



Version for the Concluding meeting

Report on Monitoring and Evaluation of Competence Research Centres (CRC)

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Executive Summary

This report on monitoring and evaluation of Competence Research Centres (CRCs) is structured along the following topics and issues.

- The relevance of monitoring and evaluation. Monitoring and evaluation (M&E) is important for the CRCs to give the centres feedback to improve performance, for funding agencies, for professional programme management and for reporting to ministries, politicians and general public on programme performance.
- The objectives of monitoring and evaluation. A M&E system should be based in the first place on the goals for the centre programme in question. Indicators for each CRC should allow for a variation in profile of the centres within the programme and during the programme period.
- The monitoring and evaluation methods and processes. The M&E-system should be structured along the chain: Input-Activity-Output-Outcome. The time aspect must be kept in mind. Some centres will lead to important impacts that will not be visible before the end of financing period.

Furthermore,

- Evaluation processes used in practice are discussed and examples are presented;
- Indicators used by COMPERA members, collected by a survey, are presented;
- Finally, the report presents some concluding remarks on how to organise effective monitoring and evaluation of CRCs and CRC programmes.



1. Introduction

COMPERA is an ERA-net for agencies that are funding Competence Research Centres (CRCs). COMPERA is supported under the ERA-NET scheme of the European Commission's Sixth Framework Programme (project duration: June 2005 to May 2010).

COMPERA has performed this study as a part of the consortium's joint activities. The goals of the study were:

1. To collect data from COMPERA members and other relevant sources about monitoring and evaluation practices of centres and CRC programmes, with emphasis on mid-term evaluations; and
2. To analyse current practice and identify a common basis in the various approaches used and to present examples of good practice.

The goals and expectations of the activities that are evaluated should be in focus. What should be achieved and what is the route there is expected to be like. Programme results and impacts as well as indicators to show that the programme is moving towards its impact goals must be identified.

Based on the data from the CRCs studied one can conclude that many have a couple important aspects in common. Based on such communalities COMPERA has presented the following definition of a CRC:

A Competence research Centre is a "Structured, long term RTDI collaborations in strategic important areas between academia, industry and the public sector.

Aim: Bridge the gap between scientific and economic innovation by providing a collective environment for academics, industry and other innovation actors and creating sufficient critical mass

Multiple activities: Pooling of knowledge, creation of new knowledge by performing different types of research, training and dissemination of knowledge, and networking of the main stakeholders and key players involved (from academia, industry or innovation actors from the policy or government levels)

The primary characteristic of a CRC, that may differ from programme to programme, is whether or not the main focus is on research as a knowledge basis for innovation (in other words: *turning money into knowledge*) or the goal is to produce innovations as a result of centre activities (i.e. *turning knowledge into money*).

Some main dimensions of a centre should be given special attention. An example of such main dimensions, also termed performance areas, is:

- Research
- Innovation
- The Centre and Network dimension



Monitoring and Evaluation of Competence Research Centres (CRC)

Other important features which may differ and could have influence on the nature, scope, depth and consequences of an evaluation are:

- Physical centre vs virtual network
- Separate Legal Entity vs Centre within Host institution
- Regional (national) focus vs International focus
- Active participation in centre activities by enterprises vs passive cash contribution
- Duration of funding, life after end of funding
- Size of Budget vs Funding profile
- Open call vs call in predefined thematic area
- Industry lead vs Academic lead

Why do we perform monitoring and evaluation and collect indicator based information?

The programme management staff of a funding agency need to know whether the programmes they fund are achieving their goals. They have to answer questions from funding ministries and politicians as to whether public money is used properly. The programme will also have to be benchmarked against other ways of supporting the same objectives. Finally the management of the centres themselves need data and information to effectively manage their projects and activities. The feed-back resulting from an evaluation to the centre managers is most important as it contributes to learning processes, strategic adjustments and improvements in structures and processes of the centre.

Different types of data will be useful to characterize centres. For each of these indicators may be selected. One may place all CRCs along an Input-Activity-Output-Outcome chain used within the context of the Corporate Research Centres programme in Australia (ref. 3), extended version.

INPUT	ACTIVITY	OUTPUT (Result)	OUTCOME (Impact)
<ul style="list-style-type: none"> • People • Money • Infrastructure • Prior IP • <i>Legal form</i> 	<ul style="list-style-type: none"> • Research projects • Stakeholder engagement • Training • <i>Development of new products</i> 	<ul style="list-style-type: none"> • Publications • Prototypes • Patents • PhDs • Masters • <i>Demonstration</i> • <i>Define new business and markets</i> 	<ul style="list-style-type: none"> • Gains in Productivity • Industrial development & sector growth • Health and Environmental benefits • <i>New products and services (business and market growth)</i> • <i>Competitiveness of the region/country</i>

(ref. 3)



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When requesting data from centres, the time domain must be kept in mind. Data related to impact cannot be expected to be available the first years of operation. It is however important to make it clear from the beginning what is going to be expected at the end.

While concluding this part of the report, here is an example of a set of fundamentals of a Monitoring and Evaluation Strategy (the case of VINNOVA, Sweden (ref. 1))

- Before start of programme: Establish a support system including relevant indicators and a data base to contain information needed for monitoring, evaluation and impact analysis
- At start: Establish basic data characterising centres
- During course of programme: System for Monitoring
- Chosen point of time during life of programme: (Start-up and) Mid-term Evaluation(s)
- At end: *ex post* Evaluation
- Posterior measurements: Impact analysis, often together with others



2. Monitoring of CRCs

2.1 Concept and the content of a monitoring system

2.1.1 The concept of monitoring

For the continuous direction of the centres an agile monitoring system is required. Although evaluations can provide useful information to optimize the CRC, it's not useful to direct the 'daily' operations. The mid-term and end evaluations are events in the course of the life time of a CRC where a summary is made of the status and the realisation of the objectives is evaluated.

2.2.2 The content of a monitoring process

When setting up such a monitoring system the following points must be addressed.

- Firstly, to take into account the needs of three parties/levels concerned, namely:
 - Political level (policy makers must have data to justify their support to the CRC);
 - Programme manager level (or the funding agency, must be able to follow up the performance of the CRC to intervene when necessary to avoid a negative mid-term evaluation);
 - Project level (self-evaluation and continuous improvement).
- Secondly, to be aware of certain dangers of monitoring system:
 - Political influence (focus on items on the policy agenda that might not be congruent with CRC objectives);
 - Increased Overhead (a monitoring system should bring benefits for the project organization, so all data collected should have a direct management relevance);
 - Numbers don't tell the whole story (the monitoring system shouldn't become a paralyzing obsession, in case of good reasons to abandon some specific metrics or to reduce some target values, this should be possible).

The below example of monitoring system data, taken from the K-plus programme (FFG, Austria (ref. 9)) includes the following system elements:

- Financial data
 - % public funding
 - % self financing (and sources)
 - Overhead costs
- Data concerning organization issues (and changers hereto)
 - Project Partners (Segmentation : Industry/University sectors, national/foreign)
 - Non project partners



- Cooperation in (inter)national funded programmes
- Scientific output and performance
 - External scientific reports
 - No and Quality of publications
 - No of Masters and PhDs
 - No of Awards
 - No of Patents
- Technology transfer activities
 - Spin-offs from CRC
 - Personal exchange with industry
 - No of prototypes
 - No of implementations of use in production processes
 - Communication activities, Seminars with company involvement
 - Joint publications with industry
 - Increase private R&D-spending
- Human Capital
 - No and profile of CRC scientific staff
 - No Liaisons with industry
 - No Joint participation in scientific fora and in-kind contributions
 - Internal training

2.2 Highlights - Results which are not quantitative

A monitoring system should include results that are appreciated and understood by a wider audience than fellow researchers in the field and research agency bureaucrats involved. To present highlights, *success stories* or what is also termed *nuggets* (or case-studies) is important to demonstrate the value of a centre for a broader group of people also at an early point of time in the lifespan of the CRCs. Accordingly, this type of feedback should also be requested from the centres.

The US National Science Foundation (NSF) in their manual for Engineering Research Center (ERC) reporting (ref. 2) has elaborated on how to identify nuggets with many good examples. For one of the ERC performance areas they present the example below:

Engineering Research Centers (ERC) - Example of a Performance area, its Objectives and a Nugget.

Ideas: Enabling “discovery across the frontier of science and engineering, connected to learning, innovation, and service to society.”

ERCs in their reporting should include nuggets that address one or more of the following objectives:

- Enable people who work at the forefront of discovery to make important and significant contributions to science and engineering knowledge;



- Encourage collaborative research and education efforts – across organizations, disciplines, sectors and international boundaries;
- Foster connections between discoveries and their use in the service of society;
- Increase opportunities for underrepresented individuals and institutions to conduct high quality, competitive research and education activities;
- Provide leadership in identifying and developing new research and education opportunities within and across S&E fields;
- Accelerate progress in selected S&E areas of high priority by creating new integrative and cross-disciplinary knowledge and tools, and by providing people with new skills and perspectives.

Example of Nugget : Creating the Future of Multimedia Technology

ERC, Integrated Media Systems Center (IMSC), University of Southern California, have developed new technology that has greatly enhanced the capability of video and audio presentation.

The IMSC's Remote Media Immersion (RMI) technology delivers theater-screen size digital video and multi-channel audio that exceeds the best sound quality in existence today over high-bandwidth Internet networks.

In October 2002, the researchers relayed a recorded concert by the New World Symphony of Miami Beach to 500 Internet researchers on a theater screen at the University of Southern California campus in Los Angeles. With the rollout of broadband Internet services and RMI technology, movie theaters and other entertainment venues could use this new technology to present streaming movies and remotely display sports events.

IMSC has also developed a related audio technology called Immersive Audio that simulates three-dimensional sound and enable virtual movement of a listener within the sound space.

In April 2002, the USC IMSC presented a mix of live music and recorded music through Immersive Audio to more than 200 people. This technology uses multi-channel signal processing to localize and maneuver sound in space to create the perception of movement. The advanced technology uses multiple loudspeakers and algorithms to generate a realistic three-dimensional sound field around individuals and groups.

National Science Foundation, USA (ref. 2)



3 The Evaluation Process of CRCs

The description of the evaluation procedure below addresses a number of specific topics:

- The timing of the different types of evaluation
- The rationale, objectives and principles behind the evaluation process
- The criteria used during the evaluation
- The data used for the evaluation
- The reporting and feedback as output from the evaluation
- The different process steps during the evaluation
- The results and consequences of the evaluation.

3.1 The timing of the different types of evaluation

The timing of different types of CRC evaluation must be kept in mind. CRCs are complex organisations of a more substantial nature and with a longer time span than a typical R&D-project.

In general one could identify *four points in time* and *corresponding evaluation actions* within a CRC-programme allowing the evaluation of CRCs:

1. Ex-ante evaluation (selection) of a CRC
2. Mid-term evaluation of a CRC
3. Final (Ex-post) evaluation of a CRC
4. Evaluation of the CRC programme (Impact assessment).

The word 'mid-term' of a CRC might in some cases be misleading, in fact it may be better to speak about phase 1 or evaluation of the establishment phase. If the evaluation is as early as after two years of operation it may be termed an establishment evaluation.

This chapter will further concentrate mainly on the mid-term evaluation, but many features will be common for mid-term and final evaluation. The main difference is that the consequences for the centre might prove much more important for the mid-term than for the final evaluation.

3.2 The rationale, objectives and principles of the mid-term evaluation

The mid-term evaluation is, from the view point of the funding agency, not merely intended to provide information, to ensure quality control and to carry out individual changes, but also to form a basis for the decision, to be taken by the funding agency as to whether and in what form the next phase of the CRC under review should be funded.



As indicated above the mid-term evaluation is a part of a (self)learning experience and is of high importance in the process of strategy building for the funding agency, the CRC and its management and stakeholders. Initiation of strategy building and learning processes on the side of the CRC! Hence the mid-term evaluation has a rearward looking component, still it should have a far more important forward looking ambition. The mid-term evaluation is focused on the measures taken to build an effective organization and the potential for longer term development. This provides an opportunity for evaluation teams to give advice and recommendations on how each centre can be even more efficient and effective.

The mid-term evaluation has also an impact on the CRC funding programme as it is of great importance to learn from the past and to assess whether the steps taken so far to develop the CRC funding programme have been adequate, to address the most pressing problems, and also to identify necessary improvements for the forthcoming years.

The main formal objective however is to provide a solid foundation for the decision on the continued funding of the Centre in question. In the worst case, for instance due to serious deviation from research or financial planning, the mid-term evaluation could lead to a decision taken by public authority to stop its support for the CRC concerned, or a decision to ask the CRC management to propose a winding-up scenario.

Besides the formal objectives, the more strategic objectives of the mid-term evaluation can be summarized as follows:

- The central procedural objective is to initiate a joint learning process, as well as to review the course taken in the past and to adapt the conditions – both in terms of the research programme and funding conditions – where necessary;
- Another objective is to arrive at a shared vision regarding the further development of the respective Centre;
- A final objective is to gather information for the evaluation of the overall programme and of the individual Centres at the end of the full operating period.

3.3 The principles underlying the mid-term and final evaluation

Unlike in the case of the ex ante evaluation, the "burden of proof" during the mid-term evaluation is on the evaluators. Each Centre is mainly evaluated on its own merits and future prospects. Unlike in the selection phase the aspect of competition in general is less important. Still a simultaneous evaluation of several Centres is valuable, both for the funding agency and for the centres to compare their performance.

It is fundamental that the objectives and the criteria are defined in advance (see further under criteria) in a way that they can be assessed in an objective way. In practice the evaluation is primarily based on core documents and data collected and presented by the Centre. In general, no additional data collection is done by the evaluation team.

By analyzing the documents provided, evaluators gain a comprehensive overview of the respective Centre; these initial findings are then compared in a preliminary meeting of the Evaluation team and expanded as well as supplemented during the Site Visit. Document analysis and site visits are considered equally important steps in formulating the recommendations of the 'Evaluation Team'.



As already indicated the word 'mid-term' might be misleading, in fact it may be better to speak about phase 1 or establishment. This evaluation takes place two to four years after start-up. If the evaluation is as early as after two years of operation it may be termed an establishment evaluation.

3.4 A self-evaluation report as input for the evaluation process

One way to organise the evaluation process is to include a self-evaluation. Some CRC programmes have found that it is a good practice to ask the CRCs to prepare and present a self-evaluation document to the evaluators (including core data and a SWOT analysis). The structure may be more or less stringent. The following is an example of the main headlines:

- Mission and vision
- Partners
- Research program
- Financial report
- Organization and management
- Personnel
- Future plans
- Performance indicators.

3.4.1 Manual for Self-Evaluation of Competence Research Centres ¹

Recently, IWT, the Flemish Agency for funding Innovation through Science and Technology, one of the COMPERA partners, developed a more elaborated guideline for self-evaluation, based on a *Logical Framework Analysis*. We describe the content of this manual briefly. The self-evaluation manual contains:

- An overview of the Self-Evaluation Method
- Instructions and guidance on how to use a LFA to describe the relation between activities, results and objectives of an organisation
- Guidance on defining indicators
- Instructions on how to set-up a data collection plan and how to collect information
- Support for Analysing on effectiveness and efficiency
- And finally, guidance for Reporting.

The goal of this self-evaluation method is to increase insight into the CRC organisation and to check whether its goals are achieved, to provide tools to improve and optimize, to justify the amount of funding. The most important questions it addresses are the relevance, effectiveness and efficiency of the CRC. It also presents a clear approach to the self-evaluation process.

¹ IWT (ref. 4): "A Manual for Self-Evaluation of Competence Research Centres" see: http://www.iwt.be/sites/default/files/publicaties/iwt_studie62.pdf



The proposed structure for this self-evaluation report contains the following chapters:

1. Description of the Competence Pool
 - Mission & objectives
 - Activities (summary of headlines)
 - Organization (structure, number of employees, key strategic processes)
2. Logical Framework Analysis (LFA)
3. Input
 - Financial data from year to year
 - Detailed overview of activities
 - Expenditure per activity
4. Output per activity (e.g. consultancy, projects realized, number of visitors) and discussing these (linked to output indicators)
5. Results and effects by activity and for the overall mission and objectives
6. Summary of performance indicators Based on the agreed list of indicators
7. Findings and conclusions, including options for improvement, suggested changes

The advantage of this LFA approach is that it provides a 'logical' structure that links activities, results, objectives and mission clearly together and helps to identify indicators to be used for monitoring output and effects. It also helps to identify loose ends in the CRC's activities.

In most cases the remainder of the evaluation of the Flemish CRCs takes place in 2 steps: first a desk review, complemented afterwards with a site visit.

3.4.2 SWOT analysis

Based on the self-evaluation of the centre a SWOT analysis may be performed (4). This is considered to be a useful way to present the highlights of the status of the centre and may constitute a basis for the plans for the final period for the centre. This SWOT analysis should include the following steps.

- ***Describing internal factors:***

The strengths and weaknesses of the organisation. These are related to CRC organisation's resources (people, knowledge, financial means, and activities). The sources for this are the analyses mentioned above.

- ***Describing external factors:***

The opportunities and threats in the (external) environment that have an effect on the organisation. These include changes in the policy domain, technological developments and economic factors.

- ***Confronting internal factors (strengths, weaknesses) with external factors (opportunities, threats)***

It is important to weigh the strengths, weaknesses, opportunities and threats by using a point system or a qualitative specification.

- ***Developing ideas on strategic options:***



Strategy development often occurs on the basis of a matrix in which the factors are presented in four cells based on strengths, weaknesses, opportunities and threats.

Example of a SWOT-table

<p>Strengths</p> <ul style="list-style-type: none"> • Advanced knowledge development • The research is demand driven • The partners are closely involved • The activities have a clear effect • A wide and active network, both nationally and internationally 	<p>Opportunities</p> <ul style="list-style-type: none"> • Extra attention and resources from public agencies for innovation in the sector • New technological breakthroughs in strategically important fields • Opportunities of interaction with innovation programmes • Position to attract funding from EU framework programme
<p>Weaknesses</p> <ul style="list-style-type: none"> • Transfer of knowledge not adequately addressed • Resources are not prioritised well • Number of partner companies too low 	<p>Threats</p> <ul style="list-style-type: none"> • The partner companies is under pressure by the economic crisis • The end of centre funding will come before company partners are ready to implement results

Cf. A Manual for Self-Evaluation of Competence Research Centres, IWT (ref. 4)

3.5 The Evaluation Process (at mid-term)

Based on the mid-term - and possibly self-evaluation - documents and the site visits, the expert panel writes a report and formulates advice about the continuation (or otherwise) of the CRC. This report is delivered within a 'reasonable' time span after the visit.

It is good practice to present this report to the management of the CRC and allow them to study this in-depth for a period. Next one should discuss this experts' report with the management of the CRC and allow them to give some time to generate feedback on this report.

As indicated earlier the feedback from the expert panel should focus on issues of improvement rather than be limited to *a simple go/no-go decision*.

In general, the evaluation team for individual CRC's consists of members with differing profiles:

- Generalists
 - Familiar with the nature of CRCs and the evaluation process
 - Same for all CRC's under evaluation
- Scientific peers: Focus on scientific quality of the work
- Supporting members (from the funding agency): Assist in securing a correct and fair process



The generalists, sometimes called *standing group*, mainly focus on the science-industry relations and on management issues. They also provide the reference level. Quite often the external experts are foreign experts (almost always two experts), although in some regions, for reasons of confidentiality native experts are used, but in any case, always with a long track record in the field of evaluation.

Although the mid-term evaluation mostly assesses the managerial and organizational issues, it is good practice to involve the scientific experts already at this stage to become acquainted with the centre and evaluation procedure in order to contribute to evaluation in later stages of the CRC. The scientific experts are mainly foreign scientific and academic peers (2 or 3) with a sound knowledge of the domain of the centre. Each CRC has its own group of scientific experts and they continue to follow the CRC in later stages.

3.6 The results and consequences of the evaluation

Based on the experts' advice and (eventual) feedback from the CRC, the funding agency has to take a decision about the continuation of the funding for the CRC. In most cases this is a conditional Go and the CRC gets a continuation decision. Only in exceptional cases this advice is a No-Go. (CRC programmes should have orderly 'wind-down' procedures prepared to cater for this eventuality).

In the most common case of a continuation as much as possible lessons have to be drawn from the assessment. The real added value of the evaluation has to be found in its support to improve the performance of the CRC.

3.7 Success factors and perceived weaknesses of evaluations ²

Evaluations take place in different contexts and before the backgrounds of different innovation systems. Nevertheless, we can indicate some factors that contribute to establishment of successful evaluation procedures:

- Clearly define the operational goals and objectives (programme and project specific, policy) as a reference system which makes it clear from the outset the goals of the CRC. This enables CRCs to adopt and put in place research and collaborations that are driven by results at an early stage.
- Evaluations should be carried out by external experts in order to ensure that findings are independent. However, evaluations should be designed as an interactive process between the evaluator and the actors or projects that are part of the evaluation. Close involvement of actors or organisations and a systematic feedback process during evaluation procedure ensure that information is consistent and data are available. Only by co-operating with the actors can insights be gained.

² Based on "International Experiences with Ex-ante and Ex-post Evaluations of Networks of Innovation", VDI, Silke Stahl-Rolf and Ocke Hamann



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- Evaluations need to provide incentives for people or organisations participating in the evaluation procedure.
- Evaluations should be based on a systemic approach: They take “innovation” and “technology policy” theories into account and are oriented toward the specificities of the innovation system.
- Evaluations need to result in programme improvements, specifications of the programme design, development of new projects, improvement of project courses or implementation/removal of programme components, i.e. successful evaluations need a defined role within the innovation system and contribute to its dynamics. Evaluations merely aiming at the documentation of project development and programme impact are of little value.



4. Indicators for monitoring and evaluation

4.1 Criteria for the evaluation and indicators

As already indicated above, the main focus of the first evaluation is on establishing a competence centre and measuring in as far the first important steps that have been taken and first results that have been achieved.

4.1.1 Indicators for success

Typical indications of success are that:

- The centre has managed to build up working structures (including boards, management ... according to the programme standards) and start regular business after an initial phase;
- The centre has dealt with its own budgets and working plans in a responsible way – without ignoring new opportunities and challenges;
- The centre has started to produce a sufficient number of scientific-technological outputs, such as patents, publications or PhD's;
- The centre has succeeded in installing a working transfer of results towards its industrial partners (without becoming a short- term RTD service provider) and if it should build up a knowledge base of its own [The evaluation will also perform a preliminary assessment of the scientific results obtained so far and whether these lead to innovation, value creation and long term research. Partnership in R&D-projects is an important element here, as well as the balance between Fundamental, basic, applied research, and the synergy between projects];
- The centre has shown that horizontal issues like educational programmes and strategic research projects have been established successfully;
- The centre has succeeded to formulate a long term strategy, including (elements of) a SWOT-analysis.

4.1.2 Performance areas

Indicators should have a close relation to the goals for a centre. Here is an example of expected impact (outcome) performance areas:

- Research in the forefront within thematic area
- Knowledge basis relevant for industrial partners
- Training of researchers in areas important for industry
- Internationalisation
- Increased R&D spending of business partners
- Innovations by partners



- Impact on industry and society at large

Example: Arrangement of Output/Outcome indicators by performance areas,

Results-Based Management and Accountability

Performance area 1: Researcher training and Recruitment

- Number of Post docs
- Number of Ph. D students
- Number of Master Students
- Number of candidates from centre that are employed in industrial sector

Performance area 2: Transfer and exploitation of results by industry

- Number of patent applications and patents issued
- Number of license agreements and income by licenses
- Number of new products, services and processes
- Case studies demonstrating impact

Performance area 3: Increased productivity and economic growth

- Number of jobs created
- Examples of companies created in new industrial sectors
- Case studies of impact on existing industries
- Benefit/cost analysis

Network of Centers of Excellence, Canada (ref. 6)

Figure 1 below shows an example of what is called a footprint of a centre.

This is a practical tool that could be used to compare the relative strengths of (strategic or competence) research groups (ref. 10). This is essentially a chart that provides a readily accessible visual representation of performance based on the five characteristics selected. The *shape* of the footprint gives an indication of the research group's strength and weaknesses. The five main performance areas shown in the figure will be given focus in the mid-term evaluation for a Norwegian CRC. Relevant indicators should be established for each of these areas. The figure also indicates that the centre may be given a score in each of these performance areas based on indicator values and peer review.

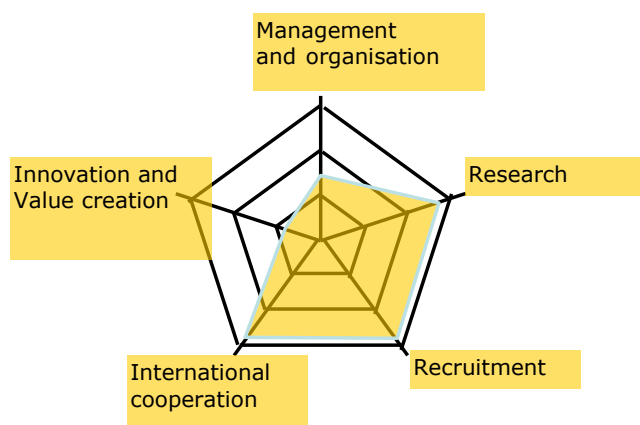


Figure 1 Footprint of a centre (RCN, Norway (ref. 10))



An example of success criteria as a basis for the mid-term evaluation, Centres for Research-based Innovation(CRI):

Goals for the CRI Scheme

To enhance the ability of the business sector to innovate by providing funding for long-term research conducted in close cooperation between research-performing companies and prominent research groups.

- Encourage companies to innovate through a greater focus on long-term research, and make Norway an attractive location for international companies to establish their operations.
- Facilitate active cooperation between innovative companies and prominent research groups.
- Promote the development of industry-oriented research clusters which lie at the forefront of international research and which participate in dynamic international networks.
- Enhance researcher training in areas of importance for the business sector, and generate research-based knowledge and technology.

Success criteria for five performance areas

1. The research

- The centre engages in long-term industrial research of a high international calibre in the field outlined in the project description, and demonstrates its high quality through its production of doctorates, scientific publications, papers for presentation at recognized international conferences.
- The centre has a distinct research profile and has been successful at the international level (e.g. when researchers win prizes or are invited to be keynote speakers at international conferences).
- Researchers from the host institution and partners participate actively in the centre's research.
- The centre's user partners have increased their research activities both through participation in the centre's activities and their own R&D activities on topics of relevance to the centre.

2. Innovation and value creation

- The centre's research has engendered or is expected to engender possibilities for innovation and enhanced competitiveness among user partners and expectations about social ramifications over and above the partners' direct participation in the centre's activities.
- The centre has achieved mutual mobility of personnel between the centre and the user partners. Researchers from partners work at the centre and research fellows and researchers from the host institution are seconded to the user partners for periods of time.
- The centre has conducted projects to ensure that the competence and results achieved by the research are effectively transferred to and utilized by the partners.
- The CRI paves the way for results that fall outside user partners' core areas to be commercialized by other means, e.g. through establishing new research-based enterprises.



3. Internationalization

- The centre is successful in international research cooperation, (Example: EU's framework programme).
- The centre engages in active collaboration with international research groups and has also in other ways contributed to the internationalization of Norwegian research and industry.
- The centre attracts outstanding foreign researchers, including research fellows and senior staff as visiting foreign researchers.

4. Researcher training and recruitment

- The centre attends to researcher training effectively, and helps to train highly skilled personnel in the centre's special fields.
- The centre is actively engaged in education, especially at the master's level, and helps improve recruitment to the centre's subject areas with particular emphasis on increased recruitment of women.

5. Management & organization

- The centre has good visibility, a strong identity and has successful collaboration with the partners.
- The centre is organized in a manner that allows it to fit into the host institution's organization.
- The centre has a Board of Directors and management that help ensure that the intentions and the plan underlying the establishment of the centre are followed up.
- The centre has a common administration with a high degree of professional autonomy.

6. Additionally: Partners and funding

- The centre receives long-term funding from the host institution and partners, and they increase their funding to exceed the minimum requirements.
- Active efforts are made to attract new partners and the centre's partners also include small and medium-sized enterprises with a high technology and innovation profile.
- The centre has been successful in securing other external funding.

RCN, Norway (ref. 10)

4.2 Selection of indicators

How indicator-based information is needed and used:

- Collection of some standard measures of performance across all CRCs in a programme and also common to other schemes for R&D funding (Selected top down indicators);
- Information base for Programme management to monitor performance of each CRC;
- Information base to help the Agency to keep track of programme level progress and goal achievement;
- Information base for the Agency report to funding Ministries on Programme achievements; and



- Information base to help centre evaluation teams (May also include bottom up indicators for each centre).

A general recommendation is to ensure that results and impact indicators meet what are known as the SMART criteria (*Specific, Measurable, Achievable, Relevant, Time-bound*) (ref. 1). Alongside each criterion are brief comments relating to the challenges the criterion faces when a system perspective is applied.

4.2.1 S.M.A.R.T

- **Specific.** In order for a goal to be usable, it must be so specific that it can be determined whether the initiative carried out has caused the anticipated impacts or not. Formulation of specific goals is hampered by a system perspective, since in most cases this means the number of variables assumed to affect the outcome is greater. However, this increased complexity does not mean that less specific goals can be accepted, but rather that more resources must be added to this stage of the policy and evaluation process.
- **Measurable.** Another important aspect is that goals are framed so as to be measured and evaluated both in terms of quantitative and qualitative variables. In cases where it is difficult to design and collect absolute measurements, methods should be developed instead to express relative changes, i.e. increases and reductions. Since this relates to measurability, application of a system perspective chiefly hampers the possibility of measuring causal connections between initiative and results.
- **Achievable.** If setting up goals is to be meaningful, it is important that these are well considered so that they are neither achieved too simply nor are obviously unrealistic. Again, what hampers the formulation of achievable goals in the system perspective is the fact that the volume of variables affecting the outcome is great, which makes an *ex ante* assessment more difficult.
- **Relevant.** This criterion indicates the significance of a clear agreement between the overall goals and the fixed operational goals.
- **Time-bound.** All initiatives must be designed so as to set out time constraints within which some type of result must be observable. The complexity and uncertainty which characterises innovation processes hampers predictions as to the time horizon for the impacts of innovation policy initiatives.

If monitoring of goal achievement is to be possible later in the policy process, requirements must be laid out for clearly framed goals. In some cases, a relevance requirement for indicators used in securing a beneficial development can be introduced. This is as an explicit criterion for selecting proposals to support. At the same time, requirements should be set for the design of routines where it concerns gathering indicators which allow goal achievement to be checked and evaluated.

4.3 Analysis of indicators used by COMPERA members

A survey asking what result and impact indicators are used was sent to all the members of COMPERA resulted in the following feedback from eight COMPERA members. The



summarized analysis could be done along the *three main dimensions* of a centre, Research, Innovation and the Centre dimension. For each of these three dimensions those Output indicators (= results) and Impact indicators most commonly used are presented below. The number in parenthesis is the number of respondents that use the indicator:

Research (Result indicators)

- No of approved EU-projects within the centre's field of operation (6)
- No of published papers in refereed journals (5)
- No of international conference contributions (5)
- No of projects with international partners (4)
- No of Co-publications with industrial partners (3)
- No EU-projects with role as coordinator (3)
- No of M Sc degrees connected to the centre (3)
- No of PhD students working in the centre (3)
- No of international visiting researchers (2)

Innovation (Result indicators)

- No of Patent applications (5)
- No of new enterprise partners (5)
- No of project results that are protected by other than patents (trademarks etc)(4)
- No of projects with active involvement of enterprise partners (4)

Centre dimension

- Active involvement of enterprises in Research agenda setting (6)
- No of centre events like workshops, seminars etc (5)
- Volume of additional funding (4)
- Communication - Press cuttings related to centre (3)
- Mobility of Staff between partners (2)

Impact indicators

Research

- No of PhD theses completed (3)
- Increase in R&D spending by enterprise partners (4)

Innovation

- No of Patents (5)
- No of licences based on patents (4)
- No of new Products, Processes and Services (5)
- No of Spin-of companies (4)
- Recruitment of personnel from academia to industry (4)



5. Evaluation of CRC-programmes

On the level above the evaluation of the individual CRCs, the funding agencies and policy makers are much concerned about the CRC support programme itself.

Programme evaluations are asking whether the programme and, accordingly, the chosen policy approach, was able to meet its objectives. Therefore, programme evaluations focus on policy learning. It aims at the improvement of programmes and assess the benefits of a collection of projects approved and supported (funded) under the programme rules.

Among others, programme evaluations take into account:

- function and impact of single programme components
- duration of funding
- duration of programme availability
- period of competitions
- impact of incentive components
- role of programme within the national research and development system
- interaction with other programmes,
- efficiency of funding / support (compared to other programmes)
- intended and unintended results of programme.

Programme evaluations are often derived from project evaluation. By analysing the impact on single projects and aggregating the results, information on the policy instrument as a whole can often be derived in a valid manner.

(Source: *International Experiences with Ex-ante and Ex-post Evaluations of Networks of Innovation*, VDI TZ (authors: Silke Stahl-Rolf and Ocke Hamann))

5.1 The programme evaluation process

This kind of evaluation focuses on the core objectives of the programme. In general, the objective of the assessment of CRC programmes is mainly to support the strategic decision-making regarding the future of the CRC-programme.

However, little 'specific' information is available about CRC-programme evaluation. Therefore this text will only contain some general reflections on this evaluation or assessment process.

Typically, the programme evaluation process contains the following elements:

- **Determine a point of reference.** Evaluations need a point of reference, i.e. the measuring of a status-quo without the policy measure in order to be able to assess the impact (“*additionality*”) of the measure. Therefore, an evaluation concept should be developed together with the programme.



- **CRC have a strong focus on industry-sciences linkages.** Assessing the outcome of networking activities: A corresponding evaluation concept should include the following levels :

1) Measuring the impact on linkages between actors and the intensity of networking activities. Questions within this context are for example:

- Did the programme result in new members joining the network?
- To what extent are members aware of the network?
- Did the frequency and quality of the linkages within the network increase?

2) Measuring the impact of increased networking activities on individual performance (innovativeness, competitiveness)

3) Measuring the impact of increased performance on network or regional performance as a whole.

- **Measure the cost-benefit ratio.** Finally, evaluations can reveal whether the investment of public money paid-off in terms of a positive cost-benefit ratio. In Europe, cost-benefit analyses are traditionally used for structuring decision making processes for infrastructure investments. Within the context of supporting networks and R&D policy in general, cost-benefit analyses are of minor importance. In the USA and Canada, however, such perspectives have longer tradition in R&D policy. The basic question in these countries is whether the spending of tax dollars generated income that led to tax revenues equal or higher than the amount of tax dollars spent, i.e. whether the spending of tax dollars has been a positive investment.

Because of the many possible overlaps and communalities between existing CRCs, there is no 100% unique type of Competence Centre. On the other hand, neither are there two CRCs that are the same. Also because the organisational set up, mandate, size and resources of Competence Centres vary considerably there is no one sensible single blueprint that can be designed to assess their impact or define their effective operation.

As a consequence wide range of structures has been used across Europe and beyond.

The variation in models is in part due to the fact that different regions have elaborated their own approach to Centres and in some cases these models have been revised over time to address changing policy objectives. Typical CRC programmes include:

- Kplus, Kind and Knet in Austria
- Engineering Research Centres in the USA
- Cooperative Research Centres in Australia
- KKK Centres in Hungary
- Networks of Centres of Excellence in Canada
- Competence Centres in Sweden
- Top Technological Institutes in the Netherlands
- Kompetenzenetze in Germany
- Funding of Kompetenznetze by the German Federal Ministry of Education and Research

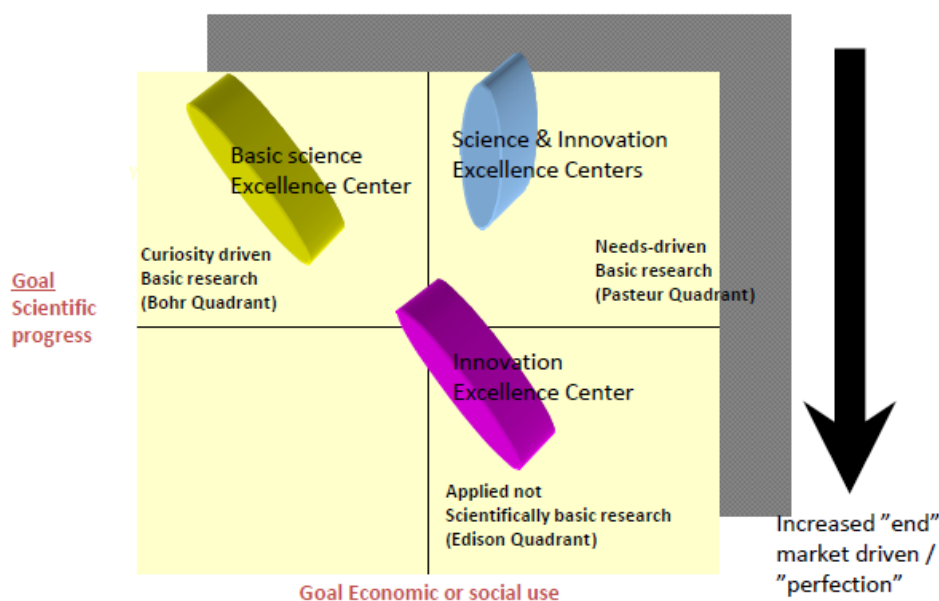


- Competentiepolen in Flanders (Belgium)
- Pôles de Compétitivité in France ...

Some initiatives are strongly based in academia. For those a key objective is to achieve critical mass and to change the behaviour of universities to encourage greater openness to collaborate with industry. Others are more demand driven and aim to get real depth in expertise and facilities as a core support to the development of industry sectors.

Virtual Centres also exist, combining different competences in existing organisations. Here the approach was to develop multi-disciplinary approaches in areas of importance for industry.

Figure 1 Positioning and the dynamic of Competence Centres is crucial to understand the type of impact and time perspective we should expect



Source Donald Stokes, *Pasteur's Quadrant: Basic Science and Technological Innovation*, Washington DC: Brookings, 1997

5.2 Types of CRC programme evaluation

The assessment is essentially a *qualitative* analysis of the impact and realization of the competence centre programmes up to a given moment in time based on expert interviews and available primary documents, supplemented by the analysis of *quantitative* structural data of the centres gleaned from existing documents and reports, as well as on a survey (site visit?) conducted in the centres. In some cases the evaluation is merely a summing up of evaluations of individual CRCs.



By means of an example, in the Austrian evaluation of the KPlus and K ind/net programmes, the most important questions of the assessment are to be summarized as follows:

- 1. Are the concept and the problem definition of the programme adequate? Have decisive framework conditions changed?*
- 2. Have the promotional instruments proven to be appropriate for the objectives (target attainment)?*
- 3. Do the administration and programme implementation meet the basic objectives?*
- 4. How future-oriented are the programme design and instruments? What are meaningful options for the future of the programmes?*
- 5. Which possible perspectives are there for the already existing competence centres and networks after the end of the current promotional measure?*

In order to perform such an assessment it is prerequisite that the objectives of the programme are clearly stated right from the initial programme design. An excellent tool to clarify these objectives is an Logical Framework Analysis (LFA, cf. p. 13-14).

In most cases a foreign consultant is responsible for performing the evaluation.



6. Concluding remarks

In this report it is attempted to give some recommendations concerning monitoring and evaluations and to present some good examples of current practice. The material is drawn both from the most experienced members of COMPERA and overseas colleagues in USA, Australia and Canada.

It should be realised that it has not identified any unique best practice. Still we believe that much can be learned by studying this material and the enclosed more detailed documents from the different agencies.

Monitoring and evaluation (M&E) is important for several reasons

- For CRCs to give them the feedback to improve performance
- For funding agencies to find out if centres are reaching their goals and to improve programme management
- For ministries, politicians and general public to be assured that public money is used properly

Some observations concerning evaluation processes

Successful evaluators are aware of the weaknesses and limitations of their evaluation approaches. In particular assessing the impacts of CRCs is a most challenging task.

Apart from this problem in measurement of impacts, one could feel somewhat uneasy due to the experimental and tailored nature of the evaluation approaches. Even though evaluations should be adapted to the specific needs of the aims of the specific programme, they miss some standardisation and guidelines that would also facilitate comparisons between programmes and on an international level.

Finally, also problems associated with the complexity of evaluating CRCs have been identified. The collection of detailed material may lead to the overburdening of the actors within the CRC network. The time lags that limit the use of evaluations as a management instrument should also be recognised.

Some observations concerning indicators

- It is useful to have some top down indicators common for all centres and connected to the strategic aims of the programme;
- Even if competence centres have much in common, there are also important differences which will influence the selection of indicators;
- Allow centres to formulate their own bottom up indicators which are considered particularly relevant for each centre;



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- The time domain must be taken into account, some impact indicators are not very meaningful in the early phase of a centre;
- Indicators are only one element to be considered in M&E of a centre or programme;
- Case-studies with success stories (nuggets) connected to performance areas may constitute a valuable part of monitoring and evaluation;
- Much can be learned by study of the indicators used for different programmes together with the strategic aims of the programme.



Annex 1

Reference Materials

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<http://www.vinnova.se/In-English/Publications/Products-hidden/15852/>

2. "Goals and key features of an Engineering Research Center and Guidelines for preparing annual reports and renewal proposals" NSF, USA, 2006

http://chaffee.qrc.com/nsf/eng/ercweb/help/ann_rpt_guide.cfm (Evaluation material for ERC)

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4. Self-evaluations of Competence Research Centres, A Manual, IWT, 2009

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<http://www.rcn.no/servlet/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition%3A&blobheadervalue1=+attachment%3B+filename%3DSFIBeskrivelse-engelsk-21102009.pdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1253962224023&ssbinary=true> (2009)



Annex 2

Agenda and Presentations at COMPERA workshops on Monitoring and Evaluation

This study started by collecting information (documents, reports and websites) about the current monitoring and evaluation practices of CRC from COMPERA partners.

Two workshops were arranged, 19th May 2009 in Oslo and 15th September in Ljubljana. Agendas and Presentations from the workshops are available at the COMPERA home page <http://www.comp-era.net/default.aspx>

CRC monitoring and evaluation practices were presented for the following programmes:

- Austria, K-plus and K-ind/net Centres
- Belgium, Flanders, Competentiepolen
- Estonia, Competence centre programme
- Ireland, Competence Centre programme
- Norway, RCN Centres for Research-based Innovation
- Sweden, VINN Excellence Center

These more complete presentations were complemented with sample information from:

- Germany, Kompetenzenetze
- Spain, CRCs in Valencian region,
- France, Experience from French CRCs

As the majority of CRC programmes are rather new, only limited information is available about the end evaluation. As in general the CRC's are intended to be funded only for a specific duration, the end evaluation has little impact on the CRC as it ends anyhow. The end evaluation of CRCs is important input for a CRC programme evaluation.

Similarly only in few regions a programme evaluation has been performed. The issue of programme evaluation including impact measurements could be an issue to be further elaborated in a continuation project.

This report focus on monitoring and the mid term evaluation of centres, and less on the end evaluation and CRC programme evaluation.



Annex 3

List of COMPERA partners

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

Austrian Research Promotion Agency (FFG) – Austria

Swedish Agency for Innovation Systems (VINNOVA) – Sweden

National Office for Research and Technology (NKTH) - Hungary

Enterprise Estonia (EAS) – Estonia

German Association of Engineers - Technology Centre (VDI Technologiezentrum GmbH) – Germany

Service public de Wallonie, Direction générale opérationnelle Economie, Emploi et Recherche (DGo6) – Belgium

National University Research Council - Executive Agency for Higher Education & Research Funding (NURC/UEFISCSU) – Romania

Research Council of Norway (RCN) – Norway

The Ministry of Higher Education, Science and Technology (MHEST) Slovenia

Basque Agency for the promotion of international Research, Development and Innovation, INNOBASQUE – Spain

Regional Ministry for Enterprise, University and Science (CEUC) of the Regional Government of Valencia – Spain

Invest Northern Ireland (Invest NI) – United Kingdom

Basque Government - Industry, Trade and Tourism Department (ITT) – Spain

Associated Partners:

VDI/VDE-IT - Germany

Enterprise Ireland (IDA) - Ireland

