there is a consensus that international co-operation is of key importance for the development of the Austrian research and innovation system – after all, Austria is a small country. Consequently, many funding programmes have been opened to the participation of organisations located abroad, although in most cases these participants do not receive any funding from the Austrian programme. There are exceptions to this rule, and actually the K-plus programme has been the pioneer in allowing a restricted share of overall funding for participants abroad. Initially the programme admitted Austrian institutions only, but after a few years into the programme, several K-plus centres attracted potential partners from abroad. The funding authorities reacted, and if the centres provided solid arguments that the involvement of these companies or research institutes was beneficial for the entire CRC, the funding agency accepted these extensions. The K-ind programme adopted a similar practice. Both cases illustrate, that internationalisation of R&D policies in Austria is very much driven by the initiative of individual persons in the administration and funding agencies.

Following the experience made during the first K-programmes, the COMET programme has been opened to international participants from the very beginning of the programme and for the larger and more ambitious K2-centres, international co-operation is a must, as they have to perform research at an internationally competitive level. In K2-centres, like ViF, foreign partners can participate on equal terms to Austrian partners.

7.5.2.2 Internationalisation at the level of the CRC ViF

ViF does not have a separate internationalisation strategy, as in fact international co-operation is an integral part of its core strategy. This strategy has been developed by the two predecessors CRCs of ViF and their partners. It has been written down as a part of the application for funding submitted to the COMET programme and has now become part of the funding contract. The co-operation strategy (national and international alike) is put into practice through the standard co-operation agreement which is signed by all partners and it is developed further by the management and decision making bodies of the centre.

The main modes of international co-operation are:

- to work together in R&D projects within the K2-centre, which is the core activity of ViF
- to participate in European research programmes
- to participate in international conferences (as well as in their scientific committees) and to organise such events in Graz
- to recruit researchers from abroad.

The geographical focus of international co-operation so far has been within the European Union, with a particularly strong link to partners in Germany. The reason for this can be found in ViF's thematic specialisation: several large car manufacturers (OEMs) are based in Germany (Audi, BMW, Daimler, Porsche and Volkswagen), and these are key partners for any research centre specialised in vehicle technologies as well as for the supplier industry. Other partners are located in the neighbouring countries Slovakia and Slovenia, but also in the Netherlands, Sweden and Switzerland.

The basis for the present ViF's capability and capacity for international co-operation was already created by its predecessors although the possibilities for cross-border relationships were restricted by the old CRC funding programmes. The "old ViF" in the K-plus programme has been particularly active, starting international co-operation already in 2005. According to the experience gained during that time, a newly founded CRC needs several years to establish a solid basis for cross-border co-operation: first it is necessary to consolidate the working relationships with and between the initial scientific and industrial partners – after all the K-programmes mainly aimed at establishing new long-term partnerships. Secondly, critical mass of research capacities has to be built, and ultimately, it is indispensable to achieve research results that are interesting and good enough to be published and presented internationally. Once the first international relationships had been established, the "old ViF" used them as references when contacting new prospective partners. A symposium in the field of vehicle acoustics which was initiated and organised by the other predecessor CRC, the Acoustics Competence Centre, turned out to be another successful approach towards international visibility. Without these years of prior experience, the new ViF, founded only in 2008 could not be the node of the large and international network of R&D partnerships it is today.

ViF actively participates in a number of EU R&D programmes, in particular in FP7, in the Joint Technology Initiative Artemis, the LIFE programme, and in the European Research Fund for Coal and Steel. Having acted as a partner only for several years, ViF has meanwhile also taken the role of a project co-ordinator, which is considered an important step forward in the centre's capabilities for international co-operation. For ViF, European projects have proven appropriate especially for large projects involving a large number of participants working together on topics which cannot be covered by ViF's own K2-research programme. Moreover, while in the K2-centre R&D projects ViF plays a key role and accounts for the larger part of the work load, European projects provide the opportunity to make first steps into new fields. ViF also participates in the Marie-Curie-Programme in order to attract young researchers from abroad and to cultivate the partnerships with other researcher institutions.

7.5.3 International co-operation activities

7.5.3.1 CRC-CRC co-operation

As a matter of fact, the question if or if not a potential partner is a CRC in the strict sense of the word⁷¹ or not does not play a role in the planning and implementation of working relationships in the ViF. Thematic specialisation and fit as well as the quality of research are the most important criteria for the selection of scientific partners. So far, ViF has barely worked together with other CRC in Austria and with none abroad, because all required research expertise has been found at other institutions.

7.5.3.2 CRC co-operations with foreign partners

As already outlined, the foundations for ViF's large international network of partners were already built by its predecessors, and ViF as a K2-centre has systematically expanded these relations. The most important reason for ViF's international orientation can be found in its thematic specialisation, i.e. its strong focus on the automotive sector. This sector is characterised by a high degree of international division of labour in a complex value chain involving numerous suppliers and (relatively few) car manufacturers, none of which is based in Austria. One of the main practical drivers for cross-border co-operation is the simple fact that sometimes no partner with a certain specific qualification exists within Austria, especially for the

⁷¹ i.e. a CRC is subject of a public R&D funding programme

multi-firm projects; for instance, no manufacturer of gear-boxes is located in Austria. In other cases, companies expand existing business relationships to foreign companies by inviting them to participate in the K2 research programme, or they establish new relationships with desired customers or suppliers.

Ideally, new partners for joint R&D are selected in such a way that the partnership can flourish beyond the funded project. In the case of a business partner this R&D co-operation could lead to a supplier-customer relationship or another kind of business collaboration among companies; for ViF and the scientific partners, a new participant could later also become a customer of contract research or of other services. Mutual knowledge and trust are of key importance in any case.

New prospective partners are approached in a flexible way either by ViF or by one of the partners, often one of the stakeholders. Economic competition is, of course, an important issue, which has to be clarified before a potential partner can become a member of the consortium, i.e. sign the cooperation agreement. In general, these questions are discussed and sorted out by the parties involved, ViF and the shareholders, before a new R&D project is proposed to the programme committee. So far, "vertical co-operations" along the value chain, i.e. companies linked as customers-suppliers, has turned out to be a particularly successful mode of working together.

Moreover, it is of key importance, that IPR issues are agreed upon from the very beginning. Based on the K-plus experience, the cooperation agreement signed by all partners comprises also a standard agreement on the handling of intellectual property rights. If necessary, specific additional agreements are negotiated by a particular group of partners that want to work together in an R&D project. In such cases ViF takes the lead in the negotiation process and drafts agreements for the parties involved.

7.5.4 Effects of international co-operations

To date, the effects of international co-operations at ViF have not been assessed, as ViF in its present form was founded only in 2008. The COMET programme foresees an interim evaluation of all K2-centres in the fifth year, and the international dimension will be one of the key criteria for assessing ViF's achievements in 2012. Indicators for measuring these achievements have been fixed in the funding contract; they include international publications, conferences, partnerships with foreign companies and research institutions as well as the participation in European R&D programmes.

At present, two main indicators point at a successful development of internationalisation: (i) the very fact that ViF has managed to substantially increase the number of foreign agreement partners including five German OEMs, and (ii) the international visibility its newly established conferences have gained within only a few years.

The most important positive effect of international co-operation observed so far by ViF and its predecessor CRCs has been a higher visibility, which in turn has been the basis for other positive outcomes, namely:

- new market opportunities: companies have managed to establish new or to strengthen existing business partnerships, and ViF has gained new customers for contract research and other services;
- higher quality and relevance of research: working with leading companies and research institutions abroad helps ViF and its partners to keep up with the international state-of-the-art; it is an important source of (critical) feedback as well as a way to access unique research infrastructures not available in Austria and, last but not least, provides access to the "working reality" of OEM's and their research needs. This does not only enhance the quality of research but also its relevance – a key factor for the later implementation and application of the results achieved;

- new funding sources, e.g. from European and national R&D initiatives and programmes, but also income from contract research.

No negative effects of international co-operation have been reported so far.

7.5.4.1 Opportunities

On top of the international network already established, ViF plans to expand its relationships to companies and research institutions in other European countries as well as overseas. At present, ViF is preparing to establish links with new partners in France, and it has made first steps towards transatlantic co-operation with Canadian scientific and industrial partners. ViF even considers setting up an office in Canada, which is expected to be the foothold for entering the US automotive market. Recently, India and China have entered the "field of vision".

7.5.5 *Barriers and needs*

7.5.5.1 Barriers

As a K2-centre, ViF faces literally no barriers for international co-operation from the side of the funding authorities (apart from the fact that it must not move its location from Austria/ respectively Graz). No major other barriers have been experienced so far, but some obstacles still had to be overcome: In some cases, ViF had to cope with financial constraints, resulting in a smaller scope of a particular R&D project. Occasionally, a desired partner dropped out during project preparation, and moreover, it is not always easy to communicate the funding principles of the Austrian COMET programme to organisations based in countries without comparable funding schemes (e.g. Germany). Language and culture so far have not been major barriers, Germany being the location of many important foreign partners; however, approaching French organisations, this might change.

ViF actively participates in other national funding schemes which, unlike COMET, normally do not allow for the funding of foreign partners. This has sometimes been a barrier especially for the involvement of scientific institutions located abroad.

7.5.5.2 Needs

ViF has already managed to establish substantial capacities, not least thanks to the flexibility of the funding authorities in the "old" K-programmes, and since 2008 the funding regime of the COMET programme has provided good conditions for international collaboration. It would be helpful, if other national funding programmes were similarly opened to foreign participants, as working together on a single project basis is often the starting point for a long-term co-operation in the framework of the ViF co-operation agreement.

Other than the earlier K-centres, the K2-centres are explicitly funded with a long-term perspective, i.e. with a strong intention to establish the small number of K2-centres as internationally visible research institutions. From the perspective of ViF it would be helpful for this development to have more financial resources available for in-house strategic research. Moreover, new modes of co-operation beyond the established R&D project should be facilitated, especially for the exploration of new strategic topics.

7.5.6 *Good practices and success factors of international cooperation*

There are a number of factors for ViF's international co-operation:

- experience: the experiences gained in international co-operation since 2005 have shaped ViF's co-operation strategy as well as its implementation;
- research capacities and capabilities: ViF did not start from scratch when it became a COMET K2-centre in 2008 but it could move on from what its predecessor, a K-plus-centre and a K-ind-centre had achieved;

- a clear and efficient model for including new partners: the standard co-operation agreement provides the rules and the framework for any new partnership. These rules make sure, the consortium can be expanded while at the same time protecting the interests of already existing partners.

7.5.7 Conclusion

As a matter of fact, ViF as a large CRC specialised in vehicle technologies and located in a small country like Austria could hardly stand its ground without international co-operation. Therefore, cross-border relationships and their development are an integral part of ViF's strategy.

The list of industrial and scientific agreement partners clearly demonstrates that ViF has established itself as an international player in its field. This is not only a reaction to the requirements of the funding programme, on the contrary: performing applied research of high quality and relevance in vehicle technologies is impossible without knowing industry's needs. It is therefore inevitable to get access to partners along the entire value chain including the large manufactures.

As a matter of fact, the COMET funding programme not only poses no barriers, but is very supportive to international co-operation, as foreign partners can participate on equal terms with Austrian partners. So far, ViF's international co-operation has not been hampered by any particular barriers, apart from the challenges that normally come along with science-industry co-operation, and which ViF has coped well with.

One important conclusion to be drawn from this case study relates to the COMET programme: the programme's openness to and support for international co-operation provides the basis for ViF's international activities. In this respect, the funding programme as such can certainly be considered an example of inspiring practice to other policy makers and R&D funders.

7.6 Spain, Basque Country: CIC biomaGUNE

7.6.1 Description of the CRC

The Centre for Cooperative Research in Biomaterials-CIC biomaGUNE, located in San Sebastian, was created in 2006 by the Department of Industry, Technology & Innovation of the Government of the Autonomous Community of the Basque Country.

The Centre for Cooperative Research in Biomaterials-CIC biomaGUNE, located in San Sebastian (Spain), was officially opened in December 2006. CIC biomaGUNE is a non-profit research organization created to promote scientific research and technological innovation at the highest levels in the Basque Country, following a policy to create a new business sector based on biosciences. Established by the Department of Industry, Technology & Innovation of the Government of the Autonomous Community of the Basque Country, CIC biomaGUNE constitutes one of the centres of the CIC network, with the mission to contribute to the economical and social development of the country through the generation of knowledge and speeding up the process that leads to technological innovation. This policy was established by the previous Basque Government, and maintained by the new Government that entered after the regional elections in February 2009.

7.6.1.1 Character of the activities.

BiomaGUNE carries out its activities in the fields of life sciences and biomaterials. The activities could be defined as mainly basic research which in the long term may permit to improve the ability to intervene at different stages of an illness by developing early diagnosis methods, "smart" treatments and the triggering of self-healing mechanisms.

Research in biomaGUNE is carried out in independent laboratories thematically grouped into three research units: Biofunctional nanomaterials, Biosurfaces and Molecular imaging. Services based on the existing facilities are offered to outside

institutions. Strong collaborations exist between members of groups from different units, in the form of joint projects, students, and shared facilities.

The research budget for 2008 was 8600 k€, out of which less than 200 k€ came from private sector investments.

7.6.1.2 Structure

CIC biomaGUNE belongs to a network of Basque research centres, formally governed by the Department of Industry, Technology & Innovation of the Government of the Autonomous Community of the Basque Country. In practice, the centre has a great deal of autonomy in deciding its own strategy.

In the period 2002-2008, a total of 34 million € was invested in building up the CIC biomaGUNE centre. Funding comes principally from two sources, the central government and the Basque government. These two have both contributed with some 44% of total costs for the centre, the central government mainly dealing in infrastructure and equipment, the Basque government with funding of research programmes. A considerable part (close to 8%) comes from the Provincial Council (Diputación foral de Guipuzcoa), and slightly more than 4% comes from private sources. The CIC biomaGUNE centre is presently involved in four EU projects, but since participation in most of these are of recent date the EU part of the funding for the centre is still less than 1% of total funding.

7.6.1.3 Governance of co-operation

CIC biomaGUNE has complete autonomy in choosing co-operation partners, and there are no limitations for foreign partners collaborating with the centre – as long as each partner pays its part. The centre strives to become an internationally competitive research centre, and one fundamental building block to fulfil this objective is to hire top-level international researchers to work at the centre. The head of BioBasque describes it like this “we are looking for the best CVs and technology platforms there are – but also for knowledge on how to create a sustainable development of the centre”.

7.6.2 Internationalisation Strategies

Over the last two decades, the Basque Government has undertaken scientific and technological policies to support the existing industrial sector and prepare the Basque Country for future challenges. The commitment to life sciences is a step in the ongoing efforts to renovate the industrial sector, and key to this transformation was the development of a specific biosciences policy known initially as BioBasque 2010, the first strategy of this kind in Spain. The strategy, in which regional industry and researchers were involved, was designed in 2001 with the aim of developing a new business sector related to biosciences. The strategic mission was basically to establish a biocluster capable of competing internationally.

BioBasque Agency is the entity and the instrument created to implement the BioBasque 2010 strategy. It is a one-stop shop for information and a catalyst for the improvement of the framework where the biosciences sector is growing.

The CIC biomaGUNE is one of several research centres under the aegis of BioBasque Agency. The CIC biomaGUNE centre does not have a codified internationalisation strategy, mainly because this recently created centre has concentrated efforts on setting up and getting its activities started. The centre is now working on a forward-looking strategy document, involving an internationalisation strategy, which will be ready by February 2010. The BioBasque Agency is actively supporting in elaborating this strategy.

- Nevertheless, it is clear that the centre ever since the beginning has had an implicit internationalisation strategy; the objective from the start was very clear, to be present on an EU level. This also means that the strategy that is now being

elaborated to a large extent will confirm and codify the existing *modus operandi* of the centre:

- to offer an internationally competitive research centre that can attract the best researchers in relevant fields, regardless of geography, to come and work at the centre in San Sebastian,
- to collaborate with the best researchers and research groups abroad, on the basis of scientific excellence rather than geographical proximity.

7.6.3 International co-operation activities

7.6.3.1 Actual international co-operations

CRC-CRC co-operation

The biomaGUNE centre does not actively and exclusively collaborate with other CRCs, since its main mission is to establish a centre of excellence based on bringing top-level scientists over to work at the centre and, secondly, to collaborate with top-level researchers abroad. The notion of collaborating with other CRCs is interesting only if it clearly adds value to this mission. CIC biomaGUNE is focused on collaborating with the best researchers and research groups in its areas of activities, independently of their formal set-up.

There is a board of directors for the different CIC centres in the Basque country, which has the main function of coordinating activities and discussing mutual issues.

CRC co-operations with foreign partners

We have spoken to two foreign partners to CIC biomaGUNE, and their stories are largely identical. Due to the fact that the centre is of recent origin, these international collaborations have only just started. The present collaboration in both cases goes back to previous ones, in FP6 or FP5, when the person now in charge of the research in question at biomaGUNE was active at another research centre in Spain. The initiative to collaborate with CIC biomaGUNE came from the coordinator of the new project.

This means that CIC biomaGUNE, this new and internationally unknown research centre, has been invited into international collaboration on the strength of the individual researcher the centre has been able to hire. And since the actual collaboration with CIC biomaGUNE as a centre has been going on for a relatively short time, these international partners do not have much to say about the pros and cons of collaborating with a centre with these characteristics as compared to other types of research centres. For the two foreign partners we interviewed, it was very much a case of business as usual: they collaborate with a highly qualified Spanish researcher with whom they have a history. Where this researcher is actually working at the moment is of less concern.

And this bottom-up approach to international collaboration is corroborated by the centre itself. The scientific director of the centre points out that CIC biomaGUNE has clear overall goals and ambitions, and that it is very much up to the senior researchers themselves to work in that direction. It is not the centre that points out in which international projects the centre should participate, but rather the centre has at a previous stage, when hiring the researcher, given him or her the authority to decide.

7.6.4 Effects of international co-operations

International co-operations have not yet been formally appraised; biomaGUNE is still not working full capacity, and according to the centre manager as well as the head of BioBasque Agency it would at this stage be premature to carry out an effects study or a benchmarking activity. It is quite clear, however, that CIC biomaGUNE has managed to create internationally competitive research groups in its main areas of activities. The fact that biomaGUNE has managed to attract qualified international researchers to work in San Sebastian is an indicator of that. In the area of molecular imaging this

has been more challenging, since there is a smaller number of top level researchers in this more narrow research area, and it is thus more difficult for a relatively young research centre to compete.

This international profile and the successful development of the centre rub off on the surrounding area. There are several examples of new companies, or branches of already existing ones, moving into the Miramón technology park in San Sebastian because of CIC biomaGUNE being located there. This, in turn, creates collaborations between sectoral agents in a way that otherwise hardly would have happened – or at least not with this speed and ease. This is a phenomenon that has been observed also in other, more established Basque CICs; according to the head of BioBasque Agency, “CIC is a partner that lets its surroundings grow”.

As regards to international co-operations, CIC biomaGUNE represents a more agile way of participating in EU projects as compared to earlier attempts and experiences in the field. This research centre construction shortens the initial phases of entering into EU collaborations.

7.6.4.1 Opportunities

CIC biomaGUNE is still in its early stages of development, but since the experience this far has been a very positive one – both when it comes to the support from national and regional bodies, and actual results achieved – the centre sees the opportunities for international collaboration as huge. Geographical focus is wide; research excellence is the main restriction or criteria for choosing international partners amongst research institutes primarily.

The centre could improve upon its communication activities locally. CIC biomaGUNE is still very much of a secret outside of the professional circles of life sciences, and could be better known locally and regionally as an emergent and internationally recognized research actor in an area where the Basque Country is getting strong.

7.6.5 Barriers and needs

Both the management of the CRC and the BioBasque Agency underline that there have been very few obstacles or barriers to international co-operation when setting up and running biomaGUNE.

The main cause for barriers lies in the administration (national and regional), not in the centre. The principal barrier right now would reside in actually letting the researchers set up and consolidate their research groups; biomaGUNE is a new centre, it needs time to adapt and recruit the right staff. The centre does not have any difficulty in finding its way around the European programmes (FPs etc), and is getting each time more knowledge and experience of the platforms and how to relate to European networks.

Problems may arise outside the EU Framework Programme instrument: if the project in question does not fit in with EU programmes, then it depends on what each country or region can permit. As there often are no joint bilateral programmes for a given collaboration, then each potential project has to have each partner presenting and ensuring funding in his own state or region. And this may sometimes work, if there happen to exist relevant national or regional programmes to apply for funding from.

7.6.6 Good practices and success factors of international cooperation

Key success factors in the case of CIC biomaGUNE:

The (previous and present) Basque Government’s commitment to life sciences, as codified in the BioBasque 2010 strategy gave strong support to focusing an emergent but small industrial sector.

The “Real Madrid” or “fast track” strategy to reach for the sky and go for the best people in the field, in order to cut across the short way to excellence and international recognition.

The fact that this centre represents scientific quality and excellence makes it a very valid interlocutor in relation to policymakers at the national or regional level. Due to its proven quality and competitiveness, the centre will carry more specific weight when voicing views or worries concerning administrative or legal barriers. A centre like this will, simply put, be in a better position to influence when administrative instruments are revised.

7.6.7 Conclusion

The CIC biomaGUNE has since its start followed a clear strategy, implicitly based on the Basque Government’s BioBasque 2010 strategy document. This line of acting naturally drove the centre to international collaboration from the beginning, and this strategy will be consolidated in the internationalisation strategy the centre is now preparing.

These factors taken together have made it possible for this newly created centre to access international networks and collaboration opportunities it otherwise would have taken a long time to achieve. It has to be remembered that the Basque Country was not even on the national Spanish map of life sciences when the BioBasque 2010 strategy was implemented. All this has created a momentum, which attracts further interest in the centre from abroad as well as on the local level.

Of course, for a strategy of entering into a global competition for the best researchers to be successful for a newly established research centre in a region with little internationally recognized track record in the field, certain prerequisites must exist. A competitive salary and favourable tax conditions are a good starting point, but it is not enough. Equally important – if not more – is the infrastructure the centre offers; the equipment CIC biomaGUNE works with in for example for molecular imaging is one of the very best in Europe. And once the centre started becoming successful in signing renowned researchers, a virtuous circle was created: excellence attracts excellence.

Very few barriers or needs have been identified, and none of those that have been mentioned can be regarded as a serious threat to the consolidation of the centre.

7.7 Flanders: FMTC

This small-scale cases study deals with the Flanders Mechatronics Technology Centre (FMTC), which is part of the ‘Competence Poles’ (CP) programme.

The CP programme is managed by the Flemish government agency for Innovation by Science and Technology (IWT). The aim of the scheme, and the CP in particular, is to support the valorisation of knowledge in Flanders. The quality of science in Flanders is high; the application of this knowledge in innovations however lags behind. The CP should overcome this paradox, by bridging the gap between science and innovation, by linking academia to (researchers from) business. Therefore, the CP, and FMTC in this case, aim at activities between activities at research centres, and short-term industrial research.

7.7.1 Description of the CRC

FMTC is a not-for profit association that develops new and improves existing competences in mechatronics to strengthen the competitive advantage of the member companies. FMTC started in 2003, and is now operational for five years. The centre started with three employees. Since then, FMTC has grown rapidly in turnover and employees. FMTC now employs 30 persons; and the turnover has grown from €422k in 2004, to €1.2m in 2008. FMTC has grown into a professional organisation with experiences in many projects. As a result, FMTC earned public funding for a second phase in the period 2008-2012.

The Flanders' mechatronics Technology Centre has the mission to “*jointly develop new and improve existing generic mechatronics competences and technologies and in so doing strengthen the competitive edge of its member companies*”. To achieve its goals, the centre executes three types of projects. Firstly, FMTC conducts applied research that ensures a longer-term perspective, with a typical time-to-market of 5 years. This type of research has three strands: smart self-diagnostics, wireless control and energy-efficient electro-mechanical drive lines. The long-term projects are characterised by ‘technology push’; the strands of this research are developed in conjunction of industries and research institutes and universities. Secondly, shorter-term projects with a time-to-market of 3 years are carried out. These projects are often bottom-up initiatives of the members of FMTC. Typically, these projects last 2 years; after this, the project partners are expected realise follow-up their own organisation. Thirdly, to assist in valorisation of the project results, FMTC performs bilateral contract research.

All research activities have an applied character: 60% of the FMTC resources are dedicated to collective research of industry and research institutes, and 12% of FMTC’s activities is contract research. Only 28% of FMTC’s resources are spent on longer-term strategic research. In 2008, FMTC was conducting 24 research projects; fifteen of the nineteen member companies took an active role in these projects. Within the thematic focus on mechatronics, elaborated topics may differ from year to year. The specified topics of research can be changed rapidly, which is a necessity for institutes that rely on applied research. If changes in the environment and market opportunities occur, this has to be anticipated as quickly as possible. In 2008, FMTC was conducting 24 research projects; nearly all companies were actively involved in those projects.

FMTC is open to all actors: all actors can participate in projects and activities of FMTC. Only *members* of FMTC define the research agenda and the research projects. But the research projects are open for all types of actors as long as they meet the quality standards and rules set up by IWT, and the quality standards of FMTC. It does not occur often that non-members take part in the projects: up until now, only one non-member took part.

7.7.2 Internationalisation Strategies

The Flemish government does not have a high-level strategy towards internationalisation of R&D. Internationalisation is however high on the agenda. The former Minister of Economy, Science and Innovation set three vital goals for her policy: entrepreneurship, innovation and *internationalisation*⁷². With regard to internationalisation, the Policy Letter 2009 points to the internationalisation agency Flanders Investment and Trade. This agency approaches internationalisation primarily from a trade perspective and does not have specialised activities towards internationalisation of R&D. Nevertheless, in most of the RTDI initiatives of Flanders there is an international dimension. The co-operation ranges from straightforward benchmarking activities and visitation committees to a highly internationalised set of projects. Especially the strategic research centres are strongly engaged in international activities.

Also no explicit strategy exists at the level of the Agency IWT. The organisation has no written internationalisation policy but they are very open to international cooperation, whether formal or informal. Regular programmes are used to support the Flemish part of the work. IWT is quite flexible – as long as projects meet programme objectives and there is evident valorisation of results in Flanders then IWT will support international

⁷² Source: Beleidsbrief 2009. Flemish Minister of Economy, Trade, Science, Innovation and Foreign Trade, Patricia Ceysens, 2009. A new Flemish government is installed mid-2009; new policy and strategy lines are however not yet published.

actors to take part in their programmes. It is even possible to pay for work at foreign universities, if there is no Flemish alternative.

FMTC does not have a formalised internationalisation strategy either. Internationalisation ambitions have recently emerged. A more informal and still emerging strategy does exist. The definition of this strategy took quite some efforts, and it is an ongoing process. The members of FMTC articulated the need towards internationalisation during an assembly of the members, while formulating the 2008 business plan. The Board of FMTC confirmed internationalisation as a key goal for FMTC. A more operational approach is needed to follow-up the high-level strategy designed at CEO level. It is more difficult to define the benefits at this lower level, as FMTC now has to assess the practical added values of different partners.

Summing up, the discussions on the internationalisation have not been codified in a document. Nevertheless the current strategy towards internationalisation is:

- To actively attract international clientele; this would increase the reputation, thus amplifying the attractiveness of the centre. Furthermore, international co-operation leads to benchmarking opportunities, and other ways to increase learning and broadening the scope of FMTC. In this strategic line, FMTC aims for neighbouring countries, in this first phase Southern Netherlands is a main focus. FMTC recently conducted a large-scale market exploration for that region within the frame of an MBA project of an employee. In a next phase, Western Germany and Northern France might be explored.
- To co-operate with foreign research organisations in international projects. From next year FMTC will outsource its research projects internationally. The co-operations with research institutes mainly focus on parties with complementary knowledge. FMTC believes the success of co-operation is mainly defined by defining complementary research areas and to establish cross-technological projects on the interface of these areas.

7.7.3 International co-operation activities

7.7.3.1 Actual international co-operations

FMTC has several types of international co-operations. Prerequisites that were met before FMTC started to work on internationalisation were the following:

- There has to be a need for internationalisation at member level;
- The project management of the centre needs to be running smoothly. It is an obvious choice to practice this nationally first, and to learn routines and develop standards, before taking a step abroad;
- Attractiveness of a centre is to a large extent defined by the reputation of your technology programme. Only if you have proven to be capable of conducting excellent projects, you will attract excellent partners.

Furthermore, geographical proximity has been an important factor that determines the willingness to co-operate. Especially when the partners co-operate in the programmes of IWT, the partners have to be in the proximity of Flanders. This kind of projects demands that there are regular meetings. According to the manager of FMTC, actors that have to travel to attend meetings would only ask for international co-operation if they are highly excellent actors. Thus a trade off exists between proximity and the degree of excellence of the actor.

Co-operation with other CRCs is not high on the agenda of FMTC, it rather co-operates with foreign research institutes and foreign companies. The framework for co-operative projects is the same for national and international situations. FMTC sees its international co-operations as an extension of its national co-operation. The requirements to the international projects are also the same as for national projects:

the projects need to fit into the long-term strategy of FMTC and complementarities are also required. As a result of this approach, the collective research projects are the same for national and international parties.

Currently there are not many international co-operations; FMTC's international focus has only recently emerged. So far, FMTC has two types of co-operations: research projects with research organisations and outsourcing / bilateral assignments with foreign companies. There are a number of co-operative research projects with international actors. The Holst Institute (the Dutch branch of the Flemish micro-electronics centre IMEC), a non-for profit research institute, is the main partner in co-operations; two joint projects are being conducted. FMTC has participated in two Dutch co-operative programmes, WICOR and IRIS. Another way to fund international projects is participation in EU projects. So far, FMTC submitted ten proposals, one of which has been granted. FMTC is the coordinator of the FP7 ESTOMAD project. Moreover, the centre co-operated in the development of a mechatronics roadmap in the FP6 project Eumecha-Pro. Furthermore, smaller projects are conducted internationally. This concerns international outsourcing of research and bilateral assignments with foreign companies.

7.7.3.2 Effects of international co-operations

As the international ambitions of FMTC have only just started it is early to appraise the full effects and impact of international co-operations.

FMTC expects that the co-operations will lead to development of the knowledge base of the members. Co-operations with complementary partners will probably lead to new and additional sources of mechatronics. Moreover, co-operation with adjoining research disciplines are expected to lead to cross-fertilisation between technologies, leading to new application fields for the competences of FMTC. Co-operation should also lead to an increase of the quality of the work undertaken.

The main effects of internationalisation are primarily expected in the knowledge supply. The members of FMTC are often OEMs with an established worldwide market share. The international co-operations for them are not too important for their market share. Only for a small share of members that are specialised subsystem manufacturers for which international co-operation with companies is interesting for their market share.

Co-operation with research partners with excellence leads to better and improved technologies and concepts. Until now, the outsourcing of research has led to results, because rather concrete questions have been answered. Co-operations with the IMEC-NL led to the development of a wireless sensor network, which in its turn led to several prototypes in the FMTC network.

7.7.3.3 Opportunities

There are still many unexploited opportunities for FMTC, as they have just started to develop an international interest. FMTC chose to have a narrow geographical focus in their co-operations. They focus now on the South of The Netherlands for attracting international clientele; this region is rich of knowledge centres that are important for mechatronics and many companies in fields of interest exist. However, for the moment FMTC primarily focuses on co-operations with research institutes throughout Europe, it is expected that this kind of co-operation has the highest added value to FMTC. When compared to the national focus, there is much more attention to long-term research in foreign countries. This is probably due to two factors: the individual members already have access to the knowledge developed at the national level, due to existing contacts. Furthermore, the pool of knowledge in foreign countries is more complementary to the work of FMTC.

The openness of IWT to international partners is an opportunity to attract foreign players. The funds received via IWT can be used for internationalisation; foreign

partners could benefit from the grants of IWT as well. The general condition that IWT sets is that the Flemish companies benefit from the grants to international parties. Competence Poles have the objective to enhance the innovation capacity of companies in Flanders by pooling the competences in Flanders. However, international co-operation is supported by the IWT, as long as it contributes to the aforementioned goal.

7.7.4 *Barriers and needs*

It is very early to appraise the barriers and needs of FMTC with regard to internationalisation. General issues are the following:

- A main issue is to find required partners. Especially the identification of the best-required research organisations is difficult. It is hard to find out the exact competences of foreign research institutes, because there are so many potentially interesting actors. The same goes when searching candidates that can apply for our requests of services (outsourcing of research). It is hard to find required actors, and especially hard to determine which partner would be best required. FMTC could use assistance in finding partners. The manager would be interested in opportunities that an (internet-based) forum could offer. He is however not certain who could develop such a forum.
- Although the national agencies are open to foreign actors, the surrounding countries often have closed programmes. FMTC would gladly take part in Dutch projects, but these are most often closed for foreign parties. Furthermore, because the surrounding countries programmes are often closed, foreign partners are often not aware of the opportunities Flanders has for them. The mechanism of open programmes could be promoted at Flemish side, but preferably also on the Flemish side. There could be a role of foreign agencies in this.
- A third barrier is the difficulty to gain projects at the EU level. The rate of success in the FP7 is rather low; and furthermore it has only limited possibilities for the more applied science of FMTC. Other interregional schemes, such as EUREKA, ARTEMIS, IDEA et cetera have a much higher rate of success. Moreover, the possibilities for applied science are much higher. However, the complexity of these schemes (eligibility criteria and administrative burdens) is an enormous threshold, especially when co-operating with foreign partners.

7.7.5 *Good practices and success factors of international cooperation*

As FMTC did only just start with international collaboration, no striking good practices examples can be presented. The FMTC manager however considers the Flemish microelectronics centre IMEC as a guiding example for internationalisation. IMEC is very successful in connecting with excellent partners. The scope of IMEC and the amount of funding it receives makes it however hard to compare FMTC to IMEC. The example of IMEC however shows that once a centre excels, partnerships with excellent players grow naturally.

Success factors FMTC addressed and that are explored more in-depth in the previous sections are:

- A solid operating centre;
- Complementary partners, this leads to cross-fertilisation of research projects, which on its turn could lead to new combinations and innovative concepts. As the CP are designed to foster innovation in Flanders, including foreign competitors is avoided;
- Attractiveness of a centre is to a large extent defined by the reputation of your technology programme. Only if you have proven to be capable of conducting excellent projects, you will attract excellent partners.

- The above-mentioned factors imply that the centre needs to gain a national reputation first. In the case of FMTC this took about 3-4 years. After being operational for 4 years, an ambition towards internationalisation emerged.

7.7.6 Conclusions on FMTC

FMTC does not have a formalised strategy. However, after the centre was up and running for about 4 years, a need for internationalisation emerged. This need arose primarily bottom up, although IWT has been perceived supportive to internationalisation.

Since about a year, FMTC started to develop its international focus. The focus is rather narrow, a market exploration identified possibilities in Southern Netherlands. This has led to co-operations in international research projects, and smaller outsourcing and contract research projects. It is too early to appraise the success of FMTC's internationalisation activities. But until now, the co-operations have led to new sources of knowledge and the development of several prototypes.

FMTC focuses on opportunities in the Netherlands, instead of approaching all required areas more superficial. Especially co-operations with research institutes is sought, because FMTC looks for new sources of knowledge. Furthermore, as FMTC consists of a large share of OEMs, the search for new markets is less important. Also, co-operations with research institutes do not endanger the competitive advantage of FMTC. The openness of the Competence Pole programme makes that FMTC has something to offer.

The main issue with regard to internationalisation is that it is hard to find required partners. FMTC would be helped with a sort of forum that would list the competences of research institutes and companies. Another issue is the openness of the programme. IWT programmes are open to foreign contributions. In surrounding countries, programmes tend to be less open. Therefore, it is hard for FMTC to source foreign funding. On its turn, international potential partners are not aware of the potential that a co-operation has. Sourcing funding from EU research policy programmes and other bilateral schemes is hard, because the research of FMTC is rather applied, the eligibility criteria are ample, and the administrative burdens are high.

A leading example for FMTC is IMEC. It has many international co-operations with renowned partners. Although the situation of IMEC and FMTC are only comparable to a small extent, IMEC shows that if you are able to build up an excellent centre that good international co-operations will follow soon.

7.8 Estonia: ELIKO CRC

In 2002, the Estonian Ministry of Economic Affairs and Communications (MEAC) commissioned a feasibility study⁷³, analysing the opportunities of the promotion of the science-industry relationship. The specific task of the study was to examine how different organisational forms could stimulate the knowledge and technology transfer between academic research and the private sector in Estonia. The study concluded that the establishment of competence centres in Estonia would intensify technological development and innovation of Estonian enterprises and industry, and boost commercialisation of results of the academic research. Subsequently, the “Technology Development Centres” programme was launched by Enterprise Estonia. Through a first competitive call in 2004, five centres were selected for funding, including ELIKO⁷⁴. In this case study, we will focus on the role of international co-operation at this CRC.

7.8.1 Description of the CRC

ELIKO is the CRC of Electronics, Information and Communication Technologies, thematically focusing on two **main research domains** - Smart Space Technologies and Services (SSTS) and Advanced Signal Processing (AST).

The **central industrial partners** of ELIKO that are most involved in the main research domains, are Artec Group, Modestat, Apprise, Gif (all four are the founding companies), and Regio Ltd. Virtually all business partners are highly specialised and advanced domestic SMEs (typically 10-50 FTEs). The **central academic partner** in all research activities is one of the founders of the Centre: the Tallinn University of Technology (TUT). One of the founder-companies – Cybernetica Ltd - has also an outstanding academic background.⁷⁵

In addition to the central research domains, there are also some **emerging interdisciplinary topics**, which integrate the research in ICT and electronics with health care services and biotechnologies. In these new research topics, collaboration with the Cancer Research Competence Center and the Research Excellence Center in integrated electronic systems and biomedical engineering (in Estonia), and with the Institute of Bioprocessing and Analytical Measurement in Heiligenstadt, Germany, is established.

All R&D activities of ELIKO are clearly driven by prompt commercialisation needs of the research taking place in the participating organisations, i.e. the joint research is built around elaboration of certain technology platforms or practical applications of specific technologies. E.g., the SSTS-related R&D includes topics of distributed sensing, RFID technologies and wireless communication, ontology based data mining, model-based software design and testing. The AST-related R&D work focuses on testing and demonstration of application efficiency of novel signal processing tools and hardware design methods. Also elaboration of the solutions for embedded (hardware) systems test, verification and debug, in particular, new assertion-based verification and debug tools, development of application specific and reconfigurable signal processors are in the research plans of ELIKO. According to the participating

⁷³ Competence Centre Programme Feasibility Study, by Technopolis-Group, Technologie Impulse Gesellschaft (TIG) and KU-Leuven Research and Development (2002).

⁷⁴ ELIKO is the oldest of the CRCs (founded on 12.October 2004).

⁷⁵ Cybernetica Ltd is the only company of the consortium employing over 100 persons, including 9 PhD and 12 PhD students. Its predecessor is the Institute of Cybernetics of the Estonian Academy of Sciences. It holds a research grant on the project "Theoretical and practical security of heterogeneous information systems", funded by the Ministry of Education and Research of Estonia. It is also a founding member of the Estonian Centre of Excellence in Computer Science. In 2008, a new non-profit structural unit - the Information Security Institute – was established in the company. During 2008, the researchers of Cybernetica published 23 research papers and presented 19 presentations at international scientific conferences. See <http://www.cyber.ee/cms-en/company>

organisations and the CEO, the research is fully applied, industrial, with “time-to-market” horizon of three-seven years⁷⁶.

In the first period (2004-2006), ELIKO was fully financed from national resources. In the periods 2006-2008 and 2008-2013 ELIKO primarily relied on EU Structural Funds – up to 70% of the full costs of beneficiaries. The **research budget** is mainly provided via the Competence Center Programme, via the annual bulk allocations⁷⁷. The shares of the Programme funding and partner funding in 2008 for ELIKO were respectively 73,9% and ELIKOs founder partners have been successful to attract additional funding from EU sources; two projects⁷⁸ are funded by the EU Framework Programmes and from the ITEA-2 sub-programme of the Eureka Cluster programmes⁷⁹.

By its legal form, ELIKO is a private, limited-liability company (LLC). A CEO is appointed to carry out the day-to-day management of the CRC. Decisions on the longer term business strategy and resource planning is made by the Council of the LLC, which consists of a representation of the founding actors. The strategic planning in research is co-managed by the advisory body - the Research Council of the CRC.

According to the Programme regulation and the **implementation practices**, all potential partners - local or foreign, academic or business – can co-operate with any of Estonian CRCs, if they have interest and ability to contribute its research activities. Still, according to the EE Programme manager, the principle is that a substantial share of the research must be carried out in Estonia, and research can be conducted in other countries, if there are objective reasons – i.e. access to unique research infrastructure or human resources.

At **operational level**, ELIKO manages the research collaborations with no distinction to local or international. Every single project has a project coordinator(s), appointed from the staff of the partners of ELIKO and this person is usually a primary “face” of ELIKO for collaboration partners (as was also acknowledged by the case interviews with the partner organisations).

7.8.2 Internationalisation Strategies

Estonia lacks an overarching, **cross-sector strategy for internationalisation of R&D**. Still, some elements of internationalisation, relevant to the Competence Center Programme, could be found in the Estonian Entrepreneurship Policy for 2007-2013 and especially its implementation document - the Estonian Action Plan on support of export and attraction of FDI (called also “Made in Estonia”, MiE)⁸⁰, and the Estonian Research, Development and Innovation Strategy for 2007-2013. These two documents, supplementing each other, promote importance of internationalisation of business and R&D operations.

In organisational terms, there are also no specific **organisational internationalisation strategies** of the MEAC and EE. Parts of the overall strategies⁸¹ deal with internationalisation – mostly in relation to international presence and

⁷⁶ By the interview results in the current and the Mid-term Evaluation of the Competence Centre Programme (2008).

⁷⁷ Allocations accordingly €0.568m (2004), €1.233m (2005-2006), €0.383m (2007), €1.278m (2008), €7.669m (2009)

⁷⁸ <http://www.smartmuseum.eu> and <http://www.roboswarm.eu>

⁷⁹ <http://www.itea2.org>

⁸⁰ Prepared and submitted on 07.10.2009 by the Ministry of Economic Affairs and Communications

⁸¹ Majandus- ja Kommunikatsiooniministeeriumi strateegia 2010-2013, EAS Strateegia 2007-2013.

competitiveness of Estonian companies and participation in international organisations and policy initiatives. The guiding principles for EE operations in the export and the FDI-support domains are more or less the same as those presented in the MiE.

At the operational and programme levels, EE has elaborated an Internationalisation Activity Plan, targeting the companies who are able to take its sales activities abroad and/or apply new technological solutions or develop new products meant for the international market. The activities directed to internationalisation focus foremost on the target markets⁸². On the target markets the foreign representations of EE⁸³ are established (main focus of operations - involving FDI, export and incoming tourism promotion). The internationalisation division of EE organises also contact and promotional events and business missions for the foreign investors (incl. special sector-oriented events). EE holds membership in several international organisations and networks (7.FP, EUROSTARS, EUREKA, MANUNET, COMPERA, and many others).

The Competence Centers Programme regulation states the **international competitiveness** of the Estonian enterprises based on the strategic collaboration with R&D sector, as a core objective of the Programme, and one performance indicator of the Programme is the volume of export sales in the participating companies (i.e. the indicator, directly reflecting the internationalisation efforts of the CRCs). The internationalisation of the CRCs operations seems to be obviously important but still, there is no codified strategy or strategic principles on internationalisation of the Estonian CRCs on the Programme level.

ELIKO does not have a codified internationalisation strategy either, but according to Mr Ruiso, the CEO, there is no connection with the case of missing strategic guidelines from EE or the Programme-level. The international competitiveness, collaboration and knowledge exchange are recognised as inevitable business drivers, and have been included in the general business and the R&D strategies of ELIKO.

By the business survey of the Mid-Term Evaluation of the Competence Centre Programme (2008), it was ascertained that all founders from the industry sector, apart of their relatively small or even micro size, are oriented to the global markets, so they have been supportive to all international networking and collaboration intents of the CRC, and have communicated their views about internationalisation needs. One could say that the **internationalisation principles** of ELIKO is a consensus-based sum or “digest” of the international plans and ambitions of the founders, and this conclusion is supported by the findings of the interview with one of the founders (Elvior LLC) and the CEO. Mr. Kull, the CEO of Elvior affirms that lack of such formalised internationalisation strategy on the CRC level is not a recognised barrier to initiate or conduct international operations, at least at the current time. Moreover, such strategy is even seen (from the business side) untimely, as far the CRC is still in the phase of the joint research planning of the local players.

The core academic partner - TUT - is a leading scientific university in Estonia, with well-established and codified internationalisation policies and networks⁸⁴, and many of the international contacts of ELIKO are facilitated by the scientists of TUT. The academic advisors from Finland, Germany, Italy, Japan and Sweden have supported the R&D activities of ELIKO over the years. But as the CRC-related activities are only small fraction of all international activities of the university, its leading role in the strategy set-up is unlikely – although it has the best capacity to do it.

⁸² Identified as Finland, Sweden, Russia, Germany, Great Britain, Ukraine, Japan, USA and China.

⁸³ It is noteworthy, that the representative office in the US is located in the Silicon Valley.

⁸⁴ See site on the TUT International Cooperation <http://www.ttu.ee/?id=1882>

Based on all 3 interviews and other sources, intent or urgent need to have a full-scale international co-operation strategy document was not identified.

7.8.3 International co-operation activities

7.8.3.1 Actual international co-operations

The CRC-survey, introducing the current study, notes different **various collaboration forms** which are active or valid for ELIKO:

- Opening up of a specific research programme to participants of other countries;
- Cross-border research programmes with multi-national interests;
- Mobility of foreign actors (researchers) between CRCs;
- Bilateral co-operation with foreign CRCs;
- Networks of CRCs: co-operation between the management of CRCs in various countries;
- International brokerage services.

The most systematic and advanced is the co-operation in the **cross-border research programmes** with multi-national interests (3 large-scale projects are currently running). Such co-operations have a most positive impact on widening networks, joint programming and linking (dominantly) small Estonian R&D businesses to the international value chains.

Mobility of foreign actors (researchers) between CRCs is important, and according to the CEO, ELIKO is very much interested to establish more wide and feasible activities – as right now, the mobility activities are relatively one-side: ELIKO regularly invites the foreign doctoral students (mostly from TUT) to work in the projects, and as said

earlier, it has a wide network of foreign academic consultants (but not visiting researchers).

The CRC-CRC co-operations (bi- and multilateral) are important but now they appear only under the framework of certain projects, or in the form of ad hoc communications and study visits. ELIKO finds that its ability to collaborate with other CRC-s on more regular basis is hampered by the administrative capacity and the size of the CRC – there is virtually no other permanent administrative staff than the CEO who should concentrate on more immediate operational activities. The main drivers for managerial co-operations with other CRCs (in particular across borders) are access to additional sources of thematic knowledge and knowledge exchange on how to manage a competence centre. The CEO mentioned, that the study visits arranged by EE (under the Competence Center Programme and the Cluster Programme) have been very useful in that respect.

From the very beginning of ELIKO operations (i.e. from 2004), it was collectively agreed (by founders) not to limit ELIKO projects to the local needs but to explore project options and research topics globally. In that respect, most **important project opportunities** are associated with the EU Framework programmes, and other EU programmes. Collaboration in the FP's and other multinational research project does give to ELIKO an international visibility and creates certain reputation for the future co-operations. It should be outlined that many of the international project opportunities are initiated or identified originally by the partner companies, and then

“accommodated” by ELIKO (for instance the participation in the D-MINT project ⁸⁵ is facilitated by the personal contacts of the CEO of Elvior).

Based on the direct evidence from Elvior, and from the earlier study⁸⁶ for the rest founder-companies, we can infer that on the partner-level, companies have diversified direct personal contacts with the CRC-s or CRC-like organisations abroad (like with VTT in Finland and Fraunhofer-Institute for Experimental Software Engineering, Germany, in the case of Elvior, or Stockholm Technical University and the Mid-Sweden University in the case of Apprise, as just a few examples). Moreover, some founder-companies (e.g., Cybernetica Ltd and Artec Group) have inasmuch other international R&D collaborations (incl. under the FPs) apart of ELIKO.

Roboswarm⁸⁷ is the first multinational research project where ELIKO is involved as an organisation (duration – 2005-2009). The project was initiated by the academic partner - TUT (the Department of Computer Science). The project consortium has 9 partners from universities and industry over the EU.

The goal of the project is to develop simple and low-cost technologies for making both single robots and groups of robots – swarms – more intelligent. Swarm applications range from simple cleaning tasks to exploration of large unknown areas, surveillance, rescue, coordinated weight lifting, minesweeping etc. where intervention from human operators is minimized.

This project example describes a **typical case** how the international collaborations emerge and evolve in ELIKO:

The interviewed foreign partner – the Mechatronics and Automatic Control Laboratory (MACLAB) of the Department of Communication, Computer and System Sciences (DIST) of the University of Genova - was involved in the Roboswarm project by responding to a call issued by TUT Department of Computer Science (responsible for the project management) and ELIKO, and forwarded to the DIST from the International Liaison Office of the University of Genova. DIST was not familiar with ELIKO (note that it was just recently established) but aware about TUT, so the main references, in addition to the academic partner, were the Framework Programme funding opportunities and the research topic itself.

Namely, the primary areas of interest of the MACLAB also include embedded control systems and distributed control and sensing architectures for robots, and its experimental activity is focused on the study of distributed control architectures based on field-bus networks and microcontroller-based computers (<http://www.maclab.dist.unige.it>). More specifically, the Roboswarm project allowed MACLAB to focus their research on swarm control and coordination, and provided an excellent opportunity to get in touch with certain new, RFID-based technologies, not available for the MACLAB before.

By the end of the project, a demonstration of the proposed approaches has been implemented in the swarm carrying out patrolling and cleaning tasks in an emulated hospital environment. MACLAB is the leader of the task for the development of the swarm coordination and learning components, and also dealt with control strategies of the swarm while ELIKO analyses solutions for realising on-site distributed knowledge base and architecture solutions for inter-robot communication and positioning. ELIKO also provides components for database access and wireless communication, and is responsible for a dissemination of the work-package.

According to Prof. Cannata, the head of the MACLAB, the first project experience has been positive, and no particular issues emerged during project management, apart

⁸⁵ www.d-mint.org

⁸⁶ The Mid-Term Evaluation of the Competence Centre Programme (2008)

⁸⁷ www.roboswarm.eu

from certain delays, which are, in his experience, common to research projects. The major contacts have been kept with the project coordinator Prof. Vain from the TUT Department of Computer Science, not ELIKO. Prof. Cannata is not sure about the role of ELIKO in diversification of international collaboration for the DIST as it is already very wide; DIST has an annual turnover of around €6m, mostly sourced from the international EU research projects and from industrial contracts. The international partnership covers the whole EU. The MACLAB itself has currently two major EC funded research project in the domain of robotics, and two other national contracts in the domain of automatic process control.⁸⁸

7.8.3.2 Effects of international co-operations

The **international co-operations of ELIKO** have not been assessed earlier in a separate study. Still, the issue was relatively comprehensively covered by the business survey and academic evaluation under the Mid-Term Evaluation of the Competence Centre Programme (2008), and some useful insights are presented in the Competence Centers scientific Peer Review (2008), done by the international experts.

In general, ELIKO CRC was evaluated positively, particularly for the commitment of its partners, and putting project results into production. Overall, ELIKO appears to be doing an integration of the R&D in a fragmented but developing industry (Mid-term Evaluation of the Competence Centre Programme, 2008). Still, it was found that the long-term sustainability of the centre is an open question, as its initial self-funding ambitions are clearly exaggerated and in the existing industrial environment of small firms it is difficult to see the centre operating without a continued and high level of public subsidies (Ibid). ELIKO had the largest overall number of international publications and the importance of conference papers, and the patent applications report, compared with other centers (Ibid).

From the side of business effects, the study found that a large international partner was needed, if the centre was to establish an international reputation and exposure (Mid-term Evaluation of the Competence Centre Programme, 2008). The Peer reviewers found that then considering the potential for industrial application of the Centres' projects, the result was mixed, with some work being immediately applicable in Estonia and other work being usable only by large companies abroad, who were not currently involved in the centre (Competence Centers scientific Peer Review, 2008).

7.8.3.3 Opportunities

There are several potential support measures, provided by EE, to facilitate international links of Estonian CRCs (briefly discussed in the Ch. 1.2). E.g., the interviewed CEO and the founder company are well informed about other national programmes or support measures that aim to support the internationalisation (under their limited objectives and scope), like the foreign representative offices of EE, the Offset program for export opportunities and the Export marketing grant. The latter was outlined in a positive way by Elvior, as finding the new markets and customers abroad is of key importance – “the goal of the R&D company is not just carry the R&D but then sell the results of this research”. The CEO of ELIKO sees good opportunities

⁸⁸ The University of Genova as the main organisation in general has extensive pan-European and global collaborations in R&D. Particularly, its involved in the networks and initiatives like the EU FPs and the Joint Technology Initiatives, EURATOM, CERN, eContentplus, Eurostars (Eureka), and many others.

to develop more business-to-business and business-to-private collaborations via the new Cluster Development programme⁸⁹.

Still, these programmes are not solving other, more immediate needs – identification of potential partners (business and academic) and finding new markets (e.g., the foreign representatives have no sector-specific resources and knowledge), or need to exchange the managerial experiences, or start joint project activities between the centers.

The lack of systematic partnerships with international industry leaders is warning⁹⁰, so the Programme management and the Center should discuss further how to facilitate more effectively the existing EE international networks and memberships in the organisations like MANUNET and EUROSTARS, or the European Space Agency and the International Astronautical Federation to identify potential partners.

EE as the funding organisation organises time-to-time networking events and business seminars with the invited speakers and representatives of the large foreign companies (e.g., with EADS Astrium in November, 2009), and it is advisable to develop this practice further, in more systematic and regular way.

7.8.4 Barriers and needs

We identified two core barriers to international co-operation: the size of the CRC, which sets limitations to the self-financing of the activities, and the funding rules of the Programme (interpretation of the scope of the eligible costs by the EE).

The **limited administrative capacity** is sourced directly from the both core barriers: one person (CEO) should perform alone all different management tasks – from the core function (coordination of the research) and financial management to reporting, pr- and HR management, reporting, etc. Due to their size and low capitalisation, the founders are not able to finance more staff at the present time. In addition, ELIKO cannot rely on

the Programme financing too as it is not clear are these expenditures eligible by the Programme regulations. While the funding capacity of the partners is an objective barrier, the regulative barrier might be only perceptual – the regulation actually allows⁹¹ compensating the costs associated with the (organisational) development of the centers.

It was proposed (by ELIKO), that alternatively or additionally to the national Programme management, the special CRC-related initiatives to promote international co-operations between the centres in different countries, to develop management skills (incl. strategy planning and performance assessment), and to establish direct contacts with the industries⁹².

The respondents do some specific recommendations too:

- Periodic knowledge and experience exchange on the management of the CRCs in the form of international benchmarking workshops, creation of the virtual meeting point for the center managers, etc);

⁸⁹ ELIKO is a member of the ITC sector consortium, planning to apply for the Cluster development grants (for a Cluster Feasibility study and a Full application) in 2009.

⁹⁰ The Mid-term Evaluation of the Competence Centre Programme (2008)

⁹¹ The provision 6.4 of the Decree of the Minister of Economic Affairs and Communication from 16.06 2008 nr 49 (Tehnoloogia arenduskeskuste toetamise tingimused, RTL, 16.06.2008, 49)

⁹² As mentioned during the interviews, it is particularly problematic to access the large companies abroad to introduce the R&D capacities and competencies if you are a small, unfamiliar company or a recently established CRC).

- Provide a reliable, authoritative platform to identify and meet potential clients (also in other sectors than ITC and electronics) and partners – a “CRCs’ R&D-services stock exchange”;
- Promote other available support programmes to the CRCs – especially the Export marketing programme and the Cluster development grant⁹³ of EE which could supplement some international operations of the centers like international marketing;
- Modify and update the Competence Centers Programme in respond to the emerging development needs and challenges of the CRCs, and be more responsive about the eligible costs;
- Cross-border research programmes for CRCs with multi-national interests are welcome, as all interviewees mentioned the lack of such options. E.g., the head of the MACLAB finds that

“If fund for cross-border R&D activities were available we would be very keen to take part in them. However, from my own experience, it is not easy to get access to these funds which are anyway very limited. I submitted a couple of requests for funds for bilateral initiatives in the past but without success.”

7.8.5 Good practices and success factors of international cooperation

It is positive that even very small companies – founders of the CRC - are **ambitious in global terms** and driven by international market needs. They continuously monitor the **technology developments worldwide** (based on the interviews in the current and in the Mid-Term Evaluation of the Competence Centre Programme studies) and maintain the international **professional relations globally** ⁹⁴. It is a positive sign of their enthusiasm and commitment, and they are not discouraged by their limited organisational capacities. Apart of the limits, ELIKO and the partner-companies systematically screen the project options under the EU programmes, encouraged and supported by success of the earlier multinational projects.

An important source to identify potential collaboration topics is Estonian researchers and engineers, working abroad.

7.8.6 Conclusion on ELIKO

ELIKO does not have a formalised, full-scale internationalisation strategy. International operations and contacts of ELIKO are limited to ad hoc project opportunities, which are identified or promoted via personal contacts of the researchers or the partner organisations.

The number of the multinational projects is modest, but the co-operations that exist are extensive and prominent partnerships, mixed from public research organisations and universities (like in the Smartmuseum project), large corporations (like in the Roboswarm and the D-Mint projects) and the CRCs from other countries. This might be a useful entrance point to further develop international links.

As seen from the examples of the Roboswarm and the D-Mint, discussed above, the scientifically ambitious and interesting project ideas (supported by the reliable funding and collegial contacts), can easily involve new partners, or initiate follow-up activities, or get access to the potential customers. E.g., due to the Roboswarm project, Italian partner is optimistic about promotion of the further research projects, based on the acquired expertise and contacts.

⁹⁴ Amongst the partners are companies and R&D organisations from Baltic and Nordic countries, Germany, Italy, Switzerland, other European countries, Japan, USA, India.

From the organisational development view, the Centre is still in the phase of the formation - from the virtual local business-academy “meeting point” to the full-scale organisation, while more immediate needs (joint research planning, IPR arrangements, HRD, knowledge exchange and transfer between the local partners) prevail over other development tasks.

Particularly important are the systematic knowledge and experience exchange on the management of the CRCs (e.g., in the form of international benchmarking workshops) to improve capacity and performance of the Center, and providing a reliable, authoritative platform to meet the potential clients (also in other sectors than ICT and electronics).

Summarising the findings of the case study, it is evident that ELIKO’s international operations are very much hampered by its size and the size of the partner-companies, and evidently some outside assistance from the Programme management or the international initiatives is welcome.

Until the industry partners of ELIKO mature to a greater degree and some larger companies emerge in the partnership, it is unlikely that ELIKO can manage all challenges of internationalisation by its own means.

Appendix A - COMPERA Partners

A.1. COMPERA partners contributing to this study

The following table shows the COMPERA partners that supported this study and the people that have provided valuable inputs and comments on the study.

Country	Persons	Organisation
Austria	Otto Starzer Anna Tropper	FFG
Basque Country	Oihana Blanco Mendizabal Xabier Maidagan	Innobasque
Estonia	Harri Faiman	Enterprise Estonia
Flanders	Tom Schamp Corien Struijk	IWT
Germany	Silke Stahl-Rolf	VDI TZ
Northern-Ireland	Claire Griffin	Invest Northern Ireland
Slovenia	Nataša Komolec Alec Mihelic	Ministry of Higher Education, Science and Technology
Sweden	Mattias Lundberg	VINNOVA
Valencia	Concha Ginestar Peiro Eduardo Tomás Dolado	Generalitat Valenciana

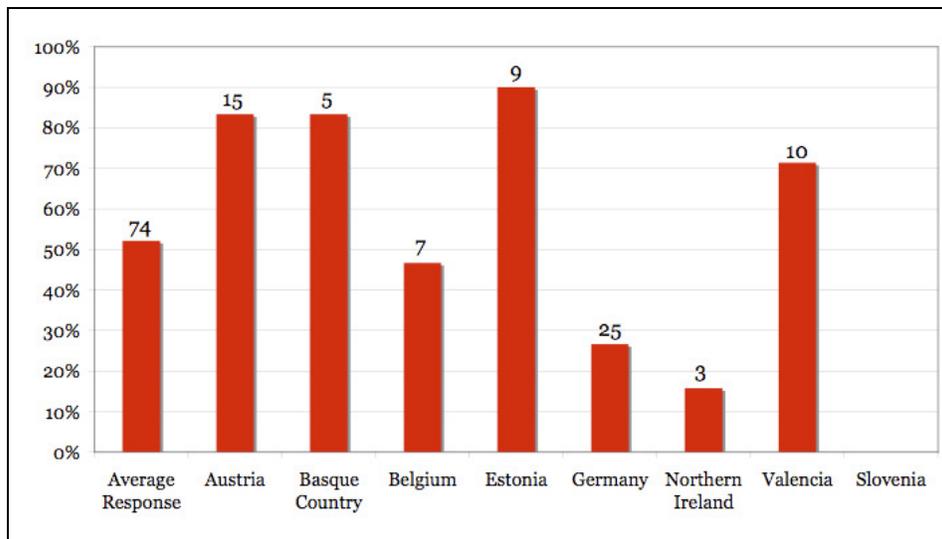
Appendix B - Response to the survey and interviews

B.1. Response rates per country

We have calculated the response rates per country (Figure A.1). The average response rate of all the respondents is 52%; this includes the e-mail addresses that were not working, or that have been changed⁹⁵. This is a rather high response rate for a survey. A typical response rate for a survey is about 25-35%. The involvement of national programme officers is probably the reason for the remarkable high response.

Countries and regions with a very high response rate are Estonia, Austria, the Basque Country and Valencia. The average response rate is lowered by Germany and Northern Ireland. Especially the German rate pulls the average down, because the population of potential respondents was a lot larger than that of other countries. Germany had a population of almost 100 potential respondents; other countries ranged from 6 to 19 potential respondents. The rather low response rate in Germany can partly be explained by the nature of potential respondents: Germany does not have a CRC programme, but a cluster programme.

Figure A.1 Response rates per country (respondents/potential respondents). Above each bar the number of respondents per country is indicated.



Technopolis Survey

B.2. Respondents to the survey

The following CRC managers filled in the survey.

CRC	Name	Country
Software Competence Center Hagenberg GmbH	Klaus Pirklbauer	Austria
Kompetenzzentrum für wissensbasierte Anwendungen und	Anita Griesser	Austria

⁹⁵ We have calculated the response rate by dividing the total amount of responses by the number of potential respondents that we send an invitation to the survey.

Systeme Forschungs und Entwicklungs GmbH		
alpS – Center for Natural Hazard Management	Eric Veulliet	Austria
Kompetenzzentrum - Das virtuelle Fahrzeug, Forschungsgesellschaft mbH (Mobility SVT/ViF)	Gerhard Zrim	Austria
Research Center Pharmaceutical Engineering GmbH	Simone Gritzner	Austria
Research Centre Applied Biocatalysis	Markus Michaelis	Austria
COMET K2 Centre for "Integrated Research in Materials, Processing and Product Engineering"	Reinhold Ebner	Austria
ACCM – Austrian Competence Centre for Mechatronics	Schatz Gerald	Austria
Polymer Competence Center Leoben GmbH	Martin Payer	Austria
CEST GmbH – Center for Electrochemical Surface Technology	Otto Groh	Austria
FTW – Forschungszentrums Telekommunikation Wien	Wolrad Rommel	Austria
CTR Carinthian Tech Research AG	Dr. Werner Scherf	Austria
Kompetenzzentrum Holz GmbH (Wood K plus)	Boris Hultsch	Austria
Austrian Center of Competence for Tribology	Pauschitz Andreas	Austria
ONCOTYROL - Center for Personalized Cancer Medicine GmbH	Philipp Unterholzner	Austria
CIC biomaGUNE	Alfonso Egaña	Basque Country
CIC energiGUNE	Jose M. Castellanos	Basque Country
CIC marGUNE	Elixabete Maidagan	Basque Country
CIC microGUNE	Carlos Luri	Basque Country
CIC bioGUNE	Alfonso Egaña	Basque Country
Flanders' PlasticVision	Geert Scheys	Belgium
IBBT	Marie Claire Van de Velde	Belgium
Flanders InShape	Maka De Lameillieure	Belgium
FMTC	Marc Engels	Belgium
Flanders' FOOD	Erwin Lamot	Belgium
VITO	Dirk Fransaer	Belgium
VIB	Rudy Dekeyser	Belgium
IMECC OÜ - Innovative Manufacturing Engineering Systems Competence Centre	Jüri Riives	Estonia
Competence Centre for Cancer Research Ltd.	Riin Ehin	Estonia
ELIKO Competence Centre	Indrek Ruiso	Estonia
Software Technologies and Applications Competence Center	Jaak Vilo	Estonia
EngineeringIMECC - Innovative Manufacturing Systems Competence Centre	Jyri Riives	Estonia
Estonian Nanotechnology Competence Centre	Ilmar Kink	Estonia
CRC of reproductive medicine and -biology	Andrus Tasa	Estonia
Competence Centre on Reproductive Medicine and Biology, new centre, recently established at 26.6.2009	Andres Salumets	Estonia
CC of Food and Fermentation Technologies	Urmas Sannik	Estonia
Logistik-Initiative Hamburg	Gernot Lobenberg	Germany
AGeNT-D	Dr. Sven Rodt	Germany
Cluster Mechatronik & Automation e.V.	Heiko Bartschat	Germany
BIOKON e.V.	Dr. Sabine Wortmann	Germany

Network of Competence for Industrial Plasma Surface Technologies INPLAS	Gerrit von Borries	Germany
Fraunhofer IZM	Harald Pötter	Germany
Kompetenznetzwerk Mechatronik BW e.V.	Bastian Obermiller	Germany
Kompetenznetzwerk Mechatronik BW	Schiek, Volker	Germany
NanoBioNet e. V.	M. Monzel	Germany
Network for Innovative Closed Loop recycling Technologies	Verena Fennemann MBA	Germany
I-KON e.V.	Adolf Brockmann	Germany
BioProfil "Funktionelle Genomanalyse"	Dr. Corinna Morys-Wortmann	Germany
DLR	H.P. Monner	Germany
edacentrum	Andreas Voerg	Germany
Mikrosystemtechnik-Netzwerk Rhein-Main	Richard Jordan	Germany
Virtual Dimension Center (VDC)	Christoph Runde	Germany
BioCon Valley	Heinrich Cuypers, PhD	Germany
AGIT mbH	Ulrich Schirowski	Germany
BalticNet-PlasmaTec e.V.	Alexander Schwock	Germany
GIQS e.V.	Maren Bruns	Germany
deENet	Jan Kallok	Germany
Laboratory of Nano and Quantum Engineering	Fritz Schulze Wischeler	Germany
ICT cluster	Dr. Jörg Woidasky	Germany
Measurement Valley	Claudia Trepte	Germany
The QUESTOR Centre	Wilson McGarel	Northern Ireland
ECIT	Godfrey Gaston	Northern Ireland
Centre of Excellence in Novel Oral Dosage Forms	Jim McIlroy	Northern Ireland
Instituto Tecnológico de Informática	Carolina Quintá Goy	Valencia
AIDO - Technological Institute of Optics, Colour and Imaging	Isabel Ferrando	Valencia
Textile Research Institute (AITEX)	Rosa López	Valencia
INESCOP	V. Barrantes Romero	Valencia
ITC	Yolanda Reig Otero	Valencia
AIJU	Jaime Vilaplana	Valencia
AIDICO - Technological Institute of Construction	Margarita Lecha Taitot	Valencia
Ainia technological centre	Julio Carreras	Valencia
Instituto de Biomecánica de Valencia	Ana Cruz Garcia Belenguer	Valencia
AIMPLAS	Valentín Polo Ramírez	Valencia

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B.3. Interviewed COMPERA Partners (or programme managers)

Country	Name	Organisation
Austria	Otto Starzer	FFG

Basque Country	Xabier Maidagan	Innobasque
Estonia	Harri Faiman	Estonia Enterprise
Flanders	Corrien Struijk	IWT
Germany	Silke Stahl-Rolf	VDI TZ
Northern-Ireland	Claire Griffin and Nigel Carr	Invest Northern Ireland
Slovenia	Darja Piciga	Ministry of Higher Education, Science and Technology
Sweden	Matthias Lundberg	VINNOVA
Valencia	Concha Ginestar Peiró	Generalitat Valenciana

B.4. Interviews for the case studies

Case	Interviewee	Organisation
AIDICO	Paula Zamora	AIDICO
AIDICO	Margarita Lecha	AIDICO
AIDICO	Maria del Rey	AIDICO
BalticNet-PlasmaTec	Alexander Schwock	BalticNet-PlasmaTec
BalticNet-PlasmaTec	Marko Häckel	Neoplas/ former head TTO at Leibniz Plasma Forschung
BalticNet-PlasmaTec	Marcin Holub	Scezin University
BalticNet-PlasmaTec	Eugene Stamate	Risø National Laboratory
BalticNet-PlasmaTec	Henrik Zimmermann	NeoplasControl
BalticNet-PlasmaTec	Sebastian Spreeberg	NeoplasControl
CIC biomaGUNE	Manuel Martins-Lomas	CIC biomaGUNE
CIC biomaGUNE	Maria Aguirre	BIOBASQUE
CIC biomaGUNE	Charles Kelly	King's College London
CIC biomaGUNE	Annemarie Pucci	Kirchhoff Institute of Physics, Heidelberg
ELIKO	Prof. Giorgio Cannata	Head of the Mechatronics and Automatic Control Laboratory, University of Genova (Italy)
ELIKO	Andres Kull	ELVIOR OÜ
ELIKO	Indrek Ruiso	ELIKO
FMTC	Mark Engels	FMTC
FMTC	Freek Couttenier	AGORIA
GigaHertz	Jan Grahn	GigaHertz
GigaHertz	Ulf Gustavsson	Ericsson
GigaHertz	Klas Yhland	SP
GigaHertz	Rik Jos	NXP
GigaHertz	Franz Dielacher	Infineon
Questor	Wilson McGarel	Questor
Questor	John Toner	Williams Industrial Services Ltf
Questor	Clifford Henry	Northern Ireland Environment Agency
Questor	Geoff Wilcox	British Petroleum
Questor	Brian Bone	Northern Ireland Environment Agency

ViF	Gerhard Zrim	ViF
ViF	Aldo Ofenheimer	ViF
ViF	Hans-Herwig Priebisch	ViF
ViF	Anton Fuchs	ViF
ViF	Raimund Almbauer	Graz University of Technology
ViF	Josef Affenzeller	AVL List
ViF	Stefan Volkwein	University of Konstanz

Appendix C - Selection of cases

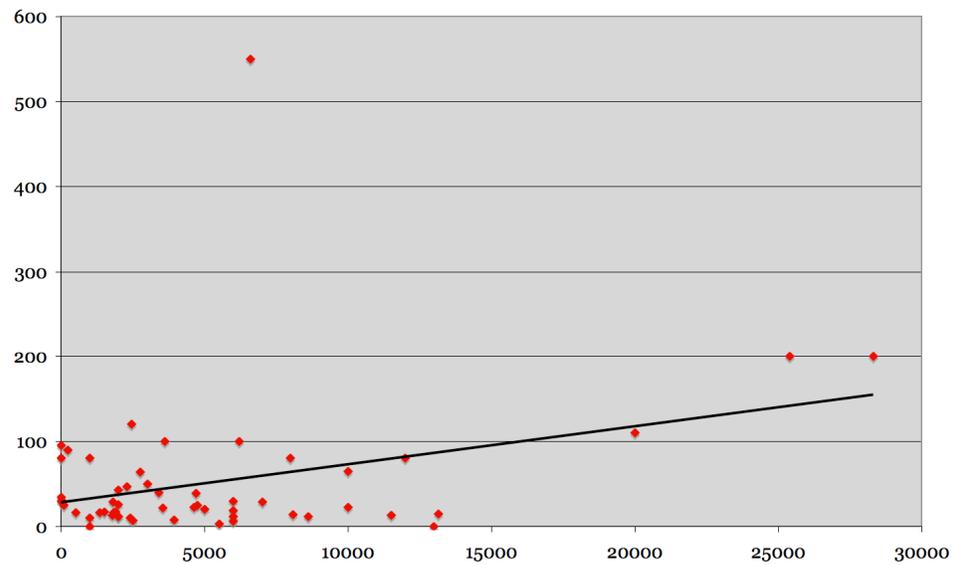
C.1. Selected cases

	FMTC	GigaHertz	CIC biomaGUNE	ELIKO	Virtual Vehicle Competence Centre	AIDICO	BalticNetPlasmaTec	Questor
Country	Belgium	Sweden	Basque Country	Estonia	Austria	Valencia	Germany	Northern Ireland
Virtual vs. physical	Physical	-no survey-	Physical	Combination	Physical	Physical	Virtual (network)	Combination
Governance: Regional vs. national	Regional	National	Regional	National	National	Regional	Regional	Regional
Different instruments	Bilateral co-operation, networks of CRCs and Mobility	- no survey- probably full participation	Cross-border research programme, Mobility	Cross-border programmes, opening up, mobility and networking	Opening up, bilateral co-operations and mobility	Cross-border programmes, mobility, bilateral co-operation, networks, brokerage	All types of instruments included.	Cross-border programmes, mobility, bilateral co-operation, networks, brokerage
Partners in- and outside EU	EU-partners	At least 1 co-operation extra EU	EU Partners	EU partners	EU partners	EU and non-EU partners	EU partners, India	Several non-EU co-operations
Extent of internationalisation/ Decisive factors	Many foreign partners, but VIB has a local focus	The Swedish CRCs are relatively focussed towards internationalisation	Because of regional policy not very internationalised	Most international CRC of Estonia	The COMET programme has an international focus	AIDICO is internationalised to a limited extent, but has interesting extra-EU activities.	Highly internationalised (50% of partners is foreign)	Broad range of co-operations, interesting links overseas

Appendix D - Additional analyses

D.1. The relation between the number of partnerships and the amount of funding (k€).

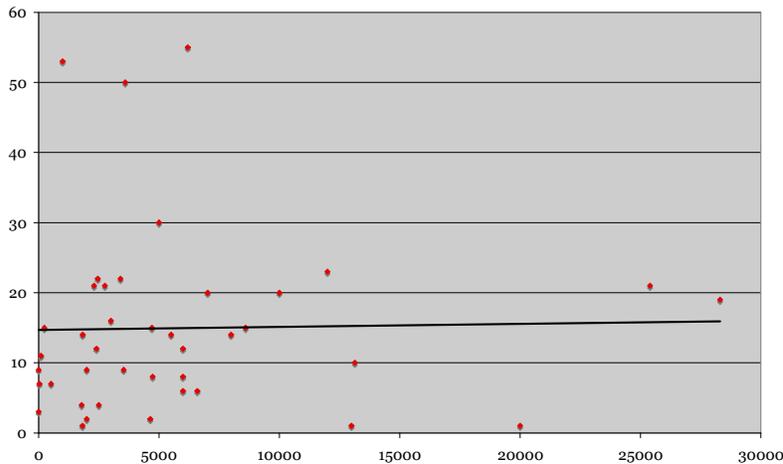
There is weak statistic proof that the number of partnerships correlate with the amount of funding ($R=0.32$) The slope (disambiguation) of this line is 0.004, which means that per m€, 4 more partnerships are to be expected.



X-axis: amount of funding (k€); Y-axis: number of partnerships

D.2. No relation between the number of international co-operation and amount of funding (k€)

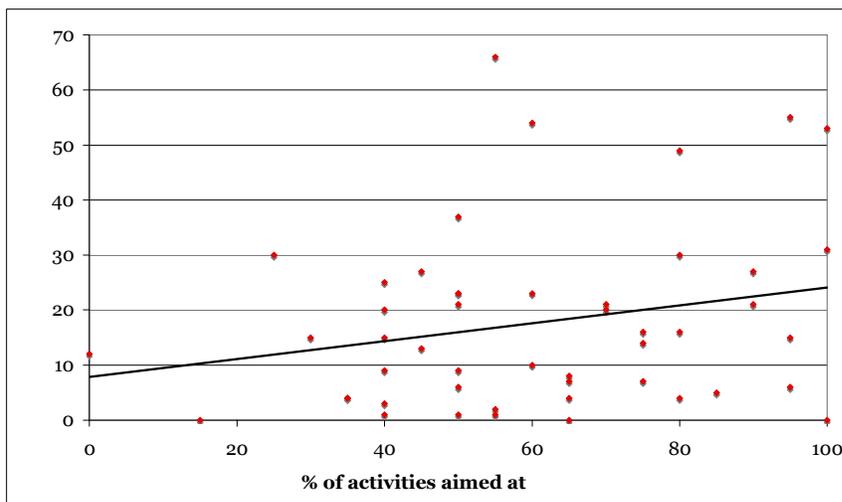
Considering the following graph, there is barely statistic proof that the number of partnerships correlate with the amount of funding ($R=0.02$) The slope (disambiguation) of this line is 0.00004, which means that per €100m additional funds, 4 more partnerships are to be expected. We therefore conclude that the number of co-operations do not relate to the amount of funding.



X-axis: amount of funding (k€); Y-axis: number of international co-operations

D.3. Research vs. Industrial focus of CRCs and the influence on the degree of internationalisation

- In order to determine whether there is a correlation between the types of CRC, i.e. CRCs aimed at research actors and CRCs aimed at industry, we have calculated the correlations and the slope of actual the correlation between the share of activities aimed at industry and the number of co-operations. In our survey we asked the CRCs to indicate what actors they dedicated their time to; this is the indicator for the degree to which the CRCs are aimed at industry or research partners. Furthermore we have asked how many co-operations the CRCs have, this indicates the degree of internationalization of CRCs.
- The figure below shows the number of co-operations set out against the share of activities aimed at industry (a) and research institutes (b). It shows that CRCs with a stronger focus on industry have a higher number of co-operations: the trend line suggests a positive trend of an increase of 1.6 co-operations per 10%. The statistic evidence is however rather weak ($R=0.23$).



D.4. Geographic focus per country; the percentage indicate the share of CRC managers that prefer co-operations with this region.

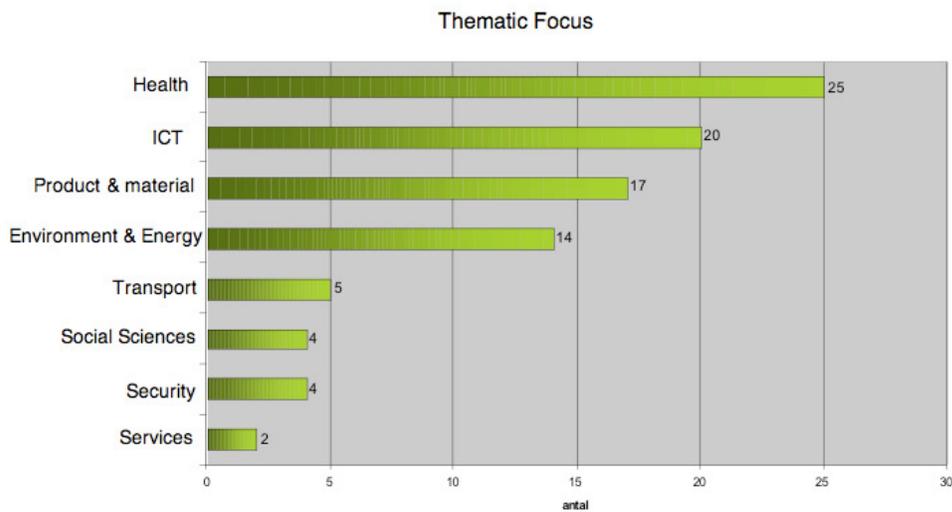
	n=	Neighbouring countries	EU-wide	Non-EU: Mediterranean countries	Non-EU: Asia	Non-EU: US	Non-EU: countries in former USSR	Non-EU: Africa	Non-EU: South-America
Austria	12	92%	100%	8%	17%	25%	0%	0%	8%
Basque Country	4	50%	100%	0%	75%	75%	0%	0%	75%
Flanders	5	60%	80%	0%	40%	60%	0%	0%	0%
Estonia	6	83%	100%	0%	17%	50%	33%	0%	0%
Germany	15	73%	67%	13%	33%	47%	7%	0%	20%
Northern Ireland	2	100%	100%	0%	100%	100%	0%	0%	0%
Valencia	9	44%	89%	56%	22%	33%	0%	22%	44%

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Appendix E - VINNOVA study on global links

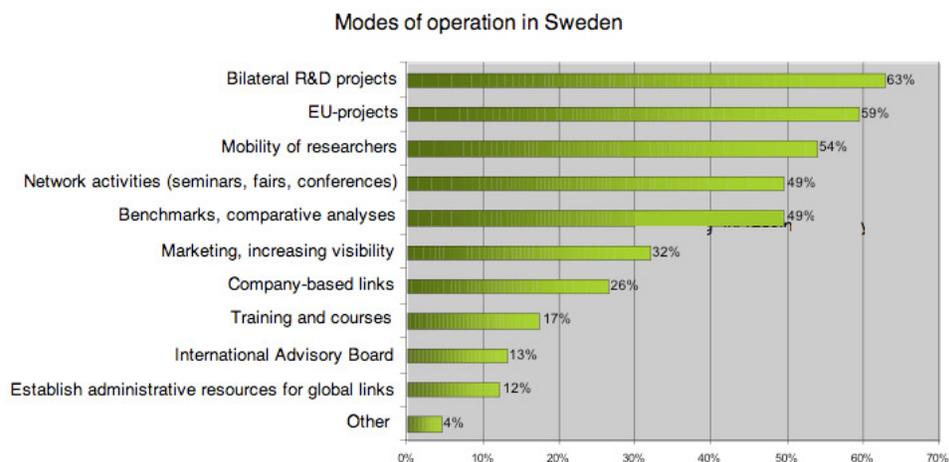
VINNOVA conducted a survey amongst a number of CRCs. The main goal of the survey was to gain insight on how VINNOVA should continue its work on internationalisation. The analysis is based on 91 responses.

E.1. Thematic focus



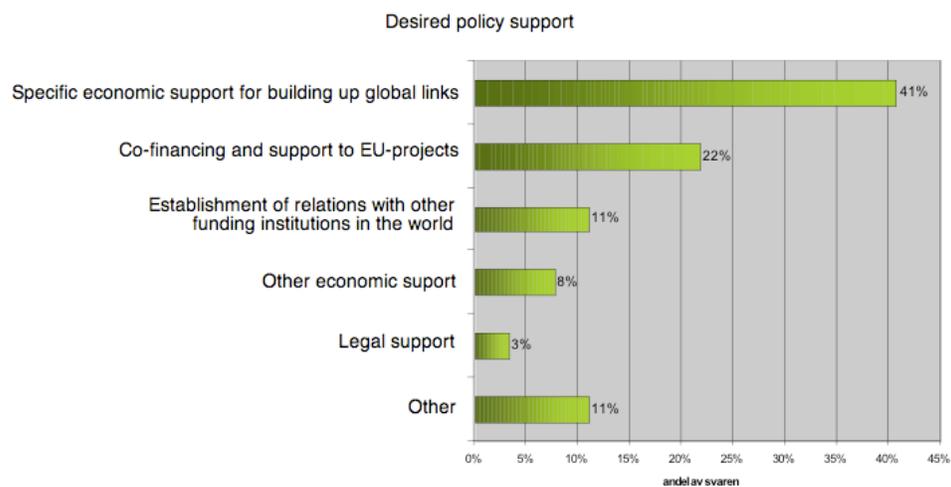
Source: VINNOVA Global Links survey

E.2. Modes of Co-operation



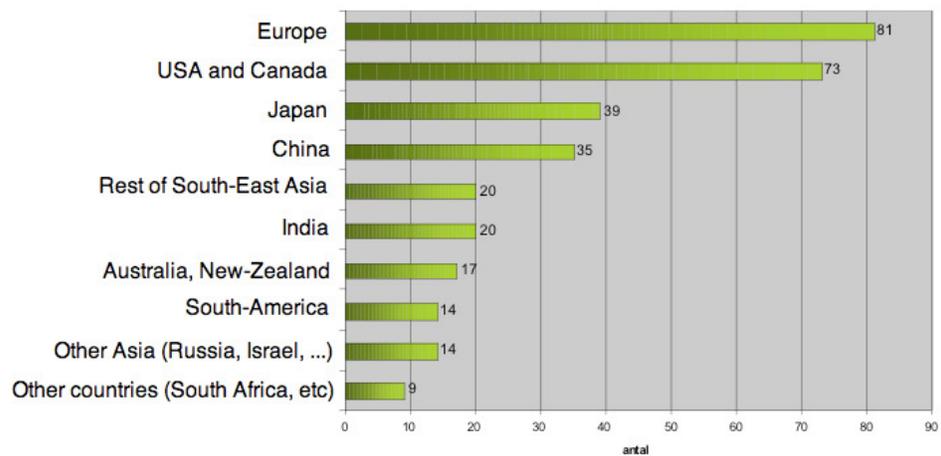
Source: VINNOVA Global Links survey

E.3. Policy needs of CRCs



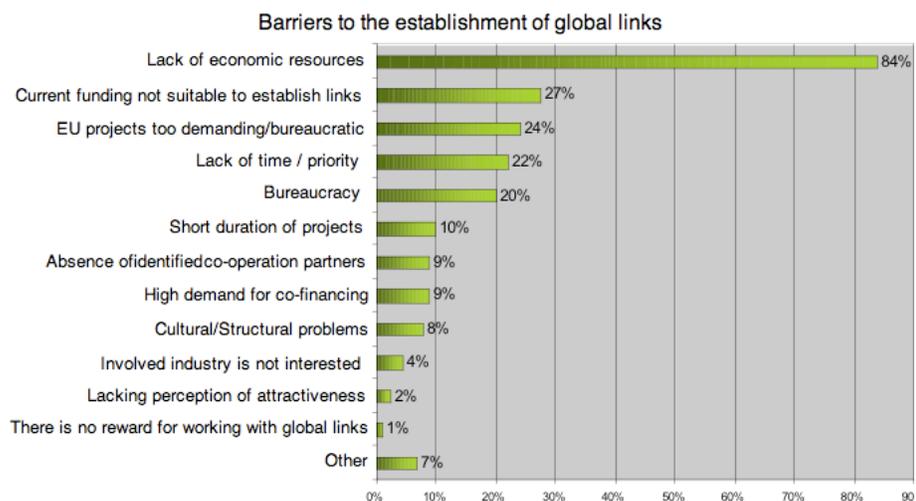
Source: VINNOVA Global Links survey

E.4. Geographical focus



Source: VINNOVA Global Links survey

E.5. Barriers to internationalisation



Source: VINNOVA Global Links survey

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