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Preface

This edition of the Plattform's Newsletter presents the results of a remarkable effort under-taken jointly by the Platform for Research and Technology Evaluation and the TAFTIE Network. The Industrial Research Promotion Fund's presidency of TAFTIE in this year created a unique and fruitful opportunity for those interested in research and technology evaluation.

It is a twofold pattern of exchange that yields a large proportion of the benefits that can be expected from evaluation. Firstly, close involvement of policy makers and funding agencies is of vital importance in order to ensure a successful feed-back of evaluation findings into the policy cycle. Secondly, international exchange can help to overcome national or regional lock-ins.

Therefore, the joint Platform/TAFTIE meeting was a milestone not only in the Platform's history, but also for the Austrian RTD community. It was an outstanding achievement having brought together international policy makers, evaluation practitioners and an expert audience in Vienna. The results demonstrate the increasing importance of evaluation across the international scene of funding schemes which, in turn, paves the way for genuine efforts in the spirit of the European Research Area.

Evaluation, thus, is a fertile ground for establishing common European views and goals, not least also expressed by the weight attributed to evaluation by the European Commission. What is clearly reflected in this newsletter's contributions as an upcoming common denominator is a shift of priorities to monitoring exercises and interim evaluations. This expresses the increased attention evaluation is receiving in the policy cycle: policy makers want to have informations at hand that are immediately relevant to their decision making.

Austria, which is also in line with that mainstream, can only benefit from the exchange within international for a such as TAFTIE. Research and technology policy is a complex learning process requiring the networking of all actors both at national and international levels. The experience with the European benchmarking efforts have already proved that common approaches are a valuable tool for a sound decision making process.

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TAFTIE (The Association For Technology Implementation in Europe) is the European association of national and regional technology and innovation programme management organisations in Europe. 14 TAFTIE Members from the 13 European countries manage technology and innovation programmes for firms and research institutes worth 3.5 billion € per year. They network among themselves to find new European business opportunities for their clients. They also benchmark and exchange good practice to raise the effectiveness and efficiency of their programmes. The FFF is chairing TAFTIE during this year 2003.

The TAFTIE Evaluation Network was established in 1994 to exchange ideas and experiences in the field of evaluation. Members of the Network are people within the TAFTIE organisations with either responsibilities in the field of evaluation and assessment or programme managers with the strong interest in evaluation. During the first years, the network mainly focused its activities on the determination of a set of performance indicators, which can be used for evaluation of programmes. As a result, the „TAFTIE Guidelines on performance indicators for evaluation and monitoring" were published in the end of 1997. Further activities comprise organisation of various seminars and work-shops on evaluation opened also to non- TAFTIE members and interested public. Currently the network deals with the issues of „Evaluation Strategy", „Monitoring" and „Sustainability".

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Rosalie Ruegg

Assessing Portfolio Performance of a Public R&D Program in the Short-to-Intermediate Period: Tools from the USA's Advanced Technology Program

ABSTRACT

Administrators and other stakeholders of public programs seek metrics which will inform overall program performance from the short run through the intermediate period, and into the long run. The USA's Advanced Technology Program (ATP) has used a variety of evaluation methods to measure achievement of its multiple objectives over all phases of its relatively long time horizon. The focus of this paper is on two principal evaluation tools ATP has used to provide measures of portfolio performance in the short-to-intermediate term. They are: (1) the Business Reporting System (BRS), a web-based survey tool that covers all projects and principal participating organizations funded since 1993, following them from project start until six elapsed years into the post-project period, and (2) the Composite Performance Rating System (CPRS), a prototype tool that uses a weighted composite of indicator data to assign each completed project a rating of 0 to 4 stars, with 0 indicating weak overall performance and 4 indicating strong overall performance across multiple program objectives, and the distribution of project scores indicating portfolio performance. This paper briefly describes the two evaluation tools, reviews ATP's use of them, gives examples of findings using each method, and discusses their strengths and limitations.

ATP: A LABORATORY FOR EVALUATION

In its relatively large body of evaluation studies conducted over the past decade, the ATP provides a creative laboratory for learning more about evaluation of R&D programs. The ATP is a relatively young public-private partnership program located within the National Institute of Standards and Technology of the U.S. Department of Commerce[1], Notable features of ATP's evaluation program include its involvement of nationally prominent scholars disseminating findings in peer-reviewed literature; an in-house staff to plan, monitor, conduct, and communicate findings; methodological variety in its evaluation approach; investigation of underlying program theory, monitoring of progress, and assessment of impacts; creative uses of existing methods and tools and support of developing new tools; and attention to best evaluation practices such as measuring against mission and additionality[2]. ATP's evaluation program aims at assisting internal program and project management, meeting official reporting requirements for performance metrics, informing stakeholders of its accomplishments and answering their questions, and promoting greater public understanding of the program, what it does, why, how, and with what result.

PORTFOLIO PERFORMANCE ASSESSMENT IN THE SHORT-TO-INTERMEDIATE TERM

ATP, like its counterparts around the world, has a relatively long time horizon for fully realizing its goals. The advanced, enabling technologies funded take considerable time to research, develop, commercialize, and adopt in multiple applications. Requirements for measures of program performance measures, however, tend to be urgent and frequent, particularly for a politically contested program like the ATP. It is not possible to wait for the program to bear its ultimate fruits before reporting performance. Rather, program administrators need ways of monitoring and assessing program developments and effects throughout the lifecycles of the multiple projects comprising the program's portfolio. At any given point, program administrators are expected to be able to characterize the overall performance of their portfolio of projects.

METHODS FOR DESCRIBING PORTFOLIO PERFORMANCE

The survey method is often a tool of choice for assessing developments and effects in the short-and-intermediate periods of a program such as the ATP. Surveys provide an economical means of gathering aggregate information about a program and its participants, even in its early stages. A survey's statistical results are generally informative to diverse audiences, and the resulting data can be analyzed and reanalyzed and possibly matched with other data. Furthermore, the survey method accommodates the use of control and comparison groups and the collecting of counterfactual information in the test for additionality[3]. The BRS, one of the two tools described in greater detail here, is a survey method.

Though seldom used for portfolio analysis, case study with uniform data collection can also be used for portfolio

analysis. It can be used to capture output and outcome data that can serve as indicator metrics. When there is only a single goal, a single indicator metric or group of closely related metrics may provide clear signals of progress towards goal accomplishment. But when there are multiple goals, and multiple indicator metrics, it may be difficult to get a clear reading of progress across a portfolio of projects based on aggregate, multiple indicators. The CPRS, the second tool described in greater detail here, is based on multiple indicator metrics drawn from short descriptive case studies using a uniform data collection template[4].

ATP'S BUSINESS REPORTING SYSTEM (BRS)

Following two contractor-administered surveys conducted in the earlier years of the program, ATP, in 1993, implemented an electronic survey administered by ATP staff. The purpose was to build an integrated set of databases that would enable the ATP to better monitor progress of projects and participants on a regular basis, gain flexibility needed to generate a variety of analytical reports on a fast turnaround basis, and maintain tight internal control over the proprietary and confidential information provided by award recipients[5].

Reporting Content and Schedule

The BRS consists of five major reporting parts, each due at a different time and each due from each lead organization and most joint venture members for all projects since 1993[6]: (1) Baseline Report, (2) Quarterly Reports, (3) Anniversary (Annual) Reports, (4) Close-out Report, and (5) Post-project Reports.

Baseline Report: On receiving an award, project participants complete a „Baseline Report." The Baseline Report asks respondent to identify planned applications of the technologies they plan to develop. For each planned application, they are asked to identify their planned strategies for commercialization, how they plan to protect intellectual property, and their plans to disseminate non-proprietary information. They are also asked to identify the most central dimension for assessing progress towards accomplishing their overall technical goal, to give start-of-project and end-of-project target metrics for that technical dimension, and also to estimate what its value would be at the time the project is scheduled to end assuming that the project were not funded by ATP (the counterfactual). Information is also collected on collaborative, financing, and R&D activities prior to starting the ATP project for purposes of comparison with experiences during the ATP project. The report is web based.

Quarterly Reports: Quarterly, project participants report any significant business developments, such as the formation of new alliances or licensing agreements related to the project. These are not web-based; rather they are paper reports.

Anniversary Reports: Annually, project participants update their business plans and report progress and experience with collaborative activities on the ATP project, attraction of new funding, filing and granting of patents and copyrights, commercialization of projects and processes, and dissemination of knowledge and technology. The Anniversary Report is web based.

Close-Out Report: At the end of each project, participants give an account of their technical accomplishments against the original project goals. In addition, project participants provide information on continued investment and sales goals over the next five years. They are asked to identify any project-related effects they know about outside their own organization. The Close-out Report is also web based.

Post-project Reports: The BRS tracks projects after ATP funding ends for six years, in reports due every other year, three times for each project[7]. The Post-project Reports are conducted by telephone interview. They seek to update information in the close-out report and to follow progress of the technology as it is commercialized and disseminated by the award recipients, their collaborators and licensees, and other parties identified by project participants[8].

Extensive Use of Counterfactual Questions in the BRS to Test for Additionality

The BRS does not employ control groups, but it does incorporate counterfactual elements throughout the survey. The questions are designed to obtain information not just on the progress and impacts of the projects per se, but specifically of that part attributable to the ATP. In order to strengthen evidence of a causal relationship between the ATP and the project developments, ATP added control groups to the two more recent surveys conducted outside of BRS[9].

Evaluation Studies and Findings based on BRS Data

ATP has issued two reports that broadly cover results from the BRS database-one in 1997 covering participants and projects funded from 1993–1995, and the second in 2000 for projects funded from 1993–1997[10]. These two reports, which showed a high degree of consistency in results, provided statistical results on progress toward research and commercialization goals. They provided evidence of leveraging effects of the program on private sector R&D expenditures, accelerating of R&D and reduced time to market, substantial collaborative activities and associated advantages and disadvantages experienced by collaborating organizations, the extent of new and improved product and process development, technology diffusion and the generation of spillover benefits. In the second report, participants in 261 projects identified 1,200 different uses of their technologies under development, spanning the spectrum of industries. A few other examples of statistical results from the second report are the following: 86% of participants reported accelerating their R&D and a similar percentage reported collaborative activities; industry reported a 58% increase in their own expenditures in the ATP-funded research area due to ATP funding; 73% of participants reported they took on higher technical risk due to receiving the ATP award; for 64% of projects in the database a production prototype was completed for at least one application of the ATP-funded technology; and 17% of companies reported earning revenues from their ATP-funded technology.

The BRS database also supports special topic reports and allows ATP to provide answers to many stakeholder questions. Focused topic reports from BRS include a comparison of small companies and larger companies in their progress towards commercial goals[11]; and a study of how different areas of technology have different timelines for realizing commercialization progress[12].

COMPOSITE PERFORMANCE RATING SYSTEM (CPRS)[13]

The CPRS was developed under contract to allow ATP administrators to answer a stakeholder question of some urgency: How are projects in ATP's portfolio performing overall against ATP's mission-driven multiple goals in the intermediate period after project completion and before long-term benefits are realized? The CPRS is constructed from multiple indicator metrics-uniformly compiled output, outcome, and outlook data drawn from case studies conducted for all completed ATP projects a few years after ATP funding ends. In the intermediate period, the indicators of focus provide evidence of progress in three dimensions: (1) additions to the nation's scientific and technical knowledge base, (2) dissemination of knowledge, and (3) commercialization by the award recipients and their partners and collaborators of new and improved products and processes from the technology developed.

Star Ratings of Projects and Distribution of Ratings across the Portfolio

The indicator data are weighted and combined to produce a numerical score that is converted to a 0 to 4 star rating system, with the weakest performers assigned 0 stars, and the strongest, 4 stars. The CPRS allows the portfolio of projects to be characterized in terms of the resulting distribution of project scores. For example, application of the CPRS to the first 50 completed ATP projects generated the following distribution of projects by performance: 16%, 4 stars; 26%, 3 stars; 34%, 2 stars; and 24%, 1 or 0 stars. This performance distribution is in line with expectations of program administrators for the high-risk research projects selected by the ATP; indeed, it is a tenet of the program that some failure must be expected if projects are tackling difficult-to-accomplish technical challenges.

Part of a Multi-Step Approach Rooted in Case Study

The CPRS is rooted in a multi-step approach that starts with project case studies using a uniform data collection template to generate output and outcome data, which together with outlook assessments, provide indicators of progress. Recently, the BRS is used as a supplementary source of data for indicator metrics used in computing a CPRS score for each project. The distribution of CPRS scores across the portfolio is examined. In addition, key indicator statistics are aggregated, and estimated minimum net benefits for the portfolio and program are computed by aggregating benefits from a limited number of case studies that feature detailed economic benefit estimates. The result is a system of interlinked levels of information that provides a versatile evaluation resource. Program administrators can take a top-down approach, starting with the portfolio distribution of CPRS scores and tracking down to the details of individual project case studies for more information. Project managers can take a bottom-up approach, starting with the individual projects assigned to them and tracking up to the portfolio level to learn how their projects or technology areas are performing relative to the broader portfolio. Figure 1 illustrates the interlinked, multiple level system of which CPRS is a part.

CPRS Formulation and Implementation

The indicators selected to signal progress towards each program goal are identified, weighting factors are developed and applied to each indicator, the resulting values for each goal are aggregated, and the aggregate scores are converted to stars. CPRS is implemented via a spreadsheet, which contains the weighting algorithms for computing composite scores.

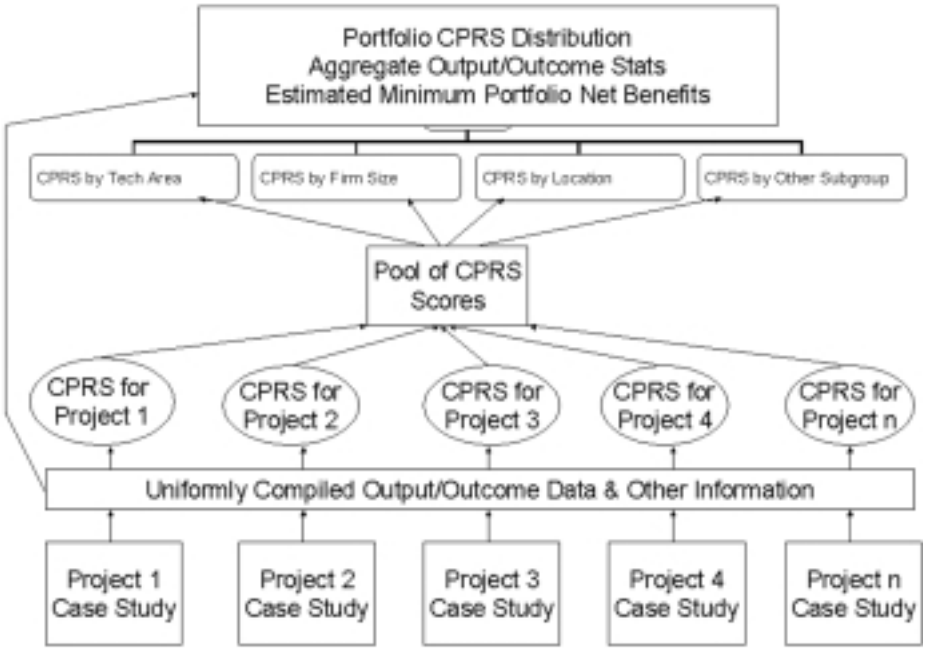

Figure 1: CPRS Embedded in a Multi-level Evaluation Framework Rooted in Case Study*

The CPRS has been developed in prototype for use by ATP. Other programs with different missions, different goals, and different time horizons could adapt the approach but would need to identify appropriate indicators and determine how each is to be weighted and combined.

Strengths and Limitations of CPRS

The CPRS provides an easy-to-grasp management and communications tool capable of highlighting overall portfolio performance and showing which projects exhibit strong outward signs of progress towards program goals, and which, moderate or few signs of progress, during the intermediate period of a project's life-cycle. It has been used by ATP for portfolio management and to brief ATP oversight and advisory bodies, public policy analysts, evaluation groups, the broader S&T community, and the general public about ATP's performance during the period of focus.

There is considerable precedence for using composite rating systems in a variety of applications. These applications share the characteristic of an ad hoc development stemming from the absence of existing theory to direct the selection of variables and the specification of weights used in their construction. The development of these systems is empirically driven rather than theoretically based, and relies on judgment regarding appropriate weighting of indicators. Moreover, the prototype CPRS formulated for ATP's use was constrained by the kinds of existing indicator data available for ATP's first 50 completed projects, and was influenced by the range of values for those first 50 projects. CPRS scores do not provide an estimate of benefits; rather the scores signal intensity of progress towards goals. For this reason, and also because project performance may change downstream, projects with similar CPRS scores for projects do not necessarily equate with similar long-term net economic benefits for those projects.

CONCLUDING COMMENTS

Administrators of public R&D programs need tools that help them assess, manage, and report progress and performance of their project portfolios over the short-, intermediate-, and long-term periods. This paper has focused on two tools used by the ATP to assess portfolio performance in the short-to-intermediate timeframe. The Business Reporting System, a web-based, regularly administered survey of project participants, provides a large database that is used to monitor progress, answer a multitude of questions about the program, and help meet reporting requirements. The Composite Performance Rating System, based on output and outcome data from completed-project case studies, provides easy-to-grasp performance ratings of projects and the portfolio of projects against multiple mission-driven goals. In addition to these tools, ATP uses a variety of

other evaluation methods, including econometric and sociometric analysis, bibliometric methods, and benefit-cost analysis.

[1]The ATP was established in 1988 under Title V (Technology Competitiveness Act), Subtitle B of the Omnibus Trade and Competitiveness Act (Public Law 100-418). It received its first appropriation in fiscal year 1990. The ATP was charged with accelerating the development and commercialization of enabling technologies by sharing with industry the costs of high-risk research, through a process that fostered collaboration among firms and other organizations, added to the scientific and technical knowledge base, engaged small firms, and resulted in wide-spread benefits extending well beyond the direct funding recipients.

[2] A broad treatment of ATP's evaluation program over its first decade, including all the methods used, is provided by R. Ruegg and I. Feller, A Toolkit for Evaluating Public R&D Investment: Models, Methods, and Findings from ATP's First Decade, NIST GCR 02-842 (Gaithersburg, Maryland, USA: National Institute of Standards and Technology, 2003).

[3] Survey also has limitations and potential problems. For example, data resulting from opinion questions have a strong subjective element; there is the possibility of incorrect responses resulting from faulty recall or a purposeful intent of respondents to bias results. Survey statistics lack the memorable details of the case study. Nevertheless, survey is a component tool of most if not all public program evaluation efforts. Indeed, the results of a recent benchmarking workshop found the use of the survey method prominent among all the participating programs. See R. Ruegg, Benchmarking Evaluation of Public Science and Technology Programs: United States, Canada, Israel, and Finland. Tekes reports of R&D impacts, January 2003.

[4] It is also likely that the indicator data used in constructing the CPRS could have been collected by survey. Using a survey, however, would not support the multi-stage structure of which the CPRS is one component. The case study method, therefore, is essential to the CPRS as presented here.

[5] Since implementation of the BRS, two additional special purpose surveys, outside the scope of the BRS, have been sponsored by the ATP. One survey was of 1998 applicants, including award recipients and non-recipients, on the leveraging effects of ATP. See M. Feldman and M. Kelley, Winning an Award from the Advanced Technology Program: Pursuing R&D Strategies in the Public Interest and Benefiting from a Halo Effect, NISTIR 6577 (Gaithersburg, Maryland, USA: National Institute of Standards and Technology, 2001). The other was a survey of 2000 applicants that built on the survey of 1998 applicants to assess overall characteristics of applicants and to compare ATP effects on award recipients and non-recipients. See Advanced Technology Program, The Survey of ATP Applicants 2000, in press 2003.

[6] Not all project participants report on planned commercial applications, because those organizations in joint ventures that have a purely research or minor support role and have no plans to commercialize the results of their effects do not report plans for commercialization.

[7] Due to the relatively short life of the ATP, none of the projects yet has been tracked the full six years after project end.

[8] Commercialization activities by those who acquire the technology through the open literature, review of patents, reverse engineering of products, mobility of researchers, or related methods are not systematically captured by the BRS, and generally are approached through bibliometric and case-study methods.

[9] See Feldman and Kelley (2001) and ATP, Survey 2000 (in press, 2003).

[10] J.W. Powell and K.L. Lellock, Development, Commercialization, and Diffusion of Enabling Technologies: Progress Report for Projects Funded 1993-1997, NISTIR 6491 (Gaithersburg, MD, USA: National Institute of Standards and Technology, April 2000); and J.W. Powell, Development, Commercialization, and Diffusion of Enabling Technologies: Progress Report for Projects Funded 1993-1995, NISTIR 6098 (Gaithersburg, MD, USA: National Institute of Standards and Technology, December 1997).

[11] J. Powell, Business Planning and Progress of Small Business Firms Engaged in Technology Development through the Advanced Technology Program, NISTIR 6375 (Gaithersburg, MD, USA: National Institute of Standards and Technology, October 1999).

[12] J. Powell and F. Moris, Different Timelines for Different Technologies: Evidence from the Advanced Technology

Program, NISTIR 6917 (Gaithersburg, MD, USA: National Institute of Standards and Technology, November 2002).

[3] R. Ruegg, Bridging from Project Case Study to Portfolio Analysis: An Eight-Step Approach Incorporating a Composite Performance Rating System, NIST GCR (Gaithersburg, Maryland, USA: National Institute of Standards and Technology, May 2003, in press).

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U.S. Congress, Title V (Technology Competitiveness Act), Subtitle B of the Omnibus Trade and Competitiveness Act (Public Law 100–418).

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How to Make Monitoring and Evaluation Match Better? The Case of the Austrian A*plus*B Programme

The Austrian AplusB (Academia plus Business) Academic Spin-off Programme funds innovative, technology-oriented spin-offs in the academic sector. AplusB provides professional support for scientists in the difficult process of turning good ideas into viable businesses.
The rationale for the programme both for Academia-researchers in closed rooms and for Business-running business men are shown in the following picture:

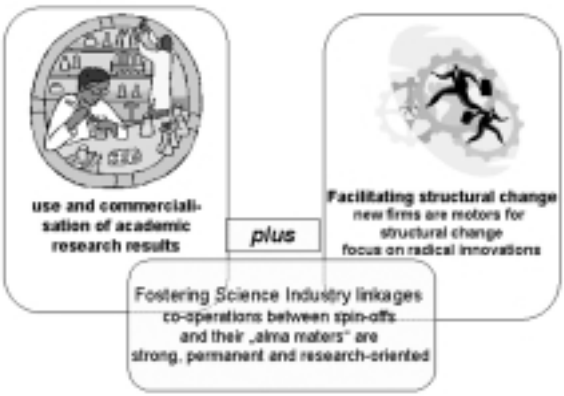

Figure 1: Why Academic Spin Offs?

The programme was launched in 2001, and during the design and the fine tuning process in designing, Programme Manager and Evaluators made some effort to achieve a better match of monitoring and evaluation.
The motivation was:

- To fix a well planned evaluation scheme right from the beginning of the programme
- To exploit potential synergetic effects between Evaluation and Monitoring
- To enhance the quality of data for both, Monitoring and Evaluation
- To ensure transparency for those, who will be evaluated
- And last but not least, to fight „questionnaire burn-out" and „evaluation fatigue".

During discussing this, we realized that this is the ideal moment for „matching". The programme was at its beginning and Programme Managers and Evaluators (the project team) had still sufficient degrees of freedom in designing the evaluation scheme and the monitoring system.
At the end of the co-operation the project team has developed several products, a publishable evaluation scheme and a monitoring system, which takes evaluation needs into account.

EVALUATION GAPS

Evaluators are not unaware of the users' aspects of their studies or – more general – their outputs.
Because several groups are involved „in the evaluation game" several levels of users have to be taken into consideration:

- Those who are commissioning evaluations,
- Those who are performing evaluations and
- Those being evaluated.

All these groups have different interests and strategies which causes interferences and turbulences between these groups.
In recent evaluation literature (Boden, Stern 2002; Georghiou 2001), part of these interferences and turbulences are well diagnosed: so called delivery and customer gaps:

What policymakers want	What evaluators say
• Information in time for sending decision	• Research may take years to have effects
• Clear attribution of effects to investment	• Linear model is a rare case and additionality is complex to assess
• Independent evidence of research excellence	• Peers defend their subjects field & international colleagues
• Key indicators to monitor & benchmark	• Crude regime distorts performance & can be manipulated

Table 1: The Delivery Gap

„The delivery gap illustrates what policy makers would ideally want from an evaluation to inform policy decisions and what Evaluators believe is actually feasible"
„In the converse situation, Evaluators ideally need to have a clear, comprehensive and logical picture of the programmes they are evaluating, together with freedom and adequate resources. However, the real world of the policymakers is also complex and constrained." (Customer Gap)

What evaluators want	What policymakers say
• Clearly defined & hierarchical objectives	• Programmes are a compromise involving multiple & confliction objectives
• Guaranteed independence	• Recommendations must be within realistic policy constrains
• Time & resources to do the job	• We need the results in three months
• Full access to information and stakeholders	• Everyone is overworked and busy

Table 2: The Customer Gap

There are two little examples that may illustrate these gaps: It's not unusual that policy makers want clear information about the impacts of a programme as fast as possible (e.g. for funding decisions). Evaluators would answer that it takes years to have measurable effects.
During an evaluation the Evaluator might need accurate information from a high level policymaker and therefore an in-depth interview with this person, which is overworked and busy (and has in fact no time at all for this).
In diagnosing the turbulences and interferences mentioned above, there is one blind spot –„gap"– between Evaluators and program managers: An Evaluator's definition of useful developments and data collections within a programme might slightly differ from the one of a Programme Manager.

What Managers say	What Evaluators answer
• Look at this nice development	• Where are the social returns?
• We collected lots of facts about our projects	• Not a single number is a useful additionality measure!

Table 3: The Management Gap

EVALUATION SCHEMES

Moving from diagnostics to some words about how policymakers, Programme Managers and Evaluators can try to overcome these gaps.

„Good Evaluation" Requirements

- Think of evaluation right from the start of a programme
- Specify objectives carefully
- Establish transparency and fairness
- Connect objectives, monitoring and evaluation (close the gaps)
- Facilitate the communication between different actors (policy, Managers, Evaluators, those who are evaluated) Use and implement evaluation Results Especially transparency on the one hand enhances fairness and on the other hand enables the collection of the right data at the right time. Moreover, evaluation schemes should be „fair" to Programme Managers too. There is no sense in implementing a too ambitious system for a small programme.

  Anyway, evaluation systems should systematically answer questions:
- At what point of time in programme life should be evaluated?
- What's on the evaluation agenda?
- Who will evaluate? Peers? Evaluation Experts?
- What are the consequences of evaluation?

Setting the system into action:
THE A*plus*B IMPULSE PROGRAMME

As in each evaluation exercise the starting points have to be the objectives of the programme. The objectives of AplusB are defined as follows:

- Ensuring a sustainable increase in the number of academic spin-offs;
- enhancing the quality of these new companies (i.e. their technology and knowledge intensity) as well as their likelihood to succeed;
- increasing the potential for spin-offs from universities, Fachhochschule colleges and non-university research institutions;
- enhancing the exploitation of research results by business;
- supporting other technology transfer measures. These objectives define the programme's general orientation and also form the basis of its funding guidelines. To realise these aims the impulse programme promotes and subsidises the foundation and operation of AplusB Centres.

AplusB Centres assist in the preparation of academic spin-offs by providing professional support for scientists in the process of turning a good business idea into a viable business. This involves not only counselling and assistance during the actual start-up phase but also establishing the idea of entrepreneurship more firmly in academic theory and practice.

MONITORING AND EVALUATION WITHIN A*PLUS*B

For setting up an evaluation system it has to be distinguished between the evaluations of the single AplusB centres and the evaluation of the programme itself. Since programme evaluation is a task of the responsible ministry, we concentrate on the evaluation of the AplusB centres (project evaluation). Programme evaluation is taken into account only as far as the results of the evaluations of the centres will serve as an appropriate input for it.
First, transparency and a sound planning process need a clear system of „when-what-who-why" for each of the evaluation steps. For the AplusB programme this systems looks as following:

	Ex ante Evaluation (apprais al)	**Interim Evaluation**	**Interim Evaluation**	**Ex post Evaluation**
Point ot time ("When?")	Before start	3rd year	5th year	After 10 years
Subject of evaluation ("What?")	Proposal for the years 1-5	Performance: centre	Performance: centre and firms Proposal 6-10	Performance
Evaluator ("Who?")	Jury	Expertes and TIG	External Experts	External Exoerts
Consequence ("Why?")	Go or not to go	Recommandations	Stop or Go	

Table 4: System

Secondly, evaluation criteria, monitoring and controlling have to be connected. For each of the objectives indicators were formulated as an appropriate measure for the extent to which the objective in question was achieved. The set of indicators is written down in the evaluation guidelines and published in advance (e.g. before the start of the programme). Furthermore, a monitoring system was developed which should guarantee a „good" data collection. „Good" means:

- not bothering the addressed persons and centres too much,
- collecting all data we use and using all data we collect,
- Collecting the data at the best point of time by using a real-time monitoring system.

Taking the objectives „enhancing of the quality of academic spin-offs" as an example the indicators are:

- The share of firms in high-tech sectors
- The growth rates of the firms
- The RTD intensity of the firm

The Collection of data in an appropriate way to create these indicators is task of the monitoring system. For the example we need data about the sector the young firm belongs to, the growth rates of the firm as well as its research intensity. On-line questionnaires for the incubees were developed as part of the monitoring system where these data are demanded at different points of time (entry into the AplusB centre, foundation of the firm, exit, the young firm 1, 2, 3 and 4 years after start-up).

The advantages of this real-time monitoring system are the very high quality of the data, the easy and cheap access to it and last but not least the creation of a comprehensive data base which will be an input for the evaluation in the third and the fifth year.
Lots of effort has been made to establish a sound Monitoring and Evaluation System within AplusB. We wonder if Evaluators of the Three-Year and of the Five-Year Evaluation could find it useful.

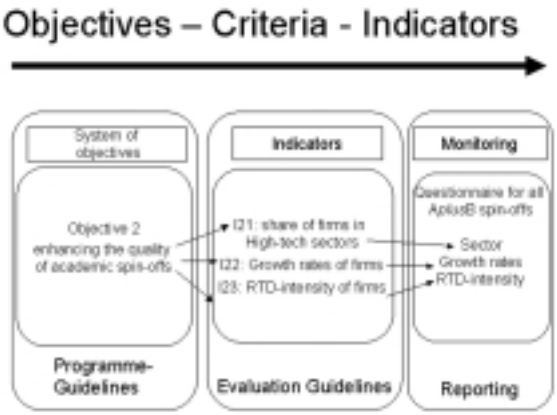

Figure 2: Objectives, Criteria, Indicators

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Strategies Behind VINNOVA's Evaluation Policy

ABSTRACT

The Swedish Agency for Innovation Systems – VINNOVA – is a young organisation, the result of merger in January 2001 between three former R&D funding agencies in the areas of technology, transportation and work life research. A new strategic plan for the period 2003–2007 has recently been adopted. Now, an evaluation policy is being formulated that is expected to match the ambitions of the new strategic plan.

The paper describes the different kinds of evaluations that will be given priority. They will be implemented with the help of a policy, a planning process and a central evaluation function. The different motives underpinning the policy are discussed.

A frame of reference has been found helpful when discussing different aspects of the proposed policy. It is composed by a set of questions, proposed by Jon Hekland of the Research Council of Norway, that is meant to serve as a basis for mutual learning between the TAFTIE members' as regards the use of evaluation policies. The questions are appended to this paper.

INTRODUCTION

This paper describes VINNOVA's thinking as of March 2003 as regards evaluations aiming at strengthening the governance of its activities. Therefore, the focus is on aspects such as programme strategy, relevance for intended users of results, programme effectiveness, quality of financed researchers and expectations on future impact as the most common general objectives for our evaluations. Each evaluation has to be defined in detail before initiation (why is it needed? how will the results be used? who will be the key receivers of the results? at what moment in time? etc) and the results of this process guides the formulation of objectives for the specific evaluation and also the competence asked for when the call for tenders is being formulated.

Since two years VINNOVA is giving impact assessments a high priority. We feel that there is little experience available as regards the impact of R&D actions in a 10–25 year perspective. Four pilot studies have been concluded and three more are under way. These assessments are however seen as a separate activity at VINNOVA and are not further discussed in this paper.

A third point regards VINNOVA's dialogue with the government on tasks given and results achieved. Occasionally, evaluations are initiated to underpin this dialogue. However, most reports on results are based on separate analyses and on monitoring efforts. The outcomes of evaluations are regularly summed up and included in the reports to the government, however, this dialogue is not seen as a major priority for our evaluations.

THE FRAME – VINNOVA'S ACTIVITIES

In the year 2002, VINNOVA's activities could be summed up as 103 different actions within a total budget of around 110 million euro. Consequently, each action was fairly small, the yearly ratio cost being around 1million euro. These actions differ individually as regards the programme strategy and in what way they are being implemented. In short, VINNOVA's toolbox may be summed up as a family of 5 different kinds of R&D programmes plus different centres of excellence, programmes aiming at strengthening regional innovation systems, market oriented tools such as an incubator programme and, finally, funding of institutes and international R&D co-operation.

The heart of the new strategic plan 2003–2007 is to take a broader grip. Thus 23 prioritised areas of activities, called 'programmes', have been defined, mainly by means of sectorial innovation system studies (comment: sectors such as telecom systems, green materials, innovative foods). Initially, each programme is be composed by ongoing actions, or 'sub-programmes', e.g. two R&D programmes, a competence centre and an institute. Step by step, these ongoing sub-programmes will be replaced by new sub-programmes, which might also involve the use of new tools. VINNOVA's focus on larger programmes is complemented by a number of matrix functions that regard particular aspects, e.g. central responsibilities for all competence centres, for all institutes and for all international R&D co-operation.

PRIORITIES REGARDING WHAT VINNOVA INTENDS TO EVALUATE

Which evaluations should VINNOVA give priority? What should they focus on? How often needs an ongoing action be evaluated?

In this section a view on VINNOVA's needs for evaluations is expressed. The point of departure is a hierarchical model of the organisation, please see the figure below.

Evaluations motivated on the policy level

Policy evaluations are intended to meet needs expressed by the board, the top management or the director of a division. These evaluations may address issues such as: how well does VINNOVA meet its main objectives? how well does a specific tool function? how well does VINNOVA perform vis-à-vis SME's? how well does VINNOVA perform from a regional perspective? etc. Long term commitments, such as funding of institutes or a 10 year competence centre programme, may need a cyclic approach, i.e. that they are evaluated on a regular basis. A third category could be the evaluation of two or more programmes together, which could be motivated when they are related to each other in one way or another.

VINNOVA has a limited experience of evaluations on this level. The planning for and initiation of policy evaluations will depend on a supportive body to provide the appropriate resources.

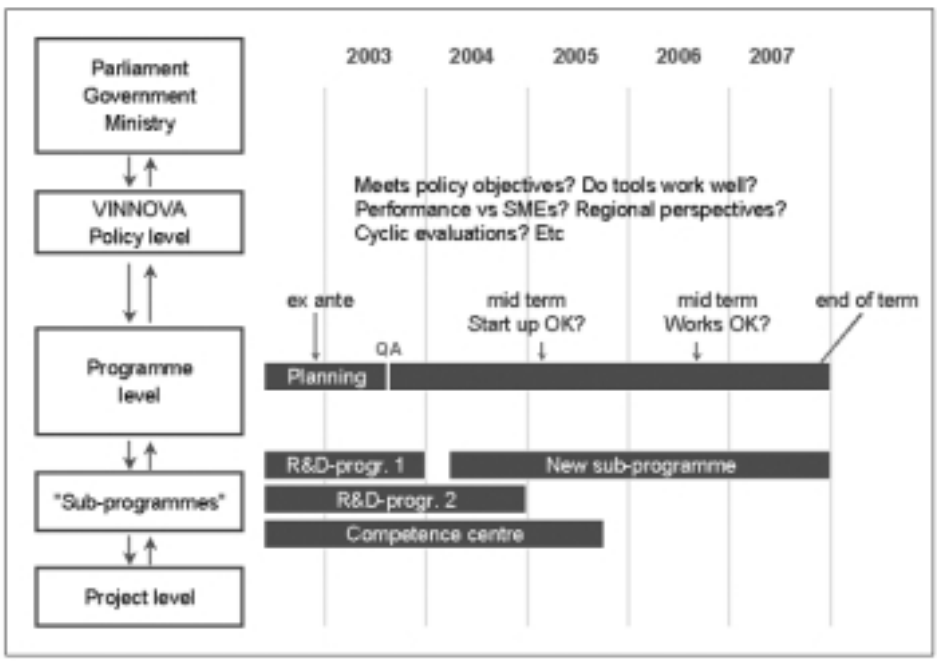

Figure 1

The figure is meant to illustrate how VINNOVA's new, larger R&D programmes are composed by ongoing sub-programmes, which after some time are being complemented, or replaced, by new sub-programmes. Needs for various evaluations on the policy and programme levels are indicated.

Evaluations motivated on the programme level

VINNOVA's experience from more than 150 evaluations during the last decade shows that mid term evaluations are helpful. These evaluations need to be concluded at such a moment in time that they can underpin decisions on future activities (good timing is important). Since a terminated programme mostly is followed by a new programme, building on experience from the old, also end-of-term evaluations often serve a mid term function.

VINNOVA is presently introducing a thorough planning procedure, where a basic element is sectorial innovation system analyses that can enlighten the rationale for a VINNOVA programme and what it should achieve. A quality assurance procedure, building on in-house experience, is being set up to comment on a proposed programme has to be passed before a go ahead decision is taken (ref. DTIs ROAMEF statements). A central part of that procedure is to review an ex ante evaluation of the proposed programme, i.e. an analysis of which impact is foreseen and how it may be observed.

The general approach on this level regards programmes that are foreseen to be implemented in two or more phases. Since the approach with larger programmes that are composed by a number of sub-programmes is new, there may be a need for early mid term evaluations, aiming to check whether the start up of the programme has been successful, maybe after year two. Normal mid term evaluations could then be foreseen on a regular basis prior to decisions on a following phase, e.g. every three or four year. A description of the need for these evaluations, and what they should focus on, is an obligatory part of the programme proposal.

Should 'warning signals' appear that a programme does not function well in one or other respect, this could motivate an ad hoc evaluation, both as a mean to understand the nature of the problem and to suggest ways and means to deal with it.

These evaluations are foreseen to be motivated and initiated by a central evaluation function, please see below.

Evaluation of sub-programmes

Within an ongoing programme, the programme management (programme manager and programme board) may find a need to take a closer look at a sub-programme. One example could be to reflect on a chosen sub-programme strategy. Another example could be to check the competence of the researchers financed by a sub-programme by a peer review evaluation. These evaluations will be initiated by the programme management itself and make part of the programme budget. VINNOVA's central evaluation function will assist with expertise on demand.

Real time evaluation (interactive research) of new tools

For the situation when new work methods (tools) e.g. programmes aiming at strengthening regional innovation systems, are put into practice, a new evaluation method is being used. Independent researchers are asked to monitor the implementation of the programme and to do analyses, in order to understand the programme mechanisms, and to give advice to the programme management. These evaluations make part of the programme strategy and are also initiated by, and paid for, by the programme management. (Comment: Real time evaluation as such is not new, however, real time evaluation by researchers who at the same time do research on the tool they are evaluating is a new practice at VINNOVA.)

MAIN POINTS OF PROPOSED EVALUATION POLICY AND PLANNING PROCEDURE

In short, the proposed evaluation policy is made up by the following points:
VINNOVA gives priority to independent evaluations of its R&D programmes and other actions as a mean to improve its effectiveness, in order to

- learn from experience in order to improve programmes and tools,
- improve VINNOVA's policy on agency and division levels,
- describe outcomes and impact of its actions ('VINNOVA shall understand the impact of its actions and make them known').

To be useful, VINNOVA's evaluations build on a relationship with those involved in VINNOVA's programmes, with a common interest to develop and improve. For that reason, feedback to those evaluated is important. At the same time, it is considered vital that the evaluators that VINNOVA chooses to engage are capable of a critical distance to what they are asked to assess.
VINNOVA (board, top management, organisation) involves itself in demanding for and benefiting from the evaluations. The processes to formulate needs for evaluations and to make use of the results are seen as important as the studies themselves.
VINNOVA's evaluations are foreseen in a yearly planning process with a three-year perspective. Apart from the these plans, evaluations may be initiated ad hoc when clear needs exist.
An analysis of the needs for evaluations during the implementation of a programme is an obligatory part of the programme proposal, on which the decision to finance the programme is based.
Evaluations of VINNOVA's programmes are initiated and commissioned by a central evaluation function, in order to secure that a good quality is being maintained, that all actions are being evaluated and that VINNOVA's reputation for transparency and objectivity is kept at a high level.
Evaluations of VINNOVA's sub-programmes remain the responsibility of the programme managements. The central evaluation function is expected to assist with expertise when requested.
Evaluations are initiated only when there is clear evidence why it is needed, when the results need to be presented, who the main users are and, as a consequence of these considerations, on which issues the evaluation should focus.

TASKS GIVEN TO THE CENTRAL EVALUATION FUNCTION

In order to be able to implement VINNOVA's evaluation in accordance with the policy, a central evaluation function needs to be given a number of responsibilities:

- to arrange a planning process yearly, where the evaluations during the coming three years are identified,
- to plan, initiate, procure and implement all evaluations on programme and policy levels,
- to arrange processes that involve main users, both when an evaluation is being planned and also when the results are presented, in order make them understand the nature of the results,
- to see to that evaluation reports are kept available,
- to define and request monitoring systems needed to collect and store information that evaluations later on are dependent on,
- to keep VINNOVA updated as regards the state of the art, e.g. by participation in national and international networks of expertise,

- to produce guidelines and other information on good practices and experiences and make available to VINNOVA's staff and, last but not least, to assist the planning and quality assurance of new R&D programmes.

COMMENTS ON THE UNDERLYING STRATEGY:

Aspects to consider

When deciding on the content of VINNOVA's evaluation agenda there is a number of issues to consider: How ambitious needs a singular evaluation be, e.g. in terms of evaluation cost in relation to programme cost? How often should a programme be evaluated, i.e. which cycles are needed? And at what phases of the programme implementation is there a need for evaluation (ex ante, mid term, end of term, ex post)? Which arrangements are needed in order to make good use of the results of an evaluation?

There is also a number of problems that needs to be avoided, e.g. that some of the agency's actions are well evaluated, whilst others to a limited degree or not at all; that some evaluators are routinely chosen because they are well known; that the evaluator is contracted by, and thus dependent on, the individual responsible for the programme to be evaluated.

Some comments

VINNOVA's approach may be summed up by the following elements:

- a centralised responsibility for evaluations on policy and programme levels, while decentralised on the sub-programme level
- formulation of the needs for evaluations in the programme planning process, that is followed by a quality assurance process, and through an annual evaluation planning process
- a central evaluation function, which reports to the top management, is given own budget for planning and implementing the evaluations,
- a major importance is given to processes that encourage good use of the evaluations,
- the central evaluation function is given the responsibility to see that appropriate monitoring functions are being put in place.

As mentioned, the evaluation agenda is composed by evaluations foreseen in programme plans and confirmed in the yearly plan for evaluations plus those ad hoc-initiated evaluations, that are initiated when strong reasons for them appear. However, all evaluations cannot be stated to be equally important. It may be reasonable to omit a planned evaluation, e.g. when other information says that the programme in question works well and a previous evaluation gave positive notes not so long ago. The question then is: how should various needs and principles be balanced against each other? VINNOVA's solution is to define a budget frame for all evaluations that are centrally initiated. The size of this budget frame has not yet been decided on, however, the interval 1,0–1,5% of VINNOVA's annual budget is being discussed. (Also, the evaluation function as such must be given adequate resources as regards the number of personnel and their competence.) This way, the arguments for different evaluations have to be weighed against each other and the basis for decisions made clear. Furthermore, it has to be observed that the need for evaluations to some degree depend on the government's priorities as regards R&D funding, which is made in a four-year cycle. Consequently, the number of evaluations may be higher some years than others, which should be observed when deciding on the evaluation budget.

The involvement of programme managers and programme boards is important because they are the ultimate users that have to act upon the results of the evaluations. At the same time, as mentioned, a too decentralised responsibility for evaluations may invite problems. VINNOVA's solution is to create involvement from the organisation through the yearly planning process, while the actual decision on which evaluations to implement, on programme and policy levels, is taken centrally. A prerequisite for a good result is that the evaluation function is capable of building up legitimacy based on competence and integrity.

Ex post evaluations on the programme level are not mentioned, for the very reason that there is no demand for these. There is no organisation at place to react on the results at this moment in time and all decisions on future financing are already taken. Therefore, ex post learning, which of course is of great interest, is formulated and achieved through evaluations on the policy level.

Useful frame of reference

During the process to formulate the evaluation policy, the TAFTIE questionnaire has been used as a checklist, to see whether various aspects have been observed. Our impression is that about every aspect brought up in the questionnaire has been dealt with. We found the questionnaire helpful and believe that it will prove useful also for the TAFTIE Evaluation Network. Please see the appendix.

APPENDIX:
Questionnaire re. the Evaluation Practices of Taftie Agencies, proposed by Jon Hekland, Research Council of Norway

Evaluation policy remains a key issue for the TAFTIE Evaluation Network. Which features characterize a well-performing evaluation function?
In order to establish a standard template for gathering and comparing information between the member agencies, the following draft questionnaire has been proposed (Jon Hekland, RCN, January 17, 2003).

Section I Three basic tasks of the evaluation function

The Quality of documentations provided by the evaluation function depends on that the evaluation documentation is:
- Explained, i.e. explicit conceptual framework
- Complete, i.e. all relevant information included
- Precise, i.e. adequate details of descriptions provided
- Updated, i.e. not obsolete descriptions
- Contextual, i.e. external factors of influence adequately treated
- Readable, i.e. adapted to readers' capabilities

The quality of assessments provided by the evaluation function depends on that the evaluation assessments are:
- Transparent, i.e. explicit preference structure
- Evidence based, i.e. clear relation between evidence and assessment
- Complete, i.e. all relevant issues considered
- Independent, i.e. unrelated assessors
- Competent, i.e. assessors knowledge relevant and sufficient

The quality of recommendations provided by the evaluation function depends on that the evaluation Recommendations are:
- Theory based, i.e. proven methods of analysis (lines of reasoning) applied
- Systemic, i.e. actors, forces and dependencies adequately modelled
- Complete, i.e. all relevant alternatives analysed
- Costs, i.e. resource requirements spelled out
- Benefited, i.e. gains explained
- Distributed, i.e. distributional effects identified (who gains, who loses)
- Compensated, i.e. ways of compensating losers identified

Section II Embeddedness of the evaluation function

The evaluation function is embedded in the organisation as regards:
- Strategy process defines evaluation programme
- Evaluation function reports directly to Board and Director General
- Evaluation function mandated and budgeted to initiate evaluations across agency operations
- Line management regularly demands evaluation services
- Evaluation recommendations are systematically followed up at all management levels
- Information collected by evaluations constitute dominant content of agencies MIS (management information system).
- Monitoring (IT-) system is purposefully designed to service evaluations
- New evaluation tasks/objects are identified by performance analysis based on MIS content.

Section III The evaluation function's capability to impact

The evaluation function impacts as follows:
- Evaluation function works proactively to drive the innovation policy agenda
- Evaluation function prepares evaluation studies to fit innovation policy debates
- Evaluation function is capable of presuming 'next hot policy issue' and design evaluations to service knowledge needs accordingly
- Evaluation function is the major information service provider for agency's strategy process
- Evaluation function provide inputs of decisive importance to line managers continuous work for improving operations

Section IV Implementation of the evaluation function

The evaluation function is implemented as follows:
- Professionally independent organisational unit
- Adequately staffed by multidisciplinary evaluation professionals
- Adequate study resources available on own budget
- Team based mode of operation
- State-of-the-Art evaluation methods and tools
- Long term and complete data warehousing of all relevant information
- Access to extensive and international network of professional evaluators

- Tender-based commissioning of studies
- Evaluation function itself externally evaluated.

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Paul Schreurs

The Integration of „Sustainability" in Project and Programme Evaluation and Monitoring Practices.

INTRODUCTION AND BACKGROUND

„Sustainability" is one of the new challenges for evaluation and monitoring strategies. It is increasingly included in the mission statement of several TAFTIE agencies (http://www.taftie.org) and subject to ongoing developments. Some funding agencies such as EET in the Netherlands have managed thematic or sectoral programmes targeted to „sustainable development". In other agencies „sustainable development" has been integrated in horizontal research funding mechanisms; i.e. „bottom up" and open to all industrial sectors and technology areas. The latter approach has been adopted by IWT-Flanders in Belgium.

Of course many research funding agencies have been including environmental criteria in research evaluation frameworks as a bonus factor. However, when dealing with policy intentions to give a higher „weight" to research proposals offering a „substantial" contribution to sustainable development, then the need appears for a more consistent and coherent tool with a higher discriminative power. This requirement should be balanced with the tendency towards simplification of evaluation processes in order to keep the additional workload to both applicants and funding agencies at a reasonable level.

In this contribution the approach will be described which IWT-Flanders has adopted to integrate „sustainability" in its existing horizontal research funding programmes. IWT's funding mechanisms can be classified in three main groups:

- Innovation support, focussing on transfer and diffusion of „good practices" (e.g. technological advice, technology watch);Industrial R&D funding, focussing on the normal short to medium term R&D horizon of an individual company or a limited number of companies;
- Strategic basic research or „competence centre" type of programmes with a medium to longer term orientation (i.e. hybrid networks or strategic technology platforms involving academic research groups and economic or social/governmental actors and focussing on more radical innovations and the generation of critical mass).

APPROACH OF IWT-FLANDERS TO INTEGRATE „SUSTAINABILITY" IN R&D FUNDING

Innovation objectives directed towards sustainable technological development (STD):

Sustainable development is a notion with different dimensions (i.e. Agenda 21). In Flanders the option was taken to start from a more narrow definition: „only the environmental or ecological dimension of innovation". A broader ambition will be analysed within the next two years. The following seven key innovation objectives were selected to characterise projects as „STD-prioritised"-projects :

- reduced materials consumption
- energy savings
- reduced emissions
- waste minimisation; prevention of environmental nuisance
- increased use of renewable resources (material, energy)
- enhanced re-use of materials through recycling
- enhanced life cycle of products and processes

Having at least one of these innovation objectives is a necessary condition to be considered as projects entering the scheme.

Ambition level of the anticipated STD-improvement

The relevant indicator is the product of the technical eco-performance improvement and the exploitation potential. In general terms, the importance of a technological innovation for its environmental impact has to be linked to its exploitation potential. The technological performance on itself is not really meaningful if the related new technology is not sufficiently diffused through commercial exploitation. It is preferable to favour technology with a somewhat more limited environmental improvement per unit of product or service but with a broad commercial potential (e.g. large series of products, wide application) than technology with huge environmental performances but with a very limited exploitation potential. Anyhow, all technology projects supported by IWT are assessed not only on the criterion of their scientific or technological quality but also on the criterion of their exploitation potential.

Second, a project has to show a „sufficiently high" ambition level with regard to „Sustainable Technological Development" (STD). What is „sufficiently high"? This has to be appreciated within the type of the research project.

For projects of strategic basic research with an exploitation potential in the medium to long term, eco-efficiency improvements have to be in order of at least 75% (rather „break-through" technologies; factor 4 or 5). For projects with a short to medium term exploitation goal, typically company projects, the eco-efficiency improvement should reach at least a factor 1.5 or lead to a reduction of environmental impact of at least 30%. Both targets are set in comparison with the actual performance of technology today. And in any case, the eco-efficiency levels of the actual best available technology (BAT) should be improved.

(Optional) Quantification of externalities.

In the following cases a more in-depth analysis is requested from the applicants in order to be able to earmark their project as an „STD-Prioritised project" :

- mixed innovation objective(s);
- a combination of both positive and negative environmental impacts with the overall balance being inconslusive;
- unclear ambition level of STD-improvement.

The methodology in this approach has been elaborated in close collaboration with VITO, a research centre in Flanders (http://www.vito.be) specialised in energy and environmental technologies). The methodology proposed is the ECO-indicator approach closely linked to the LCA-methodology (www.pre.nl ; www.factor10.be ; www.ind.tno.nl). Both the environmental improvements as well as the negative effects of the new technology have to be compared and measured in terms of ECO-points in comparison to the (industrial) situation that would be substituted („reference situation"). Not only per „unit" but in relation to the scenarios of commercial diffusion over a period of 10 years after commercial introduction. The average expected ECO-points improvement has then to be „monetarised", assuming that on average 1 ECO-point = 3 €. This gives us a (rough) magnitude of the ecological externalities associated with a technological and commercial successful innovation. If the ratio of these calculated externalities related to the total subsidies applied for, exceed a factor 4, than the project can also be assessed as an „STD-Prioritised project".

Resulting funding mechanism.

The above STD-approach has been integrated in IWT's horizontal funding programmes i.e. bottom-up and open to all technology areas and sectors. First, a given project proposal has to meet basic requirements with regard to technological quality and exploitation potential. Second, it has to be earmarked as an „STD-Prioritised project".

If both conditions are fulfilled, an industrial research project will receive a subsidy bonus of 10 % in addition to normal funding level (in accordance with the European framework legislation on industrial R&D support).

In the case of the strategic research programme with an annual call for proposals a specified fraction of the available budget will be devoted to STD-Prioritised projects (e.g. 15% in 2003 for the SBO-programme) provided of course that these projects meet the basic requirements with regard to technological quality and exploitation potential.Projects which do not qualify as an „STD-Prioritised project" still remain eligible to receive the normal funding without the STD-bonus. However, no funding at all will be provided by IWT if the economic exploitation of the research output would lead to serious potential problems in view of present or scheduled future environmental requirements (exclusion criterion).

PRACTICAL EXPERIENCES SO FAR, EXPECTATIONS AND IMPACT

The STD-approach described above has been operational since may 2002. At this moment, roughly 20% of project applications include a request for the STD-bonus. The materials and process technology areas are well represented in the portfolio of STD-earmarked projects. Therefore, the STD-approach is not „neutral" with regard to technology area or industrial sector. This is not to imply that some technology areas will be excluded from STD-benefits from the start. As an example, it should be noted that the development of software tools (e.g. in the areas of transport and logistics; embedded electricity generation; process control etc..) can be relevant from an STD-perspective when taking the planned exploitation of such tools into account.

The STD-approach has stimulated applicants to consider environmental aspects in a more systematic manner and to provide more quantitative assessments of reduction potentials of emissions and/or waste streams. On the negative side, it should be recognised that secondary negative impacts are often overlooked in practice. LCA-type thinking is still on the learning curve within the Flemish industry. The STD-manual of IWT is perceived by many companies as rather complex. „Window dressing" in the project description could also be the case on the STD issue. However, this is not essentially different for the issues of scientific/ technological or exploitation potential in the project description. A good ex ante assessment and a good monitoring of the execution of R&D-activities is the core responsability of the funding agency in all aspects of the supported projects.

The present STD-approach is perceived as a pragmatic first step. Possible extensions should be considered and may be gradually included (risks and safety aspects; wider social impacts).We have also learned that only the funding of bottom-up industrial research projects as such is not sufficient to contribute adequately to STD. There is indeed a need for a mix of innovation policy instruments including also strategic basic research or „competence centre" type of programmes to trigger more radical innovations and strategic network building.

Finally, it must be clear that a shift of technologies towards sustainable development cannot be the result of a subsidy policy for R&D and technological innovation on itself. A broader mix of policy instruments has to be developed, essentially in the fields of environmental legislations, economical and fiscal instruments, etc… Innovation policy can only be a part of an overall policymaking effort towards sustainable development. But it can and should offer a valid „signal function" that the (only) future for companies and for society is in a sustainable development.

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Merei Wagenaar

Improving Project Management and Monitoring Data: A New Approach of the E.E.T. Programme to Stimulate Sustainable Technology in the Netherlands

INTRODUCTION

The Dutch E.E.T. programme (Economy, Ecology and Technology) supports strategic middle to long-term research and development. One of the main goals is a sustainable economic development. The market launch of the project results should be between 5 or 20 years after the project-start. The E.E.T. programme started off in 1996 and is executed by the E.E.T. programme office, which is a partnership between Novem and Senter.

Three Ministries finance the E.E.T. programme: the Ministry of Economic Affairs, the Ministry of Spatial planning, Housing and the Environment and the Ministry of Education, Culture and Science. Every year approximately EUR 40 million is granted.

This article will give an introduction to the E.E.T. programme. It will explain the background and the outlines of the programme, and focus on a new approach to improve monitoring data and support the project management.

OUTLINES OF THE PROGRAMME

Goal

Goal of the E.E.T. programme is to stimulate large long-term projects, aiming at technological breakthroughs. These breakthroughs are intended to lead to substantial economic and ecological benefits. This should reinforce both the competitiveness of the Dutch industry and knowledge infrastructure.

Themes

The E.E.T. programme focuses on five environmental themes:
1. Renewable raw materials
2. Sustainable energy sources
3. Sustainable industrial production processes
4. Traffic and transport
5. Eco design.

These themes are selected because they offer solutions for the main environmental problems as signalled in the Dutch National Environmental Policy Plans.

Target groups

E.E.T. is especially aimed at
- (large) companies
- technological research institutes
- universities
- SME (small to medium-sized enterprises)
- intermediates

Execution

E.E.T. subsidies are granted on the basis of a competitive tender procedure.
The budget put out to tender every eight months is EUR 23 million of which EUR 1.1 million is reserved for 'embryonic projects' (one year feasibility projects). Accidental budget increases occur. On average EUR 40 million a year is granted.

In each such eight month periods proposals for multiyear projects and for one-year 'embryonic projects' can be submitted.
In the case of multiyear project proposals the E.E.T. scheme provides for both an advisory round and a qualification round. The advisory round is intended to make a first selection of projects and to improve the proposals. In the case of one-year embryonic projects there is no official advisory round, only the qualification round.

An external E.E.T. Advisory Committee appointed by the three Ministries assesses the proposals and makes recommendations regarding the form and content of the project. On the basis of their advice the co-ordinator of the project makes a final proposal for the qualification round. In this round, the E.E.T. Advisory Committee ranks all the proposals in order of quality: the extent to which they contribute to the objectives of E.E.T.
Subsidies are then granted in ranked order until the funds are exhausted.

The E.E.T. office plays an important role in advising organisations regarding new proposals.

In 2003 the 10th and 11th tender will take place. Based on the large number of pre-proposals in the advisory round

sufficient proposals of high quality are expected for both tenders. This will be the last tender. On 1 January 2004 there is one large instrument for innovation en co-operation in the Netherlands with credit points for sustainable projects.

Assessment criteria

The assessment criteria for new projects focus at economy, ecology, technology and collaboration. Each assessment criterion comprises approximately twenty sub-criteria, of which some examples are given below:

Economy
On what scale will the project lead to economic effects, such as profits, turnover, scale of the market, cost savings, etc. This has to be expressed in millions of Euro.

Ecology
On what scale will the project lead to ecological effects? This has to be quantified, e.g. in Peta Joules, kilograms etc. Will the project contribute substantially to solving major environmental problems?

Technology
Will the project lead to a technological breakthrough? Is the proposal a new development?

Collaboration
Is there collaboration between the knowledge sector and the industry? Will the collaboration lead to a successful project and a successful market launch? Is there enough commitment from the industrial partners?

For economic and ecological effects, risk (chance of success) and reward (potential impact) are distinguished. There is a tendency towards rewarding high risk/high reward projects better than low risk projects, since these projects are best in line with the overall E.E.T. goal.

At the start of the project a collaboration agreement is required to ensure collaboration between industry and knowledge institutes. The agreement describes the terms on which co-operation takes place and arranges the distribution of knowledge and exploitation rights.

PROJECT CHARACTERISTICS

There is no such thing as an average E.E.T. project. Nevertheless, based on statistics, an average (multiyear) E.E.T. project can be described by the following characteristics:
number of project partners: 5. Mostly a consortium comprises the whole chain of knowledge providers, and suppliers and customers (see figure 'participants' below, for participation in E.E.T. per target group).

duration of the project: 5 years

costs and subsidy: The total mean costs are EUR 4 million per project of which half is subsidised (EUR 2 million).

time-to-market: The time-to-market for most projects is between 7 and 10 years

type of project: The major part of E.E.T. projects fits into the scope of the 'sustainable industrial production processes' theme (about 40%). The 'traffic and transportation' theme is least represented (see figure 'themes').

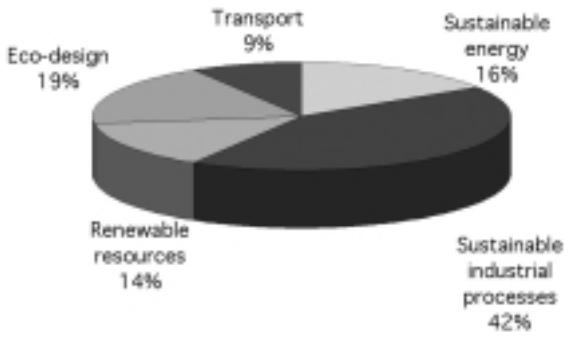

Figure 1: „themes"

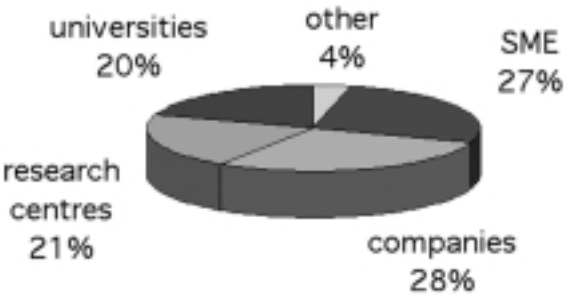

Figure 2. „participants"

MONITORING AND EVALUATION

For monitoring and evaluation in order to measure the outcome of the projects and to improve the E.E.T. programme, 'output and outcome performance indicators' are used.

Output indicators describe the output into the R&D activity in terms of various resources. Typical parameters are R&D costs, public funding, type of technology, type of the companies participating, etc.
The outcome indicators describe the realised or expected effects of a project. These indicators include data of new products, processes, services or methods, new companies, applied new technologies, increased turnover, export, employment, ecological effects (e.g. the decrease in emissions of pollutants), etc.

The output performance indicators are mostly collected from the project proposal. A standard (Excel) form is used for the collection of the outcome performance indicators digitally. By means of this form the project co-ordinator must report yearly on the current insights on the expected outcome of the project and after completion of the project. The standard form is an annex with the management reports and the final report. All forms are loaded in an (Access) database for further analysis.

Though relatively simple, the outcome indicators currently used give reasonable indications for the expected effects. Yet, at this moment (early 2003) the Programme Office is investigating if indicators can be developed that give more reliable results on the expected outcome (see Chapter 5). An important condition is that these indicators must be relatively easy to determine, since the workload for the project co-ordinator should be kept at a minimum.

RECENT AND FUTURE DEVELOPMENTS ON MONITORING: M²

The last two years there is a strong tendency to achieve more realistic insights in the effects of governmental programmes. Different studies carried out by consultancy firms recommend that the E.E.T. projects should have a stronger focus on market introduction during project execution.

The experiences in monitoring E.E.T. projects showed the difficulties in gathering accurate monitoring data. There is a large dependence on information given by the project co-ordinator. Due to the long time to market of the project results the monitoring exists mainly of expectations. So the E.E.T. office is faced with the task to make those expectations as realistic as possible.

In order to combine these two task, the E.E.T. office is starting an internal project at the moment. The goal of this project is to develop a tool to enable the project co-ordinator to gain more insight in the achievement of the project goals and the non technological aspects of the project (marketing, legislation, user acceptance, etc.).

With the tool the project co-ordinator should be able to make clear the business case for the project. From this business case decisions on project management level can be derived in order to achieve the project goals. A part of the information (expected time-to-market, expected turnover, market share, etc.) is similar to data used for monitoring purposes. By using this data the E.E.T. office expects to increase the reality and accuracy of their monitoring.

Publications available in English:
- Breaking through to sustainability – innovation, co-operation, knowledge-building in joint service of economy and environment; published by E.E.T.; December 2000.
- Innovation for sustainability – technology meets the market; published by E.E.T. on the occasion of the E.E.T. conference on March 13th and 14th, 2002.

More information
If you wish more information, feel free to contact E.E.T. through our web site www.eet.nl or through our secretariat, phone number +31 30 2393 436.

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Evaluation and Monitoring of the German "Microsystem Technology" Programmes

This article describes the present practice of evaluation and monitoring in the German programme „MST 2000+" at VDI/VDE-IT (Germany). Furthermore a framework to structure different activities of evaluation and monitoring is being developed. The article ends with some general conclusions on monitoring and evaluation of technology programmes.

„MST 2000+" – MST for high-tech-products made in Germany" is the present funding programme of the Federal Ministry of Education and Research (BMBF), that supports R&D and implementation of Microsystem Technology (MST) in selected industrial sectors and fields of application that are of relevance to Germany. The funding is about 50 Mio. € per year on average. „MST 2000+" started in 2000 and will end in December 2003. The first programme that supported MST-funding in Germany started in 1990. VDI/VDE-IT is the agency („Projektträger") responsible for the management for these programmes.

MST is a new, interdisciplinary field of innovation. Typically in a microsystem several individual functions are linked to form a miniaturised, intelligent system by using different micro- and system technologies. Optical, mechanical, chemical, and biological processes are combined with microelectronics in the closest space to realise sensory, actuatory and signal-processing functions. For microsystems there are quite a lot of areas of application (e.g. communication, automotive applications, machinery and plant industry, chemical engineering and laboratory technology, medical and pharmaceutical applications, environmental technology, food and agriculture industry, home and consumer applications). The instruments „MST 2000+" uses are 1) mainly the support of joint industrial projects; here two (or more) companies plus one (or more) research institute(s) work together (funding 30–50 %) and 2) accompanying measures to improve the framework conditions for innovations (e.g. education and qualification, information services, international networking etc.). 3) for special topics the support of scientific research projects is possible.

Evaluation and monitoring have a long tradition and play an important role in the German MST-funding and are guided by the following general goals:

- Controlling of single projects
- Analysis of programme impact
- Checking current programme status against programme goals
- Identification of bottlenecks / innovation barriers / success factors
- Providing information for programme management and policy design
- Transparency how public money has been used

Additionally the fact that MST is still a young and very dynamic technology made it necessary to generate and analyse information within the programme. Often existing statistics of established fields of research or traditional industrial sectors can not be used or only to a very limited degree because they do not tell enough about development, production or the application of MST in the economy.

The following figure summarises the different phases of MST-funding in Germany; the instruments being used in the corresponding programme, the focus of action and the activities of evaluation and monitoring:

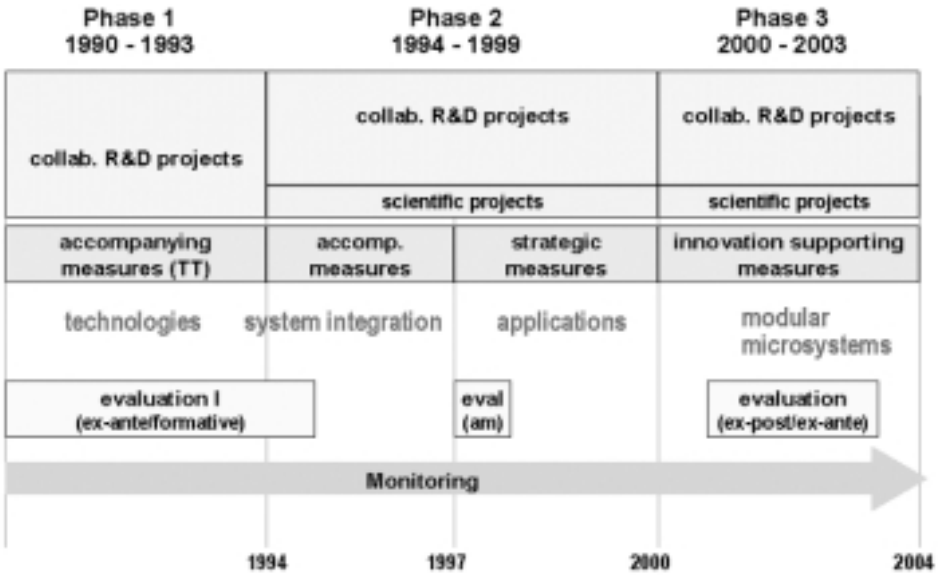

Figure 1: History of MST funding in Germany

The first programme started in 1990. Right from the beginning a formative evaluation took place. External evaluators helped to specify the field of action and to improve the instruments being used. Because of this evaluation e.g. the field of assembly technology and packaging was given a much higher importance in the first programme as it has been planned in the beginning. Furthermore the ex-ante evaluation analysed which developments could be expected for both technology and application. 1997 an evaluation of the accompanying measures took place. The results of this evaluation underlined that beyond funding R&D projects, accompanying measures are necessary to support the development of framework conditions of the innovation system. The last evaluation (2001–2003) that was finished recently will be described more extensively later on. Additionally an internal monitoring of both single projects and the total programme was made by VDI/VDE-IT constantly for reasons of programme management.

Before giving a more detailed description of monitoring and evaluation in „MST 2000+" a general framework is developed that helps to structure the different activities. In general in a technology programme monitoring and evaluation can be performed at different levels and different times. This means that there are different „modules" of evaluation and monitoring that should be combined to build an effective and efficient information and controlling system for programme management and policy design. Both evaluation, done by external evaluators, and programme management's internal monitoring belong to this system. Evaluation offers and external and independent view and assessment. Furthermore it can stimulate programme and policy learning. It can be done ex-ante, accompanying-formative and ex-post. In addition to external evaluation internal monitoring is necessary for a fact-based programme-management, both on the strategic and the operational level.

Evaluation and monitoring should consider different criteria (Cj) and indicators (Ii) that correspond with the policy goals of the programme. These set of criteria and indicators can be analysed on the project and the programme level. Cj and Ii should not be analysed only once but during the whole „life cycle" of the projects: At 1) t1 = project selection – when in the proposal expectations on the technical and economic results and effects of the projects are described, at 2) t2 = during the current project and when the project has just finished, after results and first effects have been realised and 3) at t3 after the end of the project, analysing the long term results and effects of the project.

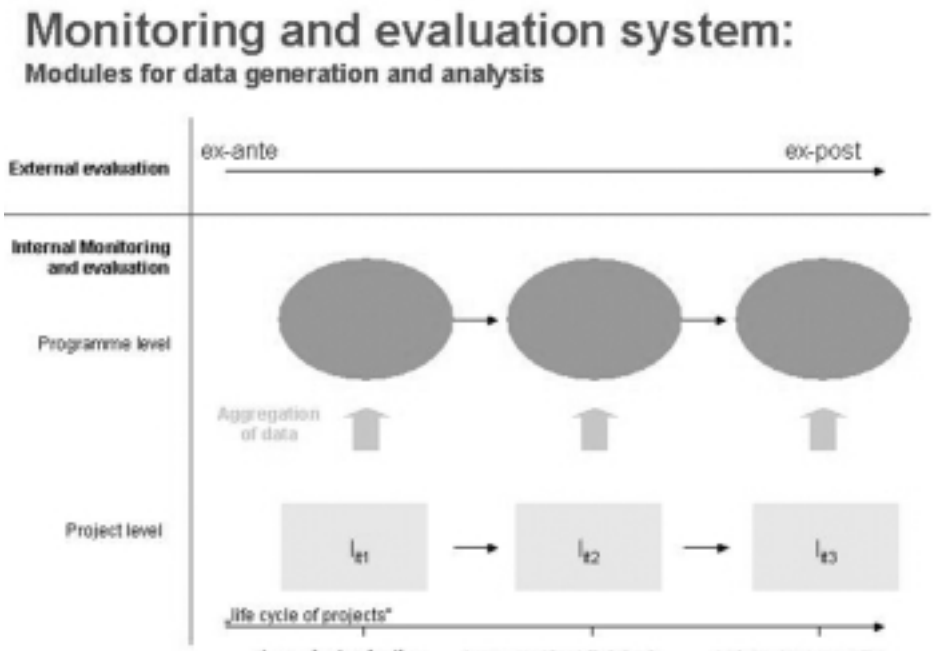

Figure 2: Modular system of programme monitoring and evaluation

For an assessment on programme level these data on indicators generated on the project level have to be aggregated. The following figure illustrates this „modular system" of programme evaluation and monitoring.

After this description of a general framework the present practice of evaluation and monitoring in „MST 2000+" will be explained. It will be shown that on the one hand some modules are already well established in programme management. One new module has just been introduced this year. On the other hand not all necessary modules have been used yet; there is still some room for improvement:.

Internal monitoring/Project level: According to the policy goals of „MST 2000+" the selection of projects is not only based on technical aspects. Relevant criteria which are checked in the proposal and later on (if the project receives funding) are:

- Focusing on the main objectives of the programme (project fits to technology and fields of application, organisational structure of project,...)
- SME-Orientation (share and role of SME in the projects, spill over effects to other SMEs,...)
- Transfer of research results into successful products (aspects of production, certification/test, possibility to reach the market, financing by partners,...)
- Expected market impact (advantages by MST, market volume, market development,...)

Just recently it has been introduced that projects have to report on their (expected) results not only in their proposals and as long as they receive funding, but additionally after funding has ended. The companies and institutes have to deliver a written report on project results. This offers a much better possibility to analyse the real effects of the programme. This assessment is done about one up to three years after the project has finished. If there will be an additional report after an even longer time for better identifying long-term effects is still under discussion.

Internal monitoring/Programme level: On the programme level key-data of the programme (as e.g. the number of new projects, average volume of funding,...) and the distribution of funds are analysed. A typical question as for distribution of funds that has to be answered e.g. is „What has been the volume of funding for SMEs?" The distribution of funds additionally is analysed as for type of organisation, technologies, fields of application, seize of companies, regions etc. The results of the analysis of the new projects in the programme are published once a year in the „MST Jahresbericht" (Annual Report MST) (http://www.mstonline.de/jahresberichte/). Furthermore the distribution of funding is analysed for longer periods.

An analysis of effects and results on programme level has not been done by internal monitoring so far. This aspect has been analysed by an extensive evaluation that started in March 2001 and finished in December 2002. Members of the international evaluation team have been: Prognos, Technopolis, Hochschule für Bankwirtschaft and Deutsche Bank Innovationsteam. The evaluation had to a) assess the results and effects of MST-funding from 1990 to 2001 (ex-post evaluation), b) analyse the present status of MST technology and application in Germany and c) identify new MST-developments and innovation barriers in the future (ex-ante analysis).
The following figure summarises aspects that have been analysed in the recent evaluation of MST-funding in Germany:

Ex-post Analysis	**Ex-ante Analysis**
• Status of technology • Technology diffusion • Results of funded projects (prototypes, patents, new products) • Qualification • Competitivness • Employment • Networks • Quality of funding instruments	• New topics in basic research • Technology development (e.g. micro-, nano-, biotechnology) • Future character of MST • SWOT-Analysis for Germany

Figure 3: Evaluation of MST-funding in Germany – aspects of ex-post and ex-ante analysis

The results of the evaluation are based on solid empirical work: The postal survey has been answered by 707 organisations from industry or research (497 funded in the programme, 210 not-funded). Furthermore there have been about 200 expert interviews (e.g. case-studies of funded projects, international experts) and a series of workshops for validation of results and identification of future developments. The overall-assessment of the evaluation was that MST-funding had been successful so far. Innovation-barriers that ask for more action in the future exist e.g. at MST-production or networking between single projects. As for the last aspect it was proposed, that the support of e.g. roadmaps could stimulate a higher degree of project interaction. Furthermore the evaluation pointed out that new technologies create high technological dynamics in MST; 10 fields of innovation could be identified (e.g. polytronics, micro-nano-integration, MST and life-sciences,...).

The evaluation results have been presented at the end of last year (2002). They directly influence the design of the future German MST-programme which is being worked out at present. This means that there is a direct link between evaluation and future MST-policy on the one hand. On the other hand it has to be considered that beyond evaluation other factors exert an influence as well (e.g. assessments of other experts and studies, stakeholders of the programme in industry and science, monitoring and conceptual work in the context of programme management, development of general policy of the ministry, present economic situation,...). Although evaluation in this respect is only one among other influences, it especially has a very important function: It offers a platform for interaction of all these

different activities and interests, can stimulate learning and a fact-based discussion when it comes to design future MST-policy.

Based on the experiences of monitoring and evaluation in the German MST-programmes finally some conclusions on monitoring and evaluation of technology programmes can be drawn:

- Monitoring and evaluation requires a systemic approach. It is necessary on different levels and at different times in a programme.
- These different „modules" of evaluation and monitoring should be combined to build an effective and efficient information and controlling system for programme management and policy design.
- Because of reasons of efficiency internal data and monitoring should be used as much as possible in this system.
- External evaluation has always to be integrated. It offers an independent and external view.
- Empirical facts and assessments are an important but not the only influence when it comes to design future funding policy. Therefore a monitoring and evaluation system has to integrate functional modules that allow interaction and learning in the „policy arena".
- Monitoring and evaluation will become more important in the future (because of e.g. higher competition for smaller budgets, higher transparency how public money has been invested,...). This makes a higher degree of implementation of corresponding systems in technology programmes necessary.

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Analysis of the Ex-Post Project Monitoring at Tekes

INTRODUCTION

Tekes, the National Technology Agency of Finland has developed an ex-post monitoring system (EPM). It is a part of impact analysis of Tekes R&D programmes and projects. Ex-post monitoring is carried out by Tekes Impact Analysis, so it is not an external study. Monitoring was executed for the first time in 2002 and in this paper the first results of the system will be presented. Also some comparisons with previous studies will be made. Finally, there will be discussion about the future steps.

BACKGROUND

In 2002 Tekes had 380 million _ funding for R&D projects. About 3000 project proposals were made by companies, universities and research institutes. Two thirds of them got funding and 2017 new R&D projects were started. During the year there were about 5000 projects on-going and a total number of 2037 projects ended.

Tekes project monitoring system consists of several modules. When Tekes was founded for 20 years ago (1983) the funding decision making stage was the most interesting. The funding has been classified according to the size of companies, technology fields, regionally, etc. This kind of material dates back to the early 80's.

Other modules have been added later. The next one was the proposal stage. With this information we can compare the approved and rejected project proposals and analyse the selection process. In the late 1990's the whole R&D project life cycle was covered, when monitoring was extended to the end of the project. Naturally, the funded projects had reported their progress and results all the time. However, they were in various lengthy and different kinds of paper reports and it was impossible to draw a big picture of the results of the whole project portfolio. The project life cycle monitoring (LCM) was developed in order to get aggregated data and it is now embedded in Tekes project database (eVal).

The last module, EPM, contains commercial success and socio-economic impacts of the projects. Earlier there have been several external studies concerning ex-post impact evaluations.

The first study was carried out in 1991 by Finnish State Auditors, when they made the auditing report of promoting activities for industrial R&D. They studied Tekes-funded industrial projects that had ended during 1983–88 by interviewing a sample of 50 project managers. The auditing report found Tekes activities appropriate, however it recommended that more funding should be allocated to SMEs. This study also included some ideas for indicators to assess economic effects that have been in use since.

The Ministry of Trade and Industry commissioned the international evaluation of Tekes. It was accomplished in 1995. The evaluators were professors Henri Guillaume and Walter Zegveld and the evaluation was based on a large number of interviews and a survey. The survey was carried out by VTT (Technical Research Centre of Finland) Technology Studies. It was made by sending a questionnaire to more than 1000 firms and analysing the 601 replies. The group consisted of industrial projects that ended during 1990–93. The questionnaire was designed according to the methodology developed for evaluating the industrial and economic effects of the EUREKA initiative (1993). The survey reinforced earlier assumptions about the role and significance of Tekes funding. The level of achievement of immediate results was reported high in terms of new products, immediate economic effects, indirect and broader effects.

The survey included a reference group. This consisted of projects that had applied funding but were rejected. Of these, only 6 % was made as planned. It turned out that the projects in this group were less challenging as the funded projects. The results might indicate that the selection process has been successful.

One recommendation of the evaluation was that all the activities of Tekes should be accompanied with built-in monitoring and evaluation procedures. As a result of this recommendation evaluation activities at Tekes have gained a more important role.

In 1998 it was considered to be useful to make a study with the projects that had ended in 1994 – 97, i.e. after the evaluation. For comparability reasons, VTT Technology Studies were chosen to make this study, too. The methodology was the same with some additional elements in order to capture the economic effects. There were 469 responses out of 986. According to the study the projects were innovative and succeeded technologically very well. However, the commercial success was not so high. Projects reported of many spill-over effects and externalities. The researchers noted that the economic effects were difficult to measure, as there were a lot of other activities which had effect on business besides a single R&D project.

The State Auditors revisited Tekes in 1999–2000 and made the report of Tekes product development funding. In this study a sample was chosen among those projects that ended in 1997. A questionnaire was sent to 200 companies and they got 143 responses. The results show that R&D funding is considered to be important especially in enhancing the networking. Auditors pointed out to the needs to increase the impact analysis and controller functions. This study emphasised the need to evaluate projects systematically, not just on ad-hoc-basis. Tekes should have an own systematic ex-post monitoring of the ended projects.

DEVELOPMENT OF EX-POST MONITORING

The first step in developing the ex-post monitoring system was to analyse the results and methodologies used in previous evaluation studies. The idea was to use similar questions in order to assure comparability. The previous surveys were very long and contained so many questions that it would not be possible to get good response rate. The next step was to find out the most important and selective questions in analysing the success of projects.

This was done using different statistical analysis. Multivariate analysis was used to study if projects could be clustered. Discriminant analysis was further used to search if there were possibilities to predict the future success with the data that is available before the project. The results showed that the projects could be clustered, but the data was not sufficient to predict the success.

In autumn 2001, the pilot study was executed. For that a new questionnaire was made. It still owes a lot to the EUREKA evaluation. Because there was a possibility to link the data with other information sources, for example company data, the background questions were not needed. The questionnaire had only 10 questions instead of 30 in VTT study. A sample of 120 projects was selected. After receiving the responses (60) altogether 40 interviews with Tekes advisors were made during the winter of 2002. During the interviews they were asked to express their views about the impact of the project and needs to change the monitoring system.

Because there was a lot of work with paper forms even with 120 projects, the work with 1000–2000 questionnaires would not be economical. It was decided to use a web survey tool and ADP application. This was planned and acquired in spring of 2002.

The survey was executed by Tekes during the summer and autumn of 2002. It consisted of all R&D projects that ended in 1999, i.e. three years earlier. Only prestudies were ruled out. A total number of 1620 questionnaires were mailed. Primary answering method was web, but 25 % was still returned either by mail or by telefax. Altogether 1024 replies were received. The response rate is 63 % that is nowadays in Finland rather high.

METHOD

The basic challenge in this kind of surveys is how to compress a very complex real world in a couple of questions, which are understandable and answerable.
This dilemma is the same for example in community innovation survey run by national statistical bureaus. If the survey is too complicated it goes directly to trash can.

Our solution was to tailor different questionnaires to different kind of projects. Because there are not only product development products that are mostly carried out by SMEs, but also industrial research projects (by larger companies) and public research projects (by universities and research institutes), the same questionnaire is not suitable for all of them. For example as a result of public research project, no sales of products will be achieved. However the basic structure was decided to be common, for example the total number of questions was 11, and some questions like the additionality was the same for all types of projects.

The questions included:
- Technological and commercial success
- Direct and Indirect effects
• within organisation
• within industrial branch or innovation network
• to society

- Additionality
- Quantitative data, like
• costs of R&D
• costs of commercialization (in SMEs)
• the wideness of utilization of the research results (in research projects)
• additional turnover (in SMEs)

PRELIMINARY RESULTS AND COMPARISONS

After the answers were received, a lot of basic statistics were made with the data. These included such issues as what are distributions and are there any regional or technology-specific differencies. The more challenging and time-consuming work is to make some benchmarking and in the following there are some preliminary results of it.

In the tables 1 and 2 there is comparison between the direct effects in Tekes EPM data and EUREKA evaluation data.

Research organisations	Companies
• New scientific knowledge	• Increased co-operation with other companies
• Increased co-operation with companies	• Improvement in quality of products
• Improvement in quality of research	• Increased co-operation with universities

Table 1: The direct effects most frequently mentioned in EPM data

Research organisations	Companies
• Scientific esteem	• Product quality
• Technological capability	• Co-operation with other companies
• Co-operation	• Sales of products

Table 2: The direct effects most frequently mentioned in EUREKA data

In Tekes EPM study the top three effects in research organisations are new scientific knowledge, increased co-operation with companies and improvement in quality of research. In companies the most frequent effects are increased co-operation either with other companies or research, and the improved quality.

The other study is the EUREKA Evaluation for ten years ago. There are many similarities but also some differences. In both studies co-operation is mentioned among the top three effects. In EUREKA sales of products ranks high whereas in Tekes study included also industrial research projects so this item is not among top three.

Another highly interesting question is the additionality of public funding. The concept of additionality has its roots in market failure rationale and was developed in the UK for evaluation purposes. Luke Gheorgiou has introduced three categories of additionality:
- input additionality, where public funding makes company to increase its own R&D
- output additionality, where the end results are different because of public funding
- behavioural additionality, where public funding has resulted to some modifications in projects

	Eureka evaluation	Finnish EU projects	Tekes evaluation	VTT study	TekesEPM
Year	1993	1998	1995	1999	2002
Faster	n/a	13 %	n/a	34 %	28%
On larger scale	n/a	14 %	n/a	31 %	32 %
With different objectives	n/a	18 %	n/a	51 %	49 %
Modified	28 %	n/a	71 %	n/a	64 %

Table 3: Behavioural additionality in five studies.

There are a number of projects that report that there was not any additionality of funding, and the projects would have been carried out anyway, even without public funding. Then there are projects that would not have been started at all without public funding.

In table 3 there are only those projects that have reported some kind of modifications due to public funding either in scale, scope or timing. This is called behavioural additionality.

The first study concerned industrial EUREKA projects. 28 % of them were carried out either faster, on a larger scale or with different objectives as they got EUREKA status and public funding. The next study is about the industrial Finnish EU projects. According to it 13 % was made faster, 14 % larger and in 18 % with different scope.

The three other studies are Tekes-funded product development projects. They cover the time frame of 1990's. Tekes evaluation and VTT study were external analysis and EPM internal made by Tekes. In 2/3 of these projects the public funding has had behavioural additionality.

Tekes projects seem to have considerably more behavioural additionality than EU- or EUREKA-projects. One could ask, if this just tells about their different character. EU- and EUREKA -projects are beforehand planned towards internationalisation. In Tekes-projects there is an emphasis on risk sharing and funding decision makes it possible to make large modifications. For example, in same cases Tekes even requires networking.

All three Tekes studies have similar behavioural additionality figures. It seems that companies give similar answers whether the survey is made by Tekes or external evaluators. This could mean that the credibility of Tekes data is good enough and possibly it can be exploited as a data in research.

FOLLOWING STEPS

The results of ex-post monitoring are being used in Tekes annual reports, both publicly as well as to the ministry. There has been a continuously rising need for impact data and EPM will serve for these purposes. EPM data will also be exploited in internal management systems. Couple of indicators have been defined in TekesBSC, which is now in operational use.
The next round will be executed within May and June 2003. One experience was the survey time should not be started in summer, because there were difficulties to catch people during the summertime. There is some pressure to include other questions in order get additional data from the survey. The changes should be small, because it is important to have time series and the response rate will fall if the responding takes a lot of time. We will try to keep the questionnaires short and clear.

A still open question is how we could enhance the feedback to Tekes staff in order to improve the learning effect. With 1000 responses it proved to be impossible to have face-to-face contacts with advisors.

EPM is just one piece in the puzzle, though it is a very important source. There is need for external analysis, other sources, international benchmarking and more detailed validity checks. However the positive experiences so far give us courage to continue.

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The Link Between Monitoring and Evaluation at the FFF

THE MONITORING SYSTEM OF THE FFF

During the past couple of year the monitoring system of the FFF for projects funded under its auspices has undergone considerable improvements. In particular, the FFF now carries out an in-depth ex-ante evaluation of all project proposals received, based on 14 economic and techni-cal indicators and also monitors the evolution of the funded projects by means of an economic audit carried out about one year after the execution of the project. The ex-ante evaluation is divided in two steps:

1. a technical evaluation of the projects
2. an economic evaluation of the projects

For the technical and economic evaluation the following main indicators are applied within the FFF, whereby the indicators in the grey fields are related to the company as a whole, while those in the white fields are related to the project itself.

technical indicators	economic indicators
technological innovation	financial performance
technical challenge	management
practical value	market experience
environmental effects	market prospects
increase of know-how	commercialisation
R&D dynamics	externalities
feasibility	social impacts

Source: Austrian Industrial Research Promotion Fund (FFF)

Source: Austrian Industrial Research Promotion Fund (FFF)
Table 1: main indicators for the ex-ante evaluation of the FFF

Each of these criteria a further defined by a number of sub-indicators. The technical criteria „technological innovation", for example is explained by the criteria innovation vs. state of the art, protection of the idea, competitive advantage, potential for future developments, and example for the industrial sector, while the economic criteria „market experience", for example, contains the sub-criteria knowledge of target groups, knowledge of competitors, project related revenues and synergies.

A scoring system allows a project to obtain a maximum of 50 points in each of the four fields indicated in Table 1, whereby some K.O. criteria exist, that may lead to the rejection of a project, irrespectively of the number of points received in the evaluation. Such a K.O. criterion might be if, for example, the foreseen innovation offends existing trade mark rights or if the financing of the whole innovation is not possible with the resources available. Based on this scoring of the indicators it is decided, whether a project receives funding from the Austrian Industrial Research Promotion Fund or not.

For those projects that are promoted by the FFF, an economic audit is carried out about one year after the project has been completed. In the scope of this revision an economical assess-ment of the project as well as of the respective company as a whole is performed, on the basis of which it is decided whether funding is going to be continued or not. The audit is conducted on the basis of the same economic indicators as applied for the ex-ante evaluation (see Table 1).

THE EX-POST EVALUATION BY THE AUSTRIAN INSTITUTE FOR SME RESEARCH

Additionally to the ex-ante evaluation by the Austrian Industrial Research Promotion Fund, the Austrian Institute for SME Research (IfGH) regularly carries out an ex-post evaluation of the projects funded by the FFF, about 3 years after their finalisation. Within the ex-post evaluation the economic impact of the funds provided by the FFF is assessed based, among others, on the following indicators:

- technical success of the project
- economic success of the project
- commercialisation of the project results
- revenues from licenses and patens
- additional and maintained turnover
- additional and safeguarded employment
- applications for patents
- etc.

Apart from these criteria, also the issue of additionality of the funded projects as well as the issue of customer satisfaction with the funding procedures of the FFF are regularly addressed in the scope of the ex-post evaluation.

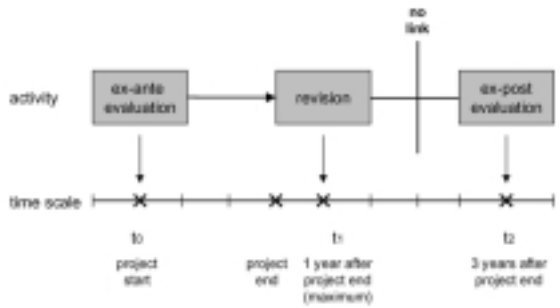
The ex-post evaluation is carried out on the basis of a standardised questionnaire sent out to all companies that have

received funding from the FFF and have finalised their projects about 3 to 4 years before the corresponding evaluation takes place. It is usually carried out biannually.

Usually the ex-post evaluation covers between 400 and 500 projects and has a response rate of about 80 %. The comparatively high response rate might be partly explained by the fact that the respective questionnaire is send out by the FFF with an according accompanying letter that might, at the side of the companies, lead to the impression, that they are obliged to fill out the questionnaire. Also an urging letter is send out to those companies, who do not react in due time, reminding them of the necessity of their response.

THE LINK BETWEEN MONITORING AND EVALUATION

Until a few years ago, however, there has been no link between the monitoring system of the FFF and the ex-post evaluation carried out by the Austrian Institute for SME Research, as is demonstrated in the following Graph 1.



Graph 1: The monitoring system of the FFF

In order to explore the possibilities of establishing a link between the monitoring system of the FFF and the regular ex-post evaluation, the FFF in 2000 assigned the Austrian Institute for SME Research to undertake a respective pilot-project. The aim of this pilot project was twofold:

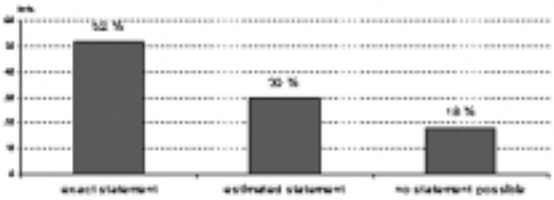
1. To review the methodology applied for the ex-post evaluation, particularly, with view to the reliability of results obtained from the assessment
2. To find a way of linking the ex-post evaluation to the monitoring system of the FFF

The first task was considered important, as an evaluation carried out by means of a questionnaire is always exposed to criticism with regard to the validity of the answers given by the respective respondents, particularly as far as information related to turnover directly attributable to the projects funded is concerned. Thus, the pilot project sought to analyse in how far statements made by the respondents on the questionnaire for the ex-post evaluation are reliable and well founded.

Reliability of results

As regards the reliability of the results of the ex-post evaluation, i.e. the quality of the statements made by the persons responsible for the project related to the turnover directly attributable to the funded projects, the assessment was conducted by means of personal visits to the enterprises and telephone interviews, in which more background information on the data sources used by the respondents for providing the respective information, on the deviation range of their estimates, and on the quality of their bookkeeping and accounting systems was obtained.

Being well aware of the attribution problem related to this kind of information, it at least turned out that, in general, the information provided by respondents with regard to the turnover directly attributable to the funded projects was quite well founded, as can be seen from the following Graph 2.



Source: Austrian Institute for SME Research, N = 30
Graph 2: Quality of statements made by respondents with regard to the turnover directly attributable to the funded projects

52 % of the enterprises were able to make comparatively exact statements with regard to the turnover attributable to the funded projects, due to well established calculation and accounting systems. Another 30 % were able to give comparatively good estimates and 18 % were not able to give any indication at all, basically because the turnover generated could not be directly attributed to a specific project.

It, however, has to be mentioned that these findings are positively biased as the sample selected for the pilot project contained an overproportional share of „high quality" projects.

Linking monitoring and ex-post evaluation

As regards linking the ex-post evaluation to the monitoring system of the FFF, it was the aim to identify those indicators from the monitoring system of the FFF (see Table 1) that could be reasonably applied in the scope of the ex-post evaluation. The selection process was based on personal and telephonic interviews with responsibles of projects funded. There were basically two conditions a relevant indicator had to fulfil, in order to be selected for consideration in the ex-post evaluation:

- the indicator had to be easily understandable for project responsibles within the funded enterprises and
- the indicator had to be variable over time, i.e. its relevance should not be restricted to the period of implementation of the project, but go beyond it.

The following Table 2 gives an overview on the indicators selected on this basis for integration into the regular ex-post evaluation 3 years after execution of the project.
Source: Austrian Industrial Research Promotion Fund (FFF)

technical indicators	economic indicators
technological innovation	financial performance
technical challenge	management
practical value	market experience
environmental effects	market prospects
increase of know-how	commercialisation
R&D dynamics	externalities
feasibility	social impacts

Source: Austrian Industrial Research Promotion Fund (FFF)

Table 2: indicators selected for the ex-post evaluation

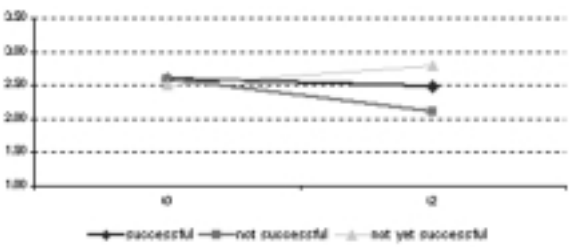
Thus, two basic lessons could be learned from this pilot project carried out in 2000:

1. Firstly, the information concerning the turnover directly attributable to the projects funded, provided by enterprises in the scope of the ex-post evaluation was found to be usually well founded.
2. Secondly, 6 out of the 14 monitoring indicators applied by the FFF were found to be suitable for integration into the ex-post evaluation regularly carried out by the Austrian Institute for SME Research.

Based on these results the questionnaire for the future ex-post evaluations was adapted accordingly. Particularly the new indicators technological innovation, practical value, market experience, market prospects, commercialisation and externalities were added to the regular list of evaluation criteria. The companies were asked to judge these indicators from their own point of view on a similar scale as applied by the FFF, whereby a separate list was provided explaining the exact meaning of the respective indicators in order to make sure that they were interpreted in the same way by the project responsibles as by the FFF.

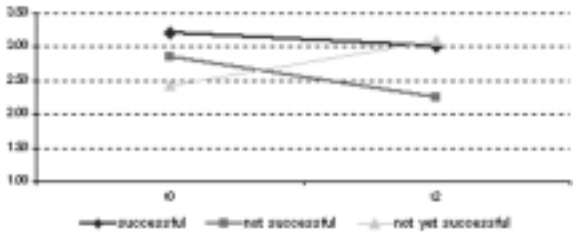
FIRST RESULTS FROM THE EXERCISE

Last year, the new system was for the first time applied on a large scale allowing to link the monitoring of the FFF to the results of the ex-post evaluation carried out by the Austrian Institute for SME Research. For the ex-post evaluation of the year 2002 about 500 questionnaires were send out to companies who had received project funding from the FFF and who had finalised their projects about 3 years ago. 390 of these questionnaires were returned (response rate: 78%) which built the basis of the assessment.
In the following the results of linking the monitoring to the ex-post evaluation are demonstrated for the technical as well as for the economic indicators selected, whereby it has to be noted, that the audit carried out by the FFF one year after finalisation of a funded project (observation point t1) is only carried out for the economic indicators. All assessments (the ex-ante evaluation, the economic audit and the ex-post evaluation) are conducted on a scale from 1 to 4, with 1 being the worst and 4 being the best score.



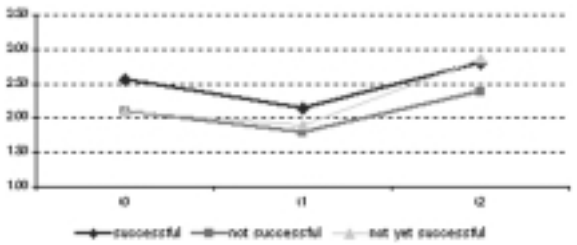
Source: Austrian Institute for SME Research (IfGH)
Graph 3: technological innovation

With regard to the indicator technological innovation it can be observed (see Graph 3), that for both, the successful as well as the unsuccessful projects the ex-post evaluation shows worse values than the ex-ante evaluation. This might be explained by the fact, that the projects were possibly not a technical novelty anymore by the time of the ex-post evaluation, but might have been when they were started. However, the indicator technical innovation does not seem to be able to explain future success of failure of a project, as for the ex-ante evaluation both, successful and unsuccessful projects receive the same average scoring by the FFF.



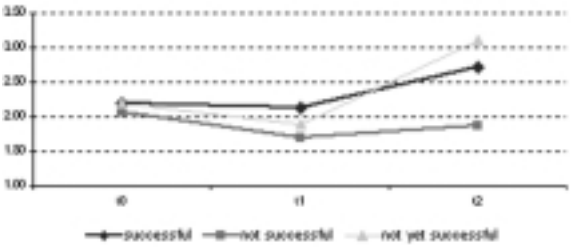
Source: Austrian Institute for SME Research (IfGH)
Graph 4: practical value

Similar to the technological innovation, the practical value of a project seems to decrease with time, as shown by higher values in the ex-ante evaluation as compared to the ex-post evaluation (see Graph 4). However, contrary to the other technical indicator, the practical value might be an explanatory variable with regard to the future success of a project. The practical value of those projects that turn out to be a success afterwards is right from the beginning judged higher than the one of projects that fail.



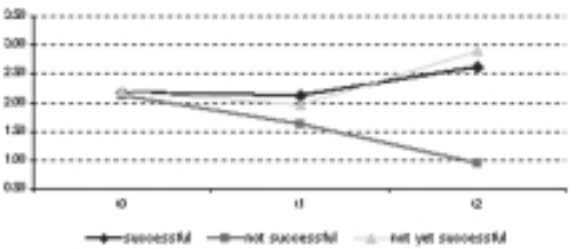
Source: Austrian Institute for SME Research (IfGH)
Graph 5: market experience

This also holds true for the economic indicator market experience, for which all three observation point (t0 = ex-ante evaluation, t1 = economic audit and t2 = ex-post evaluation) are available. It can be seen, that already at project start, successful projects are judged higher by the FFF than projects that turn out to fail. Thereby, obviously, market experience increases as time goes by, as can be seen from the higher values obtained in the ex-post evaluation as compared to the ex-ante evaluation. However, companies themselves seem to judge the market experience higher than the FFF does during his audit.



Source: Austrian Institute for SME Research (IfGH)
Graph 6: market prospects

As regards the market prospects of projects funded, the average ex-ante evaluation of successful projects is only slightly better than that of not successful projects. It seems that the FFF underestimates the market prospects of successful projects and slightly overestimates the market prospects of not successful projects in t0. In t1 the differences between successful and not successful projects become more obvious; here successful projects can already be clearly distinguished from unsuccessful projects. However, successful projects still seem to be underestimated, while the assessment of not successful projects conducted by the FFF about 1 year after finalisation of the projects is more or less confirmed by the ex-post evaluation.



Source: Austrian Institute for SME Research (IfGH)
Graph 7: commercialisation

As far as the commercialisation of project results is concerned, more or less the same patterns hold as with respect to market prospects. The FFF seems to underestimate the commercialisation of successful projects and to clearly overestimate the commercialisation of not successful projects. This actually confirms the results of the evaluation carried out in the year 2001.

Conclusions

Summarising it can be said, that the linking of the monitoring and the ex-post evaluation has proven to be a very useful and valuable exercise providing additional insight into

the development of project success or failure of projects funded by the FFF. As to this regard particularly the indicators practical value and market experience seem to be able to indicate future success of a project, while this discriminatory power does not seem to prevail with regard to the other indicators. Principally, the FFF seems to underestimate the market prospects and commercialisation of successful projects and to overestimate the market prospects and commercialisation of not successful projects during the ex-ante evaluation. Further effort might be necessary in order to improve the monitoring system of the FFF as to this regard, whereby considerable improvements could already be obtained by avoiding the possibility of average values in the scope of the ex-ante evaluation.

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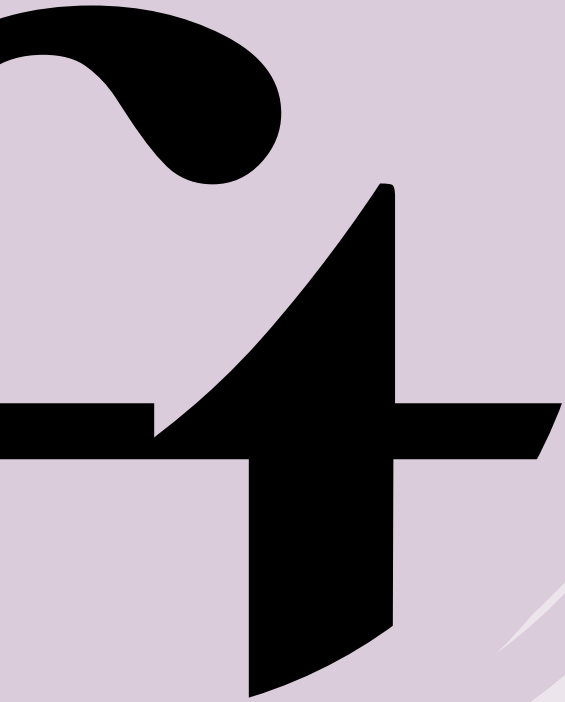

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