Creating Cross-border Competence

Impact Evaluation of the Wood Material Science and Engineering Research Programme

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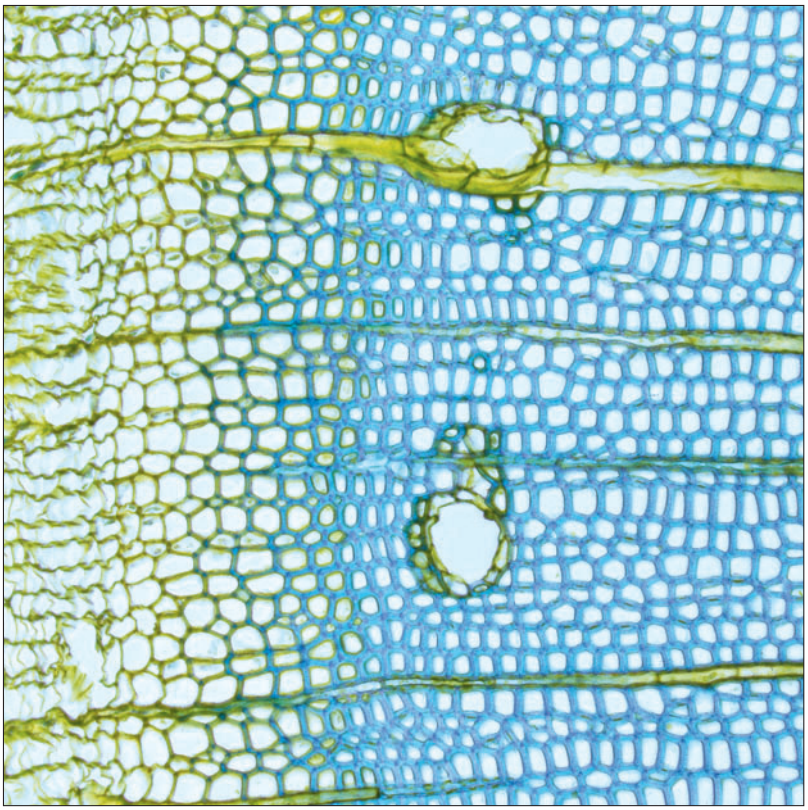
Tekes Programme Report 2/2008 | Evaluation Report



Tekes

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Evaluation Report

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Tekes Programme Report 2/2008
Helsinki 2008

Tekes, the Finnish Funding Agency for Technology and Innovation

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Foreword

The Finnish-Swedish Wood Material Science and Engineering (WMS) Research Programme (2003–2007) has been the first step towards creating a common research platform in the area of wood material science and engineering. It was intended to promote the competitiveness and sustainability of European forestry and forest-based industry.

The WMS Programme had both research and innovation oriented goals and it was a joint effort of several funding organisations. In Finland, the projects were funded by the Ministry of Agriculture and Forestry, the Academy of Finland and Tekes. In Sweden, the financiers were VINNOVA and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning. Thus, the co-operation was the key element in the WMS Programme at all levels: between research groups, between research and industry, between research funding organisations and internationally.

The total evaluation of the Programme consisted of two subprojects. The first one was the scientific evaluation commissioned by the Academy of Finland. It focused on the scientific excellence and was carried out by an international expert panel. It will be reported in the Academy publication series. The impact evaluation was commissioned by Tekes in a close co-operation with four other funding organisations. The main issues here have been the effectiveness, the operational performance and the added-value of the co-operation.

Like the WMS Programme itself, the evaluation was carried out jointly by a Finnish expert group from Advansis Oy and by a Swedish expert group from Technopolis Group Ltd. Tekes wishes to express its warmest gratitude to Kimmo Halme and all the evaluators who have made an excellent work and suggest many valuable recommendations for the future. Tekes would also like to thank the members of the evaluation steering group: Ilmari Absetz, Jaana Roos, Torbjörn Winqvist and Pekka Pesonen.

The work to create cross-border competence and to establish a well-functioning co-operation platform at European level continues. Tekes wishes that this evaluation report will become an important source of information in this process.

February 2008

Tekes, Finnish Funding Agency for Technology and Innovation

Executive Summary

Evaluation of the WMS Programme

The Swedish-Finnish Wood Material Science and Engineering Research Programme 2003–2007 (WMS Programme) was jointly funded by the Academy of Finland, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas), the Ministry of Agriculture and Forestry of Finland, the National Technology Agency of Finland (Tekes) and the Swedish Governmental Agency for Innovation Systems (VINNOVA).

The five funding organisations commissioned an ex-post impact evaluation of the WMS Programme. A separate *scientific evaluation* of the WMS Programme was carried out by an international expert panel during April and May 2007. The scientific evaluation will be reported separately by the Academy of Finland.

For the impact evaluation, the key questions addressed were:

A) Operational performance
B) Effectiveness of the programme
C) Added-value, possibilities and obstacles of the Finnish-Swedish co-operation in strengthening the network of expertise needed for implementation of projects.

The impact evaluation has been jointly carried out by Advansis Oy and Technopolis Group Ltd between March and December 2007. The evaluation employed a three-phased sequential process, which combined document analyses with quantitative research methods (surveys, output statistics) and qualitative methods (interviews, workshops, expert views).

The WMS Programme and its context

Swedish and Finnish researchers and industry in this field share many similarities and have a long history of collaboration. Yet the WMS Programme was one of the first attempts to bring the research funding instruments and programmes of the two countries and their five funding institutions closer together.

In Finland, the Programme was preceded by the Finnish Forest Cluster Research Programme Wood Wisdom (1998–2001) that focused on wood as raw material in the pulp and paper industry and the wood products industry. In many ways, the Wood Wisdom programme provided a starting point in Finland for the process that led to the initiation of the WMS Programme. The international collaboration between research funding organisations has continued and expanded into the field of wood and forest research since the commencement of the WMS Programme, building particularly on these experiences. This was anticipated already at the start of the WMS Programme, as Tekes prepared the proposal for the WoodWisdom ERA-NET during spring 2003. This Tekes-coordinated ERA-NET was launched in 2004 in parallel to the WMS Programme and it has participants from eight European countries, including all the funding organisations of the WMS Programme. The Swedish-Finnish collaboration in the WMS Programme also contributed to some extent to the initiation of the European Forest-based Technology Platform.

The overall budget of the WMS Programme was 19.7 million euros and involved 317 researchers from 29 research units and more than 70 partner organisations. Among the partner organisations, 48 were industrial companies. In Sweden indus-

try mainly contributed in kind with research work and materials, while in Finland they acted as project funders.

Operational performance

The WMS Programme structure was a reasonably complex one. There were two separate calls and two sub-programmes. There were also two Programme Coordinators – one for each country. The role of the Programme Coordinator was long unclear to the Swedish funding agencies and there was an imbalance in coordination efforts between the two countries.

The project Advisory Boards were a key element for research-industry collaboration in the WMS Programme, but according to the evaluation, Finnish industry appears to have participated in projects to a greater extent than Swedish industry. Also the rules for industry's participation were different in Sweden and in Finland. This had several implications in the projects: different participation rules caused some friction among industrial partners, the Swedish industry was positioned closer to the actual conduction of research, whereas Finnish industry participated through the Advisory Boards and the Finnish researchers had more funds and autonomy to decide on their project expenditures.

Overall, the Programme objectives were considered ambitious and challenging also by the industry, although most projects were initiated by researchers and not by industry. To a large extent, the WMS projects were curiosity-driven rather than mission- oriented.

Effectiveness

The scientific output of the WMS Programme has been extensive. All 16 research projects were successfully implemented, each of them involving researchers from both Finland and Sweden. 14 of these projects counted on industrial participation to varying degrees. A total of 317 researchers worked in these projects, 174 on the Finnish side and 143 in Swedish organisations. A total of 20 PhD degrees (or equivalent), 11 licentiate degrees and 21 MSc degrees were awarded to Programme researchers until the end of 2007.

The Programme Committee perceived that the objectives of the promotion of multidisciplinary research and strengthening of international research cooperation were fulfilled to a significant degree. The biggest challenges were in strengthening the competitiveness of forest-based industries, stimulating international mobility of researchers and intensifying research training. The contributions of the individual projects to the Programme objectives vary greatly.

Based on the in-depth case studies carried out, project-level success factors may include:

- Researchers having a history of previous collaboration or at least knowing each other from before (few teething problems)
- Genuine complementarity amongst research groups (as opposed to opportunistically constructed consortia)
- The project being part of an ongoing, larger research effort
- Participating industry participant(s) having a clear strategy for exploitation of project results.

Arguably the most important impacts of the Programme for participants from universities and research institutes were the creation of better understanding of bilateral collaboration, building of joint track records and establishment of trust for future joint initiatives. Creation of new scientific knowledge, scientific competence and technical know-how, as well as enhanced understanding of industrial realities, are other important impacts.

On a similar note, the most important impacts for the funding organisations appear to be better understanding of both bilateral collaboration and domestic interagency collaboration between research councils and mission-oriented funding agencies. These experiences may prove quite useful for example within ERA-NET initiatives.

For industry participants, impacts of the bilateral nature of the Programme appear scant, probably mainly due to the fact that there appears to have been very little international collaboration involving industry. There are examples of industry participants utilising Programme results in their own research, but the Programme yielded few results that have been directly exploited by industry.

Added value of Swedish-Finnish cooperation

The WMS Programme opened up a window of opportunity. An overwhelming majority of the researchers believe their project would otherwise probably not have started at all, and had it started without the push the Programme provided, it would have been carried out on a less ambitious scale and progressed slower than it did. Also, significantly, it would not have included projects partners from abroad and would in general have involved fewer and/or different project partners. Several researchers unequivocally state that had it not been for the Programme, collaboration with organisations from the other country would not have taken place.

In most cases, the bilateral collaboration built on existing contacts. According to survey responses, some 60% of the researchers had already cooperated with all or many of the other project participants before the WMS project, whereas less than 15% had not cooperated with any of the others before this project. This picture is corroborated by the interviews carried out with project participants from industry, universities and research institutes.

While all projects by necessity were bilateral, the extent of genuine bilateral collaboration varied significantly between projects. Some projects have provided an opportunity for cross-country collaboration on common issues, others seem to have practiced a division of labour along the border.

Overall, the collaboration between the five research funding agencies worked well, but different prerequisites (available funding, previous experiences and top-level support) did create some problems. The WMS Programme has increased understanding of bilateral collaboration on both sides of the Baltic, and has also increased understanding of the research culture in the other country. On project level, collaboration has provided participants with an increased understanding of cross-country collaboration, and a better understanding of the research culture abroad.

Conclusions and lessons

The Wood Material Science and Engineering Research Programme 2003–2007 was, in many ways, a challenging and ambitious programme. The Programme management and the funding agencies were far-sighted with respect to programme design. Without this bilateral effort, Finland and Sweden would not have such a central role in the current process of internationalisation of the forest-based sector, and would not be as well positioned to compete internationally in research in the field.

The Programme was successfully concluded and had valuable impact particularly with regards to the following aspects:

- The Programme scope definition was systematic and project selection ambitious. The Programme managed to advance top-level research in fields that were considered relevant within academia, the five funding organisations and industry. In these areas, scientific output was extensive (articles, degrees), particularly in relation to its rather limited duration and funding volume.
- There has been a positive contribution to bringing Swedish and Finnish researchers closer. Several excellent research projects would not have started were it not for the WMS Programme. The transnational research collaboration continues in many projects after the Programme, but rather at the individual level than at institutional or research group level. Existing networks have continued and been strengthened and some new cross-border collaborations have emerged. Researchers and industry value getting to know new partners for potential future collaboration.

- The competence and readiness of the five research funding agencies to organise transnational research programmes has significantly improved through the joint learning process of the WMS Programme. This has had immediate positive implications for their contributions in Nordic and European research programmes and collaboration platforms.

The WMS Programme provides a wealth of important lessons for future research programmes of international character, which are synthesised at the end of the report.

Contents

1 Preface

The Swedish-Finnish Wood Material Science and Engineering (WMS) Research Programme 2003–2007 was an ambitious programme with regard to its scientific and collaborative objectives. Swedish and Finnish researchers and industry in this field share many similarities and have a long history of collaboration. Yet the WMS Programme was one of the first attempts to bring the research funding instruments and programmes of the two countries and their five funding institutions closer together.

The ex-post evaluation of the Programme – conducted between March and December 2007 – has investigated the effectiveness, operational performance and Swedish-Finnish collaboration of the Programme. It reveals many important lessons that can be taken into account for future research programmes of international nature. A scientific evaluation of the Programme has been conducted in parallel and is reported separately.

The impact evaluation has been jointly carried out by a team from Advansis Oy in Finland (Kimmo Halme, Sami Kanninen and Kimmo Viljamaa) and the Technopolis Group in Sweden (Erik Arnold, Tomas Åström and Tommy Jansson). Also, two independent experts have been commissioned to provide their experienced views on the results and findings of this evaluation; Professor Emeritus, Jorma Sundquist, former R&D Director of KCL in Finland, and Dr. Ulf Carlson, former group R&D manager of SCA AB in Sweden.

The evaluation team would also like to thank the numerous individuals who have contributed to this work through workshops, interviews and surveys.

Helsinki & Stockholm, 31.12.2007

Advansis Oy & Technopolis Group Ltd

2 Introduction

2.1 Assignment

The Swedish-Finnish Wood Material Science and Engineering Research Programme 2003–2007 (later referred to as the WMS Programme) was jointly funded by the Academy of Finland, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas), the Ministry of Agriculture and Forestry of Finland, the National Technology Agency of Finland (Tekes) and the Swedish Governmental Agency for Innovation Systems (VINNOVA).

The five funding organisations commissioned an ex-post impact evaluation of the WMS Programme. The impact evaluation has been jointly carried out by Advansis Oy and Technopolis Group Ltd between March and December 2007.

In parallel to the impact evaluation, a separate *scientific evaluation* of the WMS Programme was carried out. The scientific evaluation was conducted by an international expert panel during April and May 2007. The scientific evaluation will be reported separately by the Academy of Finland.

The following descriptions and findings concern and are done on the basis of the impact evaluation of the Programme; however, the draft report of the scientific evaluation has also been used by the impact evaluation team. The main issues of the impact evaluation, as stated in the call for tenders, were the effectiveness, the operational performance and the added value of the co-operation. Based on these assessments, the evaluation provides recommendations regarding programme management and particularly the organisation of cooperation at the different levels of the programme.

The key evaluation questions to this end were as follows:

A) Effectiveness of the programme

- What have been the main results of the Programme so far?
- How well has the programme succeeded in achievement of the goals?
- How well has the Programme achieved in the criteria of innovativeness, industrial relevance and good science?
- Was the chosen project portfolio appropriate to achieve the goals of the Programme?
- What kind of future impact the Programme is to achieve?

B) Operational performance

- How well the Programme Committee, advisory groups, programme coordinator and funding organisations have co-operated and managed the programme?
- How did the project partners in different countries cooperate as compared to partners in same countries?

C) What is the added-value, possibilities and obstacles of the Finnish-Swedish co-operation in strengthening the network of expertise needed for implementation of projects?

- in creating a knowledge base enabling the development of innovative and eco-efficient forest-based products and processes?
- in disseminating the results and using them for promoting the competitiveness and sustainability of forestry sector and forest-based industry?

D) Recommendations for the future

- How to organize cooperation between countries?
- How to organize industry cooperation to research and to industry in other countries (already in project preparation stage)?
- How to organize international cooperation between financing organizations of different funding profiles (basic research, applied research, industrial research and development)?

2.2 Previous experiences from Nordic programmes

The importance of the international context for the success of programmes was highlighted in an evaluation[1] of the Danish-Swedish Øresund Contracts programme, which suggested that there were many positive project outcomes but also highlighted a number of difficulties that need to be considered in the design of cross-border R&D programmes. A central message from this experience was the requirement for cross-border programmes – like national ones – to address the needs of their beneficiaries rather than of politicians or administrators.

Based on experience both in Nordic cooperation and in the early stages of ERA-NET, also TAFTIE has produced some useful observations[2] about how to organise cooperation between national programmes. An absolute prerequisite for successful cooperation is that there is a shared interest, which agency management is committed to fulfil. "*Transnational collaboration between national programmes only really works well if there are real, strong, perceived needs for collaboration. Where there is a strong will to cooperate, practical ways to cooperate can often be found.*" TAFTIE saw cooperation as often being relevant between parts of different programmes or policies. For example, Finnish-Swedish cooperation on research into fundamental aspects of telecommunications technology had been implemented through a series of short programmes (INWITE, EXCITE and most recently NORDITE, with additional Norwegian participation), but more applications-oriented work is done in separate national programmes. The same logic appears to apply in the set up of the WMS Programme, where most projects tackle the more fundamental end of the R&D spectrum.

Historically, the use of technology programmes is well established on both sides of the Baltic, and has been reinforced over the years by regular meetings among Tekes, NUTEK/VINNOVA and the Research Council of Norway's Innovation Division to exchange experiences. The WMS Programme is partly enabled by this tradition, since the modus operandi is already familiar to both Swedes and Finns. One of the basic assumptions for the establishment of the WMS Programme was the already existing experiences from running research programmes on both sides of the Baltic, which would allow for smooth collaboration in a joint programme.

The aims, types and means of international collaboration as part of research and technology programmes was studied earlier in 64 programmes funded by Tekes.[3] This evaluation provided one analytical framework for assessing the nature of collaboration in the WMS Programme as well. According to its findings, international collaboration within technology programmes could be analysed at three levels of operation: a) at the programme design and financing level (strategic); b) at the programme coordination and management (operational); and c) at the project level (substance, practice). Also, the international element of programmes can be studied in terms of the programme process. This analytical framework is described in Figure 1.

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1 Sven Faugert, Erik Arnold, Alasdair Reid, Annelie Eriksson, Tommy Jansson and Rapela Zaman, Evaluation of the Öresund Contracts for Cross-Border R&D Cooperation between Denmark and Sweden, VINNOVA Rapport 2004:12, Stockholm: VINNOVA and VTU, 2004

2 TAFTIE (The Association for Technology Implementation in Europe), Framing Collaboration Models Between National Research and Technological Development Programmes, 2005 www.taftie.org

3 Competitiveness through internationalisation, Tekes 2004.

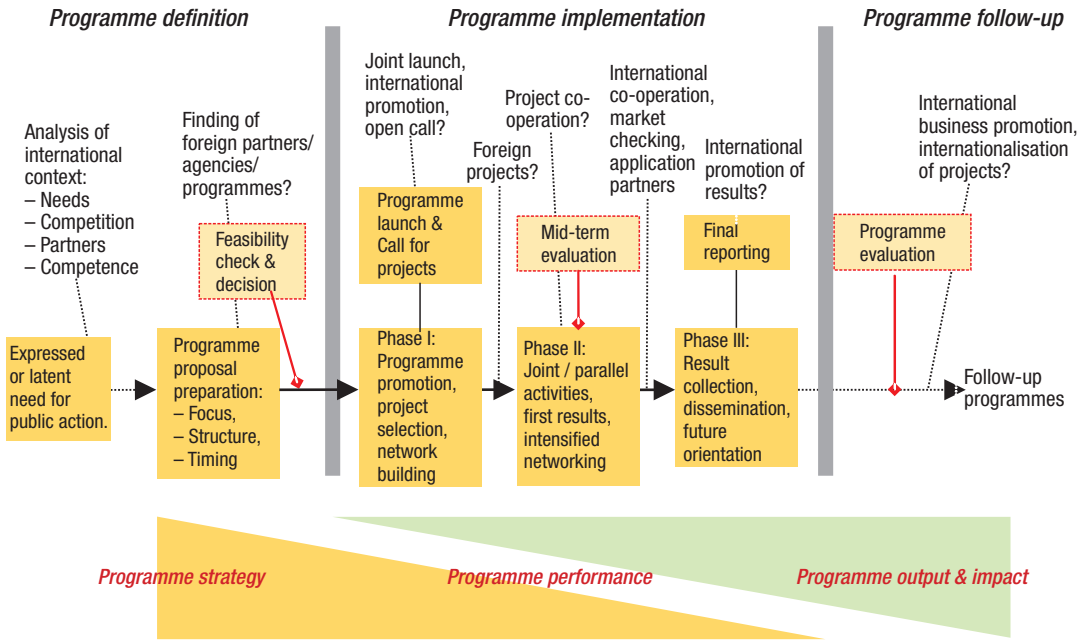

Figure 1. Analytical framework for assessing the role of international collaboration in the life-cycle of technology programmes, adopted from an evaluation conducted for Tekes in 2004.

An important element of the WMS Programme is its role in a sequence of cross-border activities that include aspects of the competitive relationship between KCL and STFI-Packforsk, other cases of local cooperation (for example between Åbo Akademi and Mid-Sweden University), Wood Wisdom ERA-NET and the European Forest-Based Technology Platform, in which the Finnish and Swedish authorities and industry have been significant actors. Key to learning about this process and about the role of WMS in it, is a thorough understanding of the context in which these programmes were carried out and how preceding programmes laid the foundation for the subsequent steps for strengthening and enlarging the international collaboration. In the evaluation, we have also considered these innovation-system specific and cross-border specific issues. This provides a basis for generating valuable insights concerning the organisation and management of future programmes, particularly in the forest-based sector but also in other sectors, as the lessons learned from the internationalisation process in the forest sector are likely to be relevant also in other contexts.

2.3 Evaluation methodology

The impact evaluation of the WMS Programme was carried out between March and December 2007 through a three-phased sequential process described in Figure 2. The process combined document analyses with quantitative research methods (surveys, output statistics) and qualitative methods (interviews, workshops, expert views) for the purposes of determining Programme impact. The key elements of this process are described in detail below.

Definition of the evaluation approach

At the beginning of the evaluation, it was particularly important to develop a common understanding of how the results of the evaluation will be used. On a general level, evaluation principles and practices are nearly universal, but on the

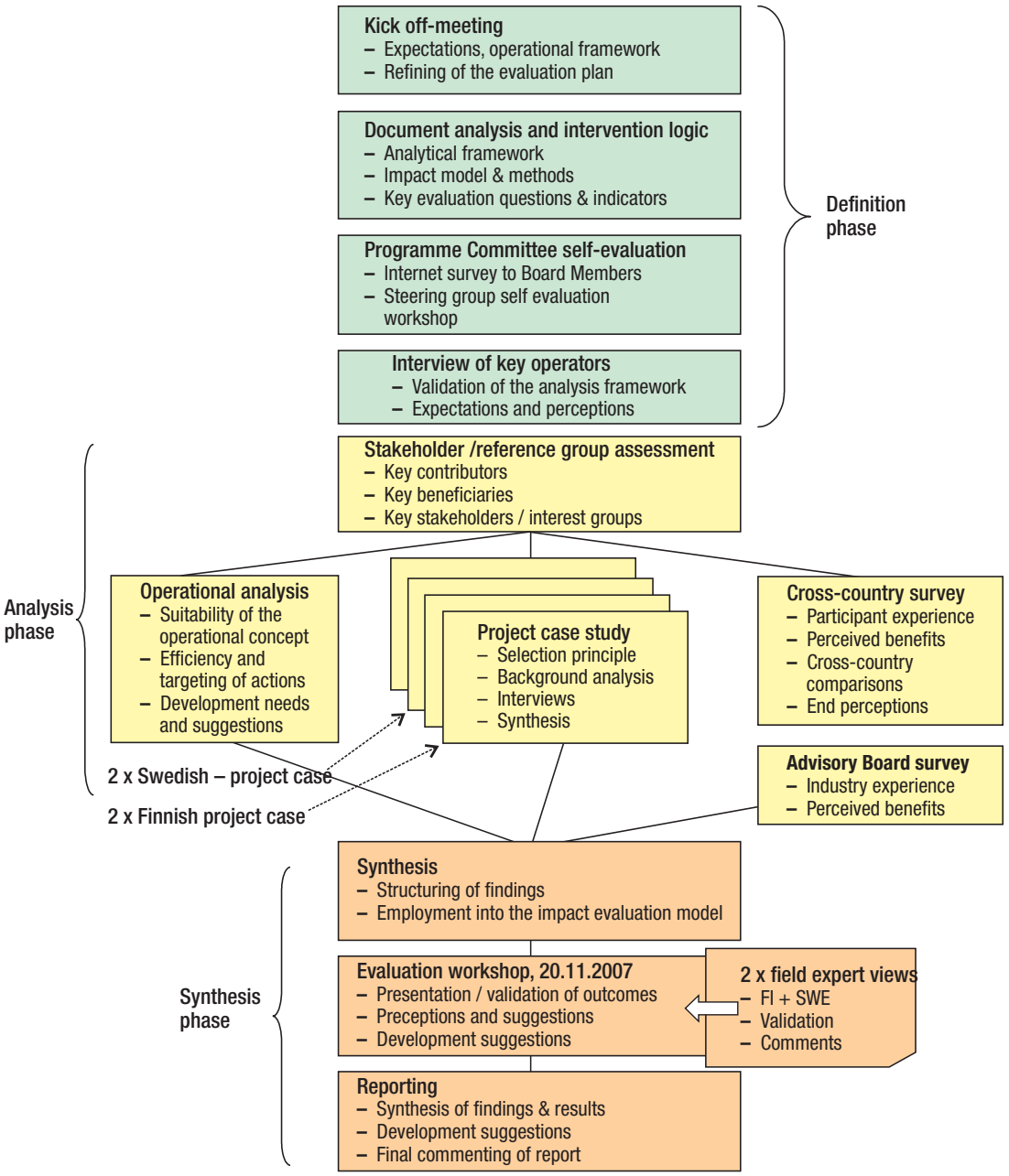

Figure 2. Illustration of the evaluation process, its phases and key elements.

practical level, programme evaluations have somewhat different emphases in Sweden and Finland.[4] Swedish research programmes tend to pay more attention to building of sustainable premises for conducting good research and their evaluations may be characterised as a learning process for all stakeholders. On the Finnish side, Tekes' technology programmes tend to have a more mission-oriented, strategic approach and this is often the main focus of evaluations as well. Both evaluation practices were taken onboard as much as possible.

Document analysis and intervention logic model

The aims of the document analysis were to generate a clear understanding of why and how the Programme was justified and launched in both Finland and Sweden. This involved analysis of program documents and other background material that supported the decision to launch the joint programme. In addition to the normal justifications, it was considered important to explain why the decision to make the Programme international was taken and what the intended effects of this aspect were.

An output of this work – which was complemented by inputs from interviews – was a description of the 'logic/impact model' of WMS Programme that is an account of the mechanisms through which the Programme was expected to reach its intended social and economic effects.

Programme Committee self-evaluation

A self-evaluation of the Programme was conducted by the WMS Programme Committee. The purpose of the self-evaluation was to collect the perceptions and experiences of the Programme Committee with regard to Programme set-up and structures, Programme scope and its appropriateness, issues of Programme coordination, as well as the meeting of Programme objectives at a general level.

The self-evaluation was conducted in two steps. First an internet-based survey was sent to all Programme Committee Members[5], focusing on the following issues:

- Effectiveness of the Programme and achievement of the specific Programme objectives
- Appropriateness of the project portfolio to achieve the goals of the Programme
- Operational performance of the Programme and functioning of the Programme organisation
- Nature, activeness, success and added value of the international collaboration
- Key expectations from the evaluation (issues of particular importance and the use of results).

The results of the self-evaluation questionnaire were presented and discussed in a Programme Committee meeting (workshop) on 20th April 2007. Although the population (N=24) and response-rate (45,8%) of the Programme Committee self-evaluation survey did not allow for statistical analyses, the received inputs and discussions provided an excellent basis for further discussions in interviews with participants and board members alike, giving signals about both Programme challenges and successes.

Interviews of key operators and stakeholders

The purpose of the key operator interviews was two-fold: first, the interviews were used to identify the expectations of different parties towards the evaluation as well as perspectives that could be useful in assessing the effectiveness, operational performance and added-value of the Programme. Second, through the interviews, the intervention logic of the Programme was refined and validated. The interviews focused on identifying key mechanisms through which the Programme strived to strengthen the forest-based innovation system, looking at the Programme management, the funding agencies as well as key participants.

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4 Here we primarily refer to the practices of VINNOVA and Tekes, as the research funding organisations mainly carrying out scientific evaluations.

5 This included representatives of all five funding agencies, the previous and current Programme Coordinators from both countries, as well as other key stakeholders and experts in the field of the WMS Programme.

The objective of the stakeholder group assessment was to evaluate Programme effectiveness based on the perceptions of key stakeholders. These stakeholder groups include participants, key beneficiaries of the Programme as well as other interest groups that have been identified in the previous phase. The analysis was carried out through interviews, focusing on the results of the Programme, the achievement of goals, the industrial relevance, and the likely future impacts of the Programme. Explicit questions were raised on the input and behavioural additionality, attribution and dead weight (i.e. the extent to which achievements during the time of the Programme would in fact have been achieved in any case). In practice, funding recipients often have a range of funding choices: there is competition among funding suppliers as well as funding applicants. Exploring the perceived strengths and weaknesses of alternative funding sources and understanding why beneficiaries chose to apply for WMS funding helped to clarify the distinct role of the Programme and provided lessons for positioning future interventions.

Operational analysis

An assessment of the cooperation in the governance of Programme activities was carried out by interviewing Programme management, advisory groups, and funding organisations. Also inputs from other sources, especially the case studies and the cross-country survey, were used for this. The objectives of the analysis were to evaluate the intensity and nature of collaboration among different parties, the cooperative mechanisms and structures established, challenges and lessons learned. These interviews also tackled questions about the role of WMS in the larger picture of programmatic interventions, since the Programme was one in a series of national and international programmes in which the Finnish and Swedish authorities have been involved over time. The way different stakeholders' roles in governance complement each other provided important lessons for future interventions.

Project case studies

The purpose of the project case studies was to deepen the understanding of the value added of the Finnish-Swedish cooperation in terms of its impact on the strengthening of the research networks of expertise and also to explore the value-added of the cooperation at the programme level.

The case study selection criteria were established in collaboration with the evaluation steering group[6]. Six potential case projects were pre-investigated and discussed with the Programme management, on which basis the final selection of case projects was made by the evaluation team. Altogether four case projects were selected; two projects led by Swedish researchers and another two led by Finnish researchers. The key characteristics of the selected case projects is summarised below (Table 1).

The case studies provided input particularly on the additional opportunities the Finnish-Swedish cooperation had provided to the participants in both countries, how the international structure supported the establishment of new collaboration, and how programme-level operations supported the dissemination of results internationally. One important question addressed was how the Programme supported the strengthening of human capital – did the international nature of the Programme create additional opportunities for research exchange and what is the likely impact of this on the researchers future careers? Specific questions addressed at the project level were for instance:

- Did the international structure provide project participants with better access to new sources of knowledge or capabilities?
- Were research collaboration with complementary competences identified and strengthened?
- Did the international structure create additional administrative burden on the participants?

6 Consisting of representatives from Tekes, VINNOVA, the Academy of Finland and the evaluations team.

Table 1. Summary of the selected case projects.

Project	2 WAW	8 BUNDLE	11 NanoCell	12 ECOMBO
Sub-programme	Basic research	Basic research	Innovation targeted	Innovation targeted
Focus area	Forest research	Forest & chemical wood processing research	Chemical wood processing	Mechanical wood processing
Coordinator	Swedish university	Finnish research institution	Swedish research institution	Finnish research institution
Type of impact: 1) creation of research networks, 2) industrial relevance	Creation of research networks	Creation of research networks	Creation of research networks and industrial relevance	Industrial relevance particularly for SMEs
Financing of sub-projects	One public financier for each sub-project (excluding small contribution from SSF in one project). No industrial funding.	One public financier for each sub-project. Industrial funding for some sub-projects.	Every sub-project funded by one public financier and industrial funding.	Multiple public financiers in each sub-project together with industrial partners and town of Kemijärvi.
Mode of industrial participation	No industrial advisory group. However, work is continued in a Tekes project.	Industrial advisory group.	In-kind contribution from Swedish industry. Industrial advisory group.	Industrial advisory group. In Finland dissemination through CoE programme.
Preliminary comments from scientific evaluation	Excellent project Good research and results. After the funding of Academy ended, Tekes continued to finance the project.	Interesting challenge case. Very relevant and important project, which has had also difficulties.	Successful project, should lead to new products. Large project. One of the most innovative projects. Started with difficulties in cooperation, but later worked out well Interesting lessons. Long lasting impact.	Included many SMEs. In Finland an interesting coordination and dissemination model was introduced, which was a useful way to involve and commit SMEs to the project. In Sweden SMEs were not involved in a similar way.

The project consortia on which the case studies focused included both projects in which the international aspect was particularly strong as well as projects in which international collaboration was not as intense as had been hoped. The purpose of this balance was to provide insight into the background to and reasons for success of international projects. In addition, the four case studies involved both projects where the Swedish participants were particularly active and in central positions as well as projects in which Finnish participants were the most active partners. The cases included two basic research projects and two innovation-targeted projects.

Case information was gathered through desktop analysis of project objectives, implementation and results as well as through interviews with key participants and project managers. Interviews for individual case studies were done both in Sweden and in Finland to capture the perceptions in both countries. The information received was analysed on a case-by-case basis as well as across the whole sample to generate insights into key success factors for the management of international collaborative programmes.

Cross-country survey

The purpose of the cross-country survey was to collect quantitative information on Programme implementation, results and impacts for comparative purposes. As a method for collecting empirical information, the survey complements the case studies, as it provides an overview of all the WMS projects. The survey questionnaire focused on participants' experiences regarding Programme management and implementation, project outcomes and particularly the extent of networking and collaboration in the Programme. The survey was conducted with a web-based questionnaire (webropol).

The information gathered with the survey was analysed with descriptive statistics describing the whole sample of participants. In addition, the survey data was used to explore potential differences in the perceptions and experiences of Finnish participants on the one hand, and Swedish participants on the other.

The cross-country survey was submitted to all coordinators and researchers in the sixteen projects of the WMS project, including all the 65 sub-projects. Of the 121 e-mail addresses provided to the evaluation team, 94 were valid when the survey was distributed. Responses were received from 46 individuals, resulting in an overall response rate of 48,9%. At least one response was received from each of the 16 projects of the Programme.

Advisory Board Survey

13 of the 16 projects had an Advisory Board assigned to them. The Advisory Boards mainly consisted of industrialists, who represented research project financiers and other end-users of expected outcomes. The Advisory Boards had an important function in overlooking and discussing the relevance of project outcomes. It was therefore essential for the evaluation purposes to collect all Advisory Boards' perceptions. This was done through a web survey sent to all 54 Advisory Board members, of which only 14 responded, providing a 25,9% response rate. Due to the low response rate, no statistical analysis was done, but survey responses to open questions were used merely as additional information to complement other sources.

Synthesis and evaluation workshop

The synthesis phase of the evaluation drew together the results and findings of the different analyses. The stakeholder group assessment generated a broad view on the effectiveness and added value of the Programme to the strengthening of the innovation system. The operational analysis focused on Programme-level activities and shed light on the operational performance as well as on the added value, possibilities and obstacles relating to the Finnish-Swedish cooperation. The case studies provided detailed understanding of the impact generation processes and added value of the Programme as seen from the perspective of individual projects. The cross- country survey provided an overall picture of the projects and their networking, and enabled comparison across countries.

Two experts with a broad experience in the forest-based sector were invited to the evaluation process. The experts were to comment the findings to ensure that the conclusions were balanced, well-founded and relevant to the development of the innovation system. The comments of the experts are integrated into the findings presented in this report.

The draft synthesis formed through these different inputs was presented at an evaluation workshop held on 20th November 2007 at Tekes. The participants of the workshop consisted of the evaluation team, the evaluation steering group, Programme management, and other key stakeholder groups. The evaluation findings were presented and discussed in detail, while the workshop also served as a mean to disseminate the preliminary evaluation results before final reporting.

3 Wood Material Science and Engineering Research Programme 2003–2007

3.1 Background and Programme context

The Finnish-Swedish Wood Material Science and Engineering Research Programme (2003–2007) was aimed at creating core competences enabling the development of innovative sustainable products, processes and services. In addition, it was planned to strengthen the innovation system in the field of wood material science and engineering and to intensify the knowledge and technology transfer between producers and users.

The WMS Programme tackled a series of technical challenges associated with optimising and exploiting wood-based materials – partly within the supply chain of the pulp and paper industry and partly in the mechanical wood products industry. These are issues of particular interest to the Nordic countries and a handful of other countries, including the USA, Canada and Austria. They span a range of disciplines from genetics through chemistry to mechanical engineering and address the needs of a set of industries with very different amounts of absorptive capacity.

Some of the large forest and paper-related organisations involved in the Programme have significant internal R&D capabilities and absorptive capacity, while most companies involved in forestry and wood mechanics (the beginning and end of the supply chain) often have considerably more humble R&D capabilities and lower absorptive capacity. Understanding and developing strategies for embedding the Programme in its context in Finland and Sweden was therefore an important aspect of the management of the Programme as a part of a larger set of activities aimed at supporting industry. These different contexts set the framework for the design, implementation and effectiveness of the Programme in the two countries and therefore also provided key to learning from this evaluation.

In Finland, the Programme was preceded by the Finnish Forest Cluster Research Programme Wood Wisdom (1998–2001) that focused on wood as raw material in the pulp and paper industry and the wood products industry, see Figure 3. The Wood Wisdom programme was novel in its broad, overarching nature that linked researchers and industrial companies in the value-adding chain of the forest industry. In many ways, the Wood Wisdom programme provided a starting point in Finland for the process that led to the initiation of the WMS Programme. The Wood Wisdom programme, and particularly its final evaluation, indicated that in the future, publicly funded research in the forest sector should be directed towards wood materials research.[7] During the programme it also became apparent that increasing international collaboration was crucial in order to exploit scarce R&D resources efficiently. These views were reflected in Sweden, where forestry and forest industries shared similar interests in relation to the European Commission's framework programmes, despite the fact that wood material science has not been prioritised in the European Commission's 6th framework programme.

7 Salo, A., Utunen, P., Lievonen, J. & Mild, P. Finnish Forest Cluster Research Programme (1998–2001): Results from a self-evaluation process. Tekes, 2002.

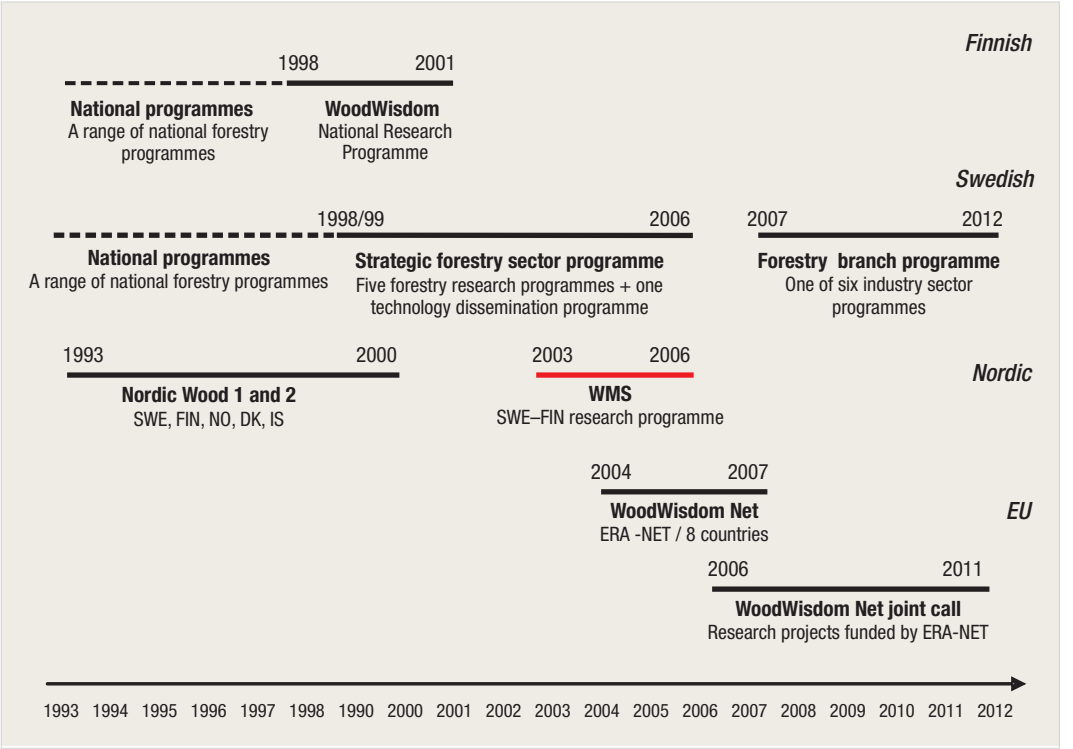


Figure 3. WMS Programme context.

As the Wood Wisdom programme was funded by several public research financiers, it provided an opportunity for learning how to organise jointly funded programmes. These experiences were later utilised in the WMS Programme, but in a more complex international setting.

The international collaboration between research funding organisations has continued and expanded into the field of wood and forest research since the commencement of the WMS Programme, building particularly on these experiences. This was anticipated already at the start of the WMS Programme, as Tekes prepared the proposal for the WoodWisdom ERA-NET during spring 2003. This Tekes-coordinated ERA-NET was launched in 2004 in parallel to the WMS Programme and it has participants from eight European countries, including all the funding organisations of the WMS Programme.[8] The Swedish-Finnish collaboration in the WMS Programme also contributed to the initiation of the European Forest-based Technology Platform[9].

3.2 Focus and objectives

In the background of the WMS Programme is the perceived need to strengthen the scientific base and research collaboration between universities, research institutions and world-class companies in key competence areas, which in both Sweden and Finland clearly include forest research and its applications. It was also perceived that national innovation systems and their research funding in the two neighbouring countries could lead to duplica-

8 Full name: Networking and Integration of National Programmes in the Area of Wood Material Science

9 Full name: Sustainable Benefits from Renewable Forestry Resources

tion in areas where similar research is funded separately on both sides. Closer programme collaboration in such areas would most likely facilitate the development of a larger competence base and enforce greater synergies among the operators.

To tackle this challenge, five public research funding organisation, the Academy of Finland (i.e. National Research Council), the Finnish Ministry of Agriculture and Forestry, the Finnish Funding Agency for Technology and Innovation (Tekes), the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas) and the Swedish Governmental Agency for Innovation Systems (VINNOVA) started a joint programme in the area of wood material science. The Programme initially covered the years 2003-2006, but was eventually extended to March 2007.

The overriding objectives of the WMS Programme were *a) to create core competences enabling the development of innovative sustained products, processes and services* and *b) to strengthen the innovation system in the field of wood material science and engineering and to intensify the transfer of knowledge and technology between producers and users*. There were three particular focus areas in the Programme that were *1) forest research, 2) wood products* and *3) pulp and paper.* Horizontal focus aspects to these were sustainability and eco-efficiency. Figure 4 illustrates the focus areas and their interlinkages that have been used in Programme promotion.

The specific WMS Programme objectives were to:

- Promote the sustainable use of natural resources
- Strengthen the competitiveness of forest-based industries
- Generate added value in the wood products industry
- Establish a knowledge base for the development of innovative forest-based products
- Intensify the transfer of new knowledge and technology from producers to users
- Promote multidisciplinary research
- Strengthen international research cooperation in the field of wood material science
- Stimulate international mobility of researchers, and to
- Intensify research training in wood material science.

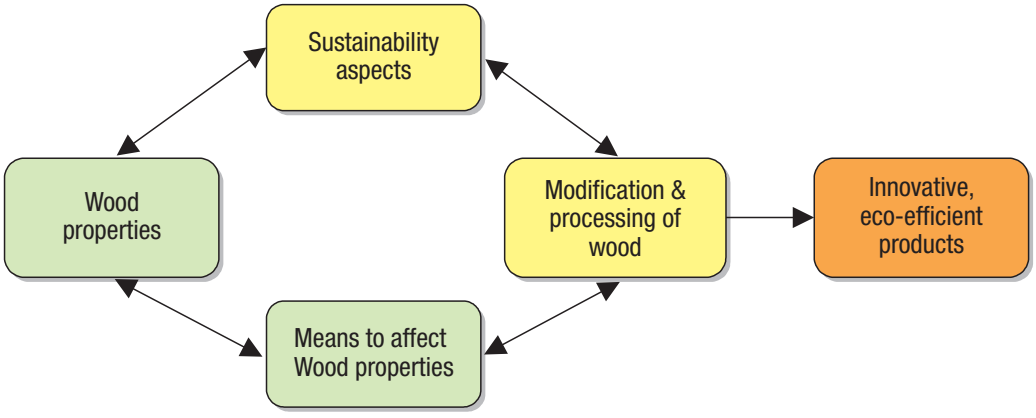


Figure 4. WMS Programme focus areas and their interlinkages.

3.3 Programme structure and volume

For practical organisation reasons, the WMS Programme was divided into two sub-programmes, one for basic research and the other for innovation-targeted research and development. This was a structure already used in previous Finnish programmes and would allow some proposals to be assessed and selected through a process more typical to basic research funding organisations (in this case particularly Formas and the Academy of Finland) with high emphasis on scientific quality, while other proposals could be assessed and selected through a process more typical to funding of applied research and technological development (VINNOVA and Tekes) with emphasis on industrial relevance and innovations.

The division into two sub-programmes also allowed for different focus areas. The basic research projects were to generate new knowledge of wood formation for use in tree breeding and forest management. The innovation-targeted research and development projects were designed to create new functionalities for wood-based products and to develop new forest-based products.

The overall budget of the WMS Programme was 19.7 million euros. Compared to its closest predecessor, the Finnish Wood Wisdom Programme (33 million euros), the WMS was not a large programme. Over the years, the average size of national research and technology programmes has grown in Finland. Tekes' technology programmes are significant in size and usually range between 50–150 million euros, while the Academy of Finland's research programmes are smaller and its share of funding is normally less than ten million euros per programme.

Programme funding was supplied by VINNOVA, Tekes, industry, research institutes, Academy of Finland, Formas, Finnish Ministry of Agriculture and Forestry, universities and others. Industry included altogether 48 companies, of which 15 were small and medium-sized companies. Their contributions were partly in-kind. The distribution of Programme funding sources is illustrated below.

Initially, there were *16 research projects* in the WMS Programme. A full list of projects is provided in Annex 1. Eight of the projects were basic research projects and the remaining eight were innovation-targeted research and development projects.

One selection criterion was that projects must have partners from both Sweden and Finland. This was often accommodated through separate, national sub-projects, which had separate funding arrangements. The projects had 2–6 sub-projects, resulting in altogether 65 subprojects.

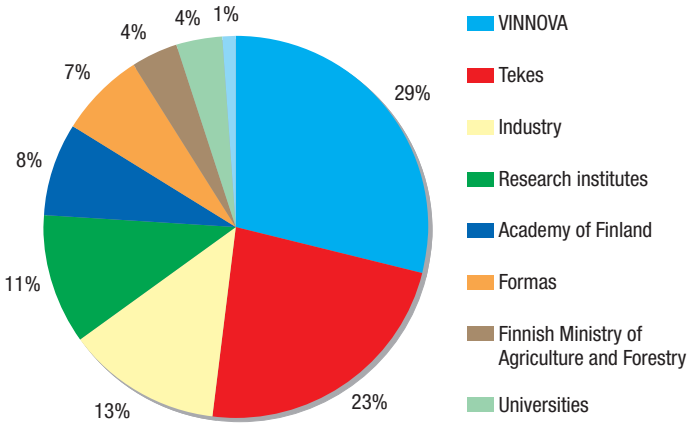


Figure 5. The distribution of funding sources of the WMS Programme.

During the course of the Programme, one more innovation-targeted project was added to the Programme. The additional project[10] has not, however been covered in this impact evaluation and the following statistics do not take into account its results.

3.4 Participants

The WMS Programme[11] involved 317 researchers from 29 research units and more than 70 partner organisations from several countries. Among the partner organisations, 48 were industrial companies. Their roles in the Programme varied, as in Sweden industry mainly contributed in research work and materials, while in Finland industry mainly acted as projects funders.

A major input was organised through project Advisory Boards, which included 138 members. All projects but three had an Advisory Board. The Advisory Boards reported having had a total of 94 meetings in the course of the Programme, while the Programme funding agencies had nine coordination meetings.

According to the scientific evaluation, the WMS Programme also allowed for a significant number of students to be trained and participate in the intellectual growth process, contributing to flow of information and knowledge.

3.5 Key outputs

The final report states that the WMS Programme has been a unique undertaking from its very inception, as it brought together around 30 research institutes and universities and nearly fifty enterprises. Furthermore, the Programme established a solid knowledge base in the field of wood material science and strengthened the cooperation between Finnish and Swedish funding agencies, created cross-border competence networks and brought industry closer together in research. How these impacts were achieved, as well as to which extent the specific objectives of the Programme were met, will be addressed reporting following sections.

As a direct output, the WMS Programme generated 127 scientific articles in international scientific journals with referee practice, 61 conference articles and 60 other scientific publications.

20 doctoral dissertations, 11 licentiate theses and 21 master's theses were generated by the Programme. In comparison to the Wood Wisdom Programme, the WMS Programme had a relatively high output of top academic degrees.[12] Such indicators should nevertheless be treated with caution, as academic degrees seldom can be completely attributed to one specific programme.

10 Project number 17: Functional Genomics of Wood Formation (FuncWood), led by the University of Helsinki.

11 These programme volume numbers differ from those shown in the WMS final report, as the figures of the 17th project have been excluded from the evaluation.

12 For example: in the WMS Programme, 0.9 PhDs were produced per every million euros, which is nearly twice as much as in the Wood Wisdom programme.

4 Impact evaluation of the WMS Programme

4.1 Operational performance

4.1.1 Setting-up the Programme

There was a positive momentum at the end of the Wood Wisdom Programme and the research funding organisations wanted to continue the broad-based collaboration that had been successfully built over the past years. There were also a number of research projects in Wood Wisdom that could benefit from continuation.

Internationalisation was an overriding objective for the WMS Programme at the very beginning. The ERA-Net structure in EU framework programmes was at the time not yet available and broader collaboration was considered under Article 169. The follow-up of Wood Wisdom was intended to be truly an international programme.

The notion of an international programme on wood material science emerged among Finnish funding agencies, which in mid-2001 approached their Swedish and Norwegian counterparts. The Norwegian agencies decided not to participate due to an unclear situation due to reorganisations, whereas VINNOVA and Formas were interested in participating. VINNOVA and Formas had been formed only half a year earlier through a major reorganisation of the Swedish research funding system. The Ministry of Agriculture and Forestry in Finland remained as a minority funder in the WMS Programme, but had an important role in leveraging other funding organisations at the start of the Programme.

The expectation was that it would be relatively easy to collaborate in a Swedish-Finnish research programme. Although forest industry and Nordic scientists were active in international collaboration, the funding organisations soon found out that national research funding structures were not equally well prepared for international collaboration at programme level.

Because of their experience from previous joint programmes and particularly from the recently finished Wood Wisdom Programme, Tekes, the Ministry of Agriculture and Forestry and the Academy of Finland were well prepared and dedicated to establish a new, Finnish-Swedish research programme in the area of wood material science. In contrast, both VINNOVA and Formas were recently formed, their internal structures had yet to settle and their budgetary situations were strained. As a consequence, neither VINNOVA nor Formas were able to quickly secure funding for the new programme, since it had not been established according to normal procedures in the Swedish context and there was little or no support for participation from VINNOVA's management. Programme preparation was thus delayed. Formas was able tap some funds from other open calls, but VINNOVA's budget had already been committed and it had to reallocate funds from two running programmes.[13] Gradually funds became available on the Swedish side as well. Formas and VINNOVA thus had considerably less time to prepare for the Programme and were, according to some statements, consequently not as strategically committed to the Programme as their Finnish counterparts.

4.1.2 Definition of the scope of the Programme

The WMS Programme had the aim to combine both basic research and applied research in one programme, according to a so-called value-chain

13 *Gröna Material* and *Trämanufaktur* programmes

approach. The idea was that, in principle, the programme research themes would form a continuum or a broader frame for knowledge development, in which competence is enhanced at every stage of the value chain. An important emphasis was given to the client needs at the end of the value chain and these needs were reflected in the selection of research topics throughout the chain.

A rather unique approach was used in the definition of the research priorities of the Programme, broadly involving stakeholders of forestry and forest industries. This process, including three consecutive workshops in Finland (November and December 2002) and one in Sweden (January 2003) was planned and facilitated by Professor Ahti Salo from the Systems Analysis Laboratory of the Helsinki University of Technology.

Before the three Finnish workshops, the scope of the research programme was modelled by producing a hierarchical taxonomy, which consisted of three research areas and 16 research themes. The research areas were defined as relatively broad fields of scientific inquiry: 1) *characterisation and alteration of wood material properties,* 2) *innovative eco-efficient fiber, chemical and bio-products*, and 3) *eco-efficient wood products*. These three themes eventually became the topics of the WMS preparation workshops. Under each of these areas, five or six more specific research themes were listed.[14]

In order to probe the interest of researchers, a questionnaire was sent to some eighty top researchers prior to the workshops, in which they were invited to present concrete research topics which they felt important under the 16 themes for the upcoming programme, as well as to present why these were important and what would be suitable approaches to address them. The survey resulted in some 120 potential research topics for the design of the WMS Programme. These were later evaluated on the basis of four key criteria: *1) novelty of research topic, 2) relevance to industrial competitiveness and desired long-term environmental socio-economic impact, 3) research competencies and 4) capabilities of potential users and other beneficiaries to exploit results*.

A Scandinavian workshop was held in Sweden under the topic of *Modification and processing of wood raw material into innovative, eco-efficient products*. The same set of evaluation criteria was used also in the Finnish workshop. Finally the Swedish and Finnish themes were merged and fine-tuned in a joint workshop.

The systematic and participatory theme definition process applied in the WMS Programme can be considered as being novel and efficient. A substantial amount of practical research topics were collected and analysed, and also the awareness and commitment of researchers could be ensured in this process prior to the launching of the calls. The large effort put into the definition of the research programme themes was considered important to ensure a well-functioning programme.

Much of the emphasis in defining the WMS Programme's focus areas originated from Wood Wisdom and subsequently, the collection of potential research topics from the Finnish side of researchers. Similar preparatory effort could have been organised on the Swedish side to ensure the fields and topics take both countries' interest into account in a balanced way.

According to some interviews, despite the strong bottom-up approach in the theme selection, the final themes of the WMS Programme were still largely determined by the focus areas of the funding organisations. This was reflected in a strong focus on forest research, while less emphasis was placed on materials research. The scientific evaluators in the selection of the basic research projects questioned why materials research was not part of the WMS scope, as it would logically complement the forest research and thus enhance potential. Materials research was excluded from the Programme, as it was not within the scope of Formas.

14 Salo, A., Liesiö, J., A case study in Participatory Priority-setting for a Scandinavian Research Programme, 2004.

The research traditions and industry structures of forest, pulp and paper and mechanical wood processing sectors are quite different from each other. Hence, the three focus areas selected did not automatically build on existing collaboration. In fact, it was considered challenging to bring these focus areas closer together in one research programme. Project selection was ambitious, but the focus areas have different research traditions and the projects consequently did not present many synergies between each other. This, together with the reasonably small Programme volume resulted in a programme that did not consist of a particularly uniform set of complementary projects. Hence, there was not much collaboration between projects.

In hindsight, the Programme Committee argued that the definition of WMS Programme project portfolio could have been based more on national research agendas and particularly their overlaps and could have better adhered to the predetermined call criteria in project selection to ensure programme coherence. An increased focus on radical ideas instead of continuing on established lines of research could also have been beneficial. Moreover, a larger funding volume would have allowed covering all important topics and with a view to extending competence networks, exchange of people could have been promoted to a greater extent.

However, at the time of Programme inception, national research agendas in the area[15] had not yet been defined, meaning that the Programme could not be linked to them. With the initiation of the Wood Wisdom ERA-Net in 2004 and the European Forest-based Technology Platform, the national research agendas were being prepared, but this was after the commencement of the WMS Programme.

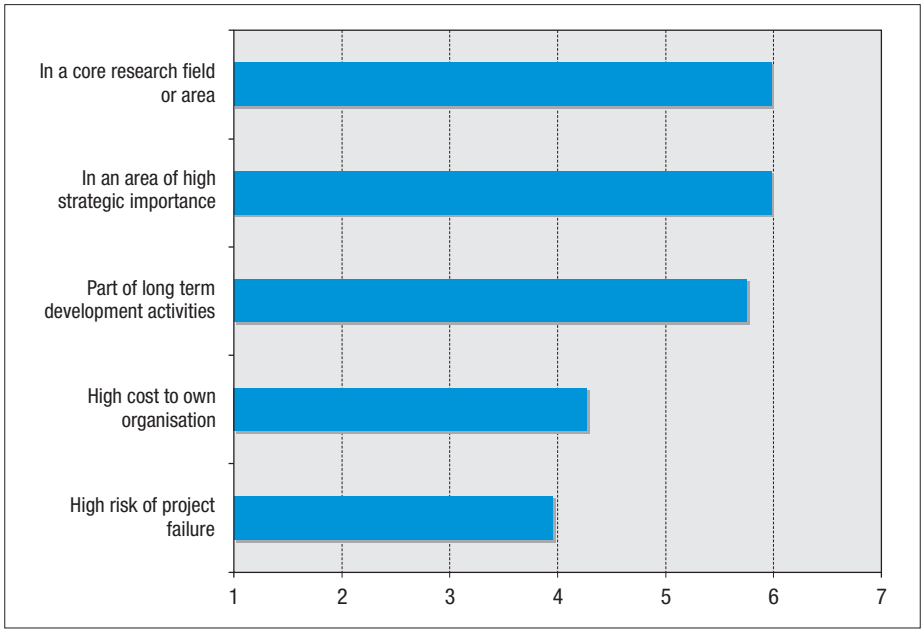


Figure 6. Researchers' perception on the strategic relevance of their own projects. (Scale: 1 =Strongly disagree,…, 7 =Strongly agree. N=45)

15 The Strategic Research Agenda (SRA) defines the common research objectives in European Forest-based Technology Platform (see: www.forestplatform.org/index.php?mid=102) and in connection to that, the National Research Agendas (NRA) define national objectives (see: www.nra-sweden.se/upload/NRA/NRA_summary.pdf)

Although the scope of the WMS Programme was rather broad and perhaps even fragmented, the project topics were considered very relevant to their own organisations. According to the researchers, the projects were nearly all of high strategic relevance and part of an on-going development process (see Figure 6). The researchers' motivation to apply for funding was much less related to sharing of project costs or risks.

4.1.3 Selection and funding of projects

The WMS Programme was split into *two calls*, and therefore also into two *sub-programmes* in order to comply with the evaluation practices of the funding agencies. The dual structure had by itself few practical implications for the projects, but the launch and administration of the sub-programmes differed.

The first call for proposals, organised by Formas and the Academy of Finland (some projects were co-funded by Tekes and Ministry of Agriculture and Forestry), focused on the basic research projects (*Theme 1: Raw material properties of wood, Theme 2: Means to improve the material properties of wood and fibres*). The call closed in September 2002 and the 121 proposals received were evaluated at the end of November 2002. An external expert team was commissioned to conduct the evaluation. Overall, the quality of proposals was considered good, which was reflected in the evaluation scores. Funding was made available for three-year projects, but projects involving doctoral and post-doctoral training in Sweden could receive four-year funding from Formas. The funding decisions for the eight selected projects were made by the Academy of Finland in December 2002 and by Formas, Tekes and the Ministry of Agriculture and Forestry in February 2003.

The first call was rapidly organised, mainly due to the urgency of the funds still available at the Academy of Finland. This resulted in that it was mostly researchers that already had a working cross-border collaboration that had sufficient time to prepare good proposals for the call. If the preparation time had been longer, this would better have allowed creation on new consortia.

The second call, organised by VINNOVA and Tekes and focusing on innovation-targeted research and development projects (*Theme 3: Modification and processing of wood raw material into innovative, eco-efficient products*) had a later start. The call for proposals closed in the beginning of August 2003.

The proposals from the second call were evaluated through a two-step process. First, the 51 short proposals submitted were assessed and prioritised by the WMS Programme Committee. Then, 17 positively reviewed proposals were asked to submit full proposals for the final funding decisions of the Programme Committee and the two agencies. Among the positively reviewed, two proposals were merged into one and finally the funding decisions of the eight selected innovation-targeted projects were eventually made in early 2004.

Each of the innovation-targeted projects was obliged to sign a consortium agreement. There were different models for these and it took time before one acceptable for both Tekes and VINNOVA could be found. At the time innovation-targeted projects could start, the basic research projects had already been running for a year.

The overall quality of forest research has increased over time and the ambition for project selection within the Programme was high. There were many good project proposals that were not funded by the Programme. Some highly rated proposals that did not have a sufficiently strong Swedish involvement were funded separately by Tekes (outside the WMS Programme). To our knowledge, this did not take place on the Swedish side.

The three-year duration of the Programme is rather short. Projects in this field are typically around four years, partly to better accommodate PhD students to complete their degrees.

4.1.4 Programme organisation and management

The WMS Programme structure was reasonably complex. There were two separate calls and two sub-programmes. In each of the selected projects, funding was arranged directly to the subprojects. Each of the funding agencies participated in the Programme in a 'variable geometry', i.e. only in some projects, and every sub-project had a unique funding arrangement, although agreed at project level.

Basic research projects received funding mainly from Formas, the Academy of Finland and the Ministry of Agriculture and Forestry in Finland. The innovation-targeted projects, which commenced one year later, received funding mainly from VINNOVA, Tekes and industry, see Figure 7.

The funding structure was made more complex since funding decisions and participation rules varied between countries and funding organisations. Although this was foreseeable in a programme that had a 'virtual common pot' of funding, it still affected the projects and overall Programme management. For example in the Bundle project, the sudden unavailability of agreed funding from Formas in one sub-project forced the whole project to adjust its approach accordingly (see case description in Annex 3). Another example is the delayed starts in the VINNOVA-funded projects partly caused by the fact that VINNOVA had to reallocate funds from already ongoing national programmes. Moreover, the differences in rules for industry participation between VINNOVA (in-kind) and Tekes (in-cash) created friction at the project level. Clearly, the funding agencies' differences in rules and practices added bureaucracy to the Programme, which in turn influenced projects.

The *Programme Committee*'s role was important mainly in the Programme design and definition phase. After that, it did not have a clear role and its functions in the Programme were perhaps not communicated well enough to its members. Partially, this diminishing role was intentional. The experiences from the Wood Wisdom Programme had suggested the Programme Commit-

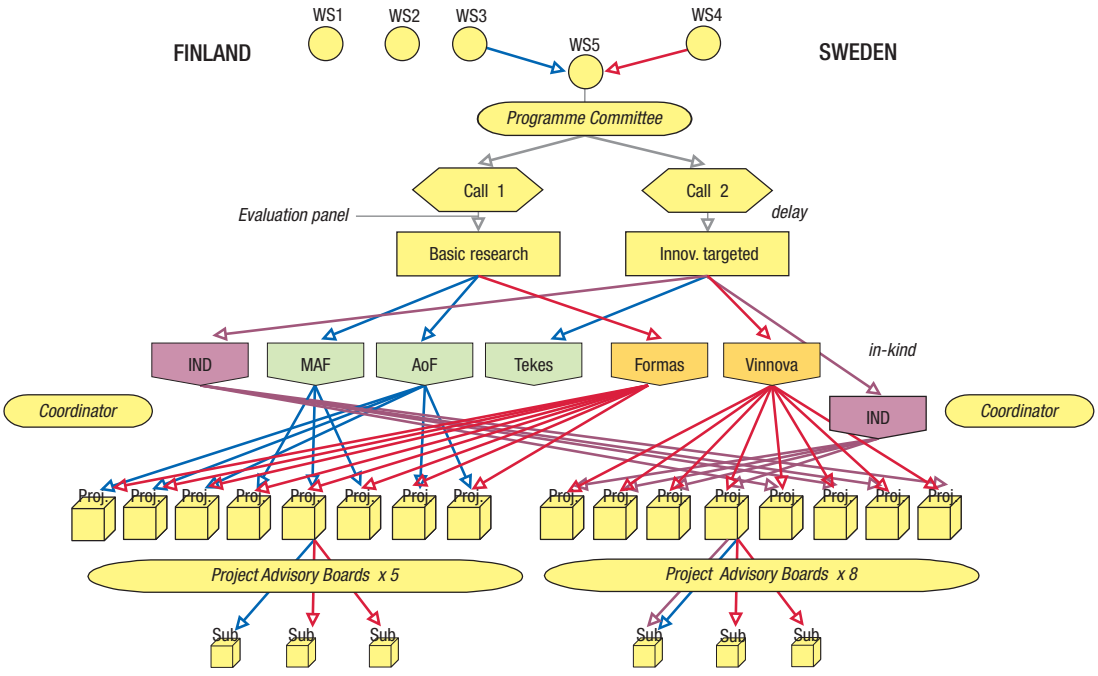


Figure 7. Organisation of calls and project funding in the WMS Programme.

tee should not to have an operative role in the next programme. As a result, there were not many strategic functions left to the Committee to perform after the Programme had been launched. In hindsight, perhaps a mid-term evaluation of the Programme could have been one. The self-evaluation of the Programme Committee also indicates some lack of enthusiasm and commitment to the Programme, which also may be illustrated by the fact that less than half of the Committee members responded to the questionnaire. At the Programme Committee workshop were the results of the questionnaire were discussed, some members questioned whether there should have been a Programme Committee at all after Programme launch given that the Committee had neither operative nor supervisory functions.

The *Advisory Boards* set up in most projects had a strong industrial participation. This practice had been found effective already in the Wood Wisdom Programme as well as in VINNOVA's other programmes and was therefore applied also in the WMS Programme. Indeed, the role of Advisory Boards was a key element for research-industry collaboration and for project management in many projects, see Figure 8. However, in some projects, researchers and companies viewed one-on-one discussions as a more effective means to share ideas and exchange information. In three basic research projects (IDEST, WAW and MICROAN), there was no industry involvement whatsoever. The practices for participation in Advisory Boards differed between countries. In Sweden, companies nominate a limited number of members to represent several companies, whereas in Finland all companies expect to be Board members. In some cases, this difference, which possibly may have its origin in the in-kind/in-cash difference for industry participation, resulted in unequal representation from the Swedish and the Finnish sides. This may also partly explain why Finnish industry appears to have participated in projects to a greater extent than Swedish industry.

The key functions of the Advisory Boards were to advise and support the projects with respect to their relevance and applicability, as well as to establish contacts with other interested parties, particularly in industry. Leading and managing the project were the responsibilities of the project manager, not of the Advisory Boards.

There were also separate coordination meetings with the five *funding agencies* for the purposes of administrative synchronisation. In retrospect, the collaboration between the funding agencies could have been even closer and programme and funding structures better synchronised.

The WMS Programme had two Programme Coordinators, one for coordinating and promoting the actions in each country. In Finland, the coordinator of the Wood Wisdom Programme continued with the preparation and coordination the WMS Programme[16]. In fact, in some earlier references, the WMS Programme was first called Wood Wisdom 2. According to Programme documentation, two coordinators were anticipated from the inception, but only in documentation from 2004 (one year after the commencement of the first projects) this was certain.

The role of the Programme Coordinator was long unclear to the Swedish funding agencies. The WMS Programme management concept was based on the Finnish research and technology programme tradition with hands-on guidance from programme management. The Finnish intentions of engaging a programme coordinator came as somewhat of a surprise to the Swedish funding agencies, since this is not practised in Sweden and resulted in lack of specific budget for programme coordination in Sweden. As a result, there was an imbalance in coordination efforts between the two countries. The Finnish side had a budget, was committed and experienced, while the Swedish one had no resources, attempted to do it on the side and was largely inexperienced in programme coordination. Effectively, programme coordination was mostly carried out in

16 In 2007, Kristiina Poppius-Levlin from KCL took over the coordination of the WMS programme, from Leena Paavilainen. In Sweden, the Programme was coordinated by Bengt Larsson from VINNOVA.

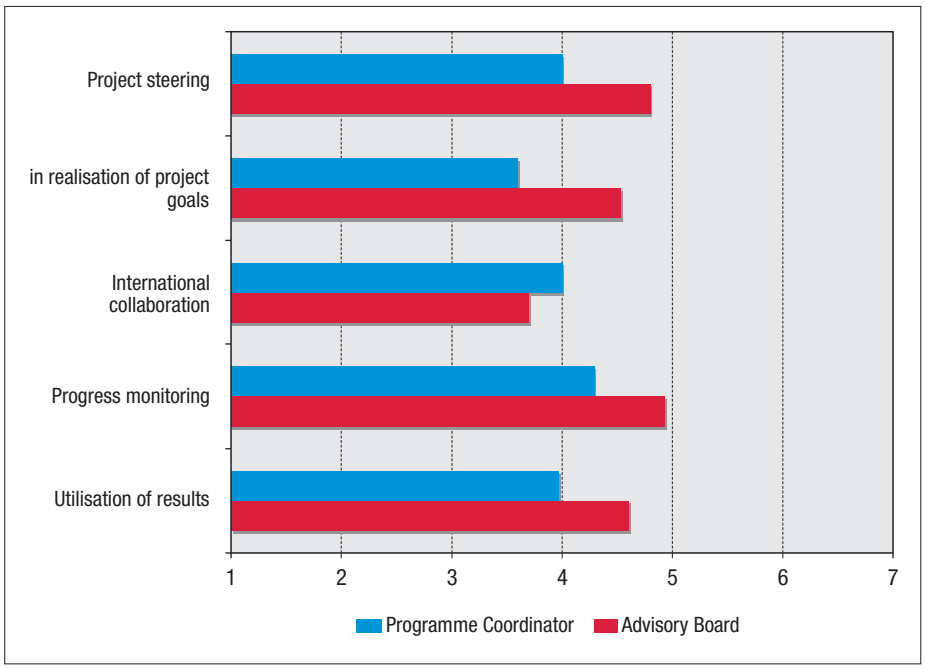


Figure 8. Project participants' view on Programme Coordinators' and Advisory Board's support to projects, respectively. (Scale: 1=Strongly disagree,…, 7=Strongly agree. N=16)

Finland. The Programme Coordinators' contributions to the projects are illustrated in Figure 8.

The Programme Committee noted the following strengths regarding the WMS programme organisation:

- Strong control by the coordinator and the funding organisations
- Only bilateral projects financed
- Consortium agreements were required
- Joint annual reporting and seminars
- Providing as a forum for cooperation for the different actors of the cross-border innovation system
- A platform for multidisciplinary, multi-target research.

The perceived weaknesses were:

- Different rules of the funding agencies and unequal financing models for industrial participation
- Too low participation of industry in some projects and insufficient utilisation of research results
- Lack of (funding for) researcher mobility across the border
- Complicated, diverse structure inhibiting concentration of research efforts
- Short duration of projects for basic research.

According to the Programme Committee, the main challenges in organising a trans-national research programme are related to *directing the research groups into real cross-border joint projects*, largely due to the cultural distance in project objectives, geographical distances and limited project duration. Facilitating trans-national industry collaboration was considered particularly demanding and also resource consuming.

4.1.5 Research-industry collaboration

Although the industrial presence was closely built into the WMS Programme, most projects were basic research projects with only long-term anticipation of industrial applications.

The Programme did not include any purely industrial R&D projects (as for example is often the case in Tekes technology programmes), and there were few industrial projects running parallel to the Programme. Perhaps a stronger contribution by industry to parallel development projects could have increased the utilisation of research results.

As previously pointed out, the rules for industry's participation are different in Sweden and in Finland. This had several implications in the projects:

- Different participation rules caused some friction among industrial partners
- Swedish industry was positioned closer to the actual conduction of research, whereas Finnish industry participated through the Advisory Boards
- Finnish researchers had more funds and autonomy to decide on their project expenditures.

The Programme objectives were considered ambitious and challenging also by industry, but most projects were initiated by researchers and not by industry. To a large extent, the WMS projects were curiosity-driven rather than mission-oriented. In those projects that indeed were mission-oriented, exploitation may have taken longer than expected.

Industry's prime objective was to solve practical problems with new knowledge and from this perspective, goal fulfilment was mediocre. Considering that projects were initiated by researchers and thus mostly curiosity-driven in nature, one could argue that industry's expectations may have been somewhat unrealistic. For the same reasons, it is not surprising that researchers view their own achievements to this end somewhat better.

From the industry perspective, the Programme had an important objective – besides the research itself – in training researchers and building a Nordic resource base of researchers. The importance of this is emphasised by industry in interviews and surveys. Enlarging the recruitment base is considered particularly challenging.

In most WMS projects, the Finnish industry was better represented and also more active than the Swedish one. There are several likely reasons behind this. Overall, Tekes also has broader industry networks and provides significant funding for industrial research, which may lower the barrier for industry to participate in programmes. Perhaps most importantly, the Finnish industrial participants had committed cash (in contrast to the in-kind contributions in Sweden) and thus possibly had a greater incentive to ensure good return on their investment.

Utilisation of research results was essentially up to each partner and therefore the emphases, objectives and results to this end vary. The main means of utilisation of knowledge were follow-up research projects and utilisation of the created knowledge in their own, other research work (see figure 9).

Some projects were close to practical application and some very fundamental in nature and the expectations and possibilities for industrial utilisation consequently vary accordingly. Also some basic research projects, particularly SPWT and STDUT, were very innovative, had significant practical relevance and their results have been utilised by industry[17].

17 Relatively strong industrial uptake has also been reported in VACHA, IMWO and MICROAN among the basic research projects according to the Cross-country survey responses.

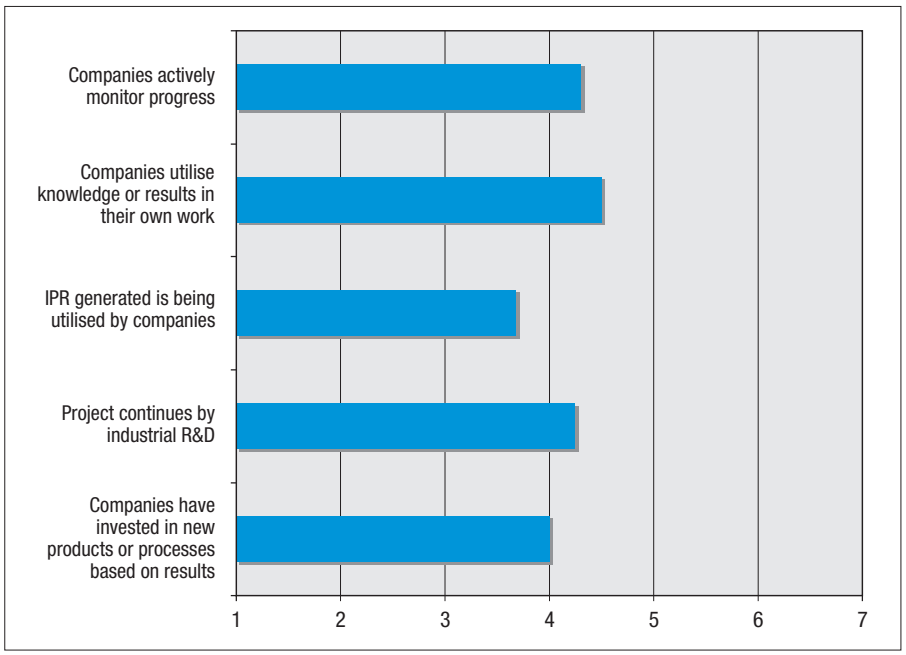


Figure 9. The utilisation of project outcomes according to the researchers.
(Scale: 1 =Strongly disagree,..., 7 =strongly agree. N=16)

Also the nature of industrial collaboration varied. In some projects, industry actively collaborated amongst themselves, but in most cases industrial participants were not very involved in projects and were mainly only in contact with a specific researcher and not the entire consortium. In many cases, industrial participants mainly monitored project developments and research results and appear not to have had any specific research or application objective for their participation.

The reasons provided why industry sometimes had difficulty in getting involved and taking stock of projects results were that:

- Project objectives were not always sufficiently precise to be properly assessed for their industrial relevance.
- The strategic importance of project objectives for industry varied – some projects were of great importance, some less.
- In some (but not all) projects, the objectives were pre-defined by the scientists and industry could only accept and comment, but not really influence or contribute to project objectives. In other projects the Advisory Board/industry could influence the research.

Not all industrial partners had a clear view of what to expect from their own participation. According to the researchers, the project objectives were very precisely defined and measurable, but few redefinitions took place and the influence of the Advisory Boards was considered moderate only (see Figure 10).

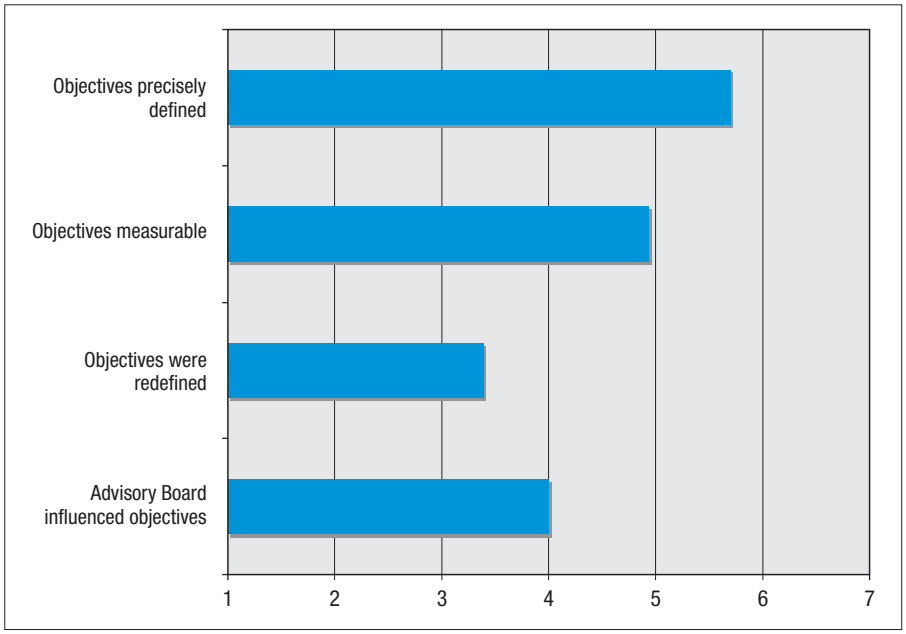


Figure 10. Researchers' perception on the definition of project objectives. (Scale: 1 =Strongly disagree,..., 7 =Strongly agree. N=34)

4.2 Effectiveness

4.2.1 Main results of the WMS Programme

The main results of the WMS Programme are summarised in the following paragraphs.

All 16 research projects were successfully implemented, each of them involving researchers from both Finland and Sweden. These projects were divided equally between two sub-programmes, basic research projects and innovation targeted research and development projects. 14 of these projects counted on industrial participation to varying degrees. A total of 317 researchers worked in these projects, 174 on the Finnish side and 143 in Swedish organisations.

A total of 20 PhD degrees (or equivalent), 11 licentiate degrees and 21 MSc degrees were awarded to Programme researchers until the end of 2007.

Table 2. Number of degrees awarded to researchers in the WMS Programme. Source: Appendix 1, WMS Programme final report

Degrees	Finland	Sweden	Total
PhD, D Agr & For, DSc, DTech	16 (13)	4 (3)	20
Licentiate	2 (3)	9 (7)	11
MSc	12 (13)	9 (9)	21

15 PhDs were awarded in basic research projects, and five in innovation-targeted research and development projects. It should be noted that by end of 2007, no academic degrees had been awarded in the two projects MICROAN and InnoFireWood. Another three projects – IDEST, ECOMBO and InnoLongSpan – had at the same time not yet produced any PhD degrees.

Altogether 16 of the 20 PhD degrees were awarded to students at Finnish universities and the remaining four to students at Swedish universities; for licentiate degrees, the equivalent numbers were two and nine, respectively. For the MSc degrees, there is a slight dominance of students at Finnish universities.

The numbers of degrees presented in the appendix of the final report do not coincide completely with the total numbers in the project presentations. The numbers in parenthesis in Table 2 are the total of the numbers in the individual project presentations, and according to these there were 13 Finnish and 3 Swedish PhD degrees awarded until the end of 2007. If one includes the degrees yet to be earned in coming years, the PhD figures match better.

Regardless of exact numbers, the big difference between PhD degrees earned by Swedish and Finnish students is striking. However, on the Finnish side three degrees were awarded in 2004 and as many the year after, whereas the first Swedish PhD degree dates back to 2006. Obviously, Finnish research projects to a certain extent engaged PhD students who had already come a good way to-

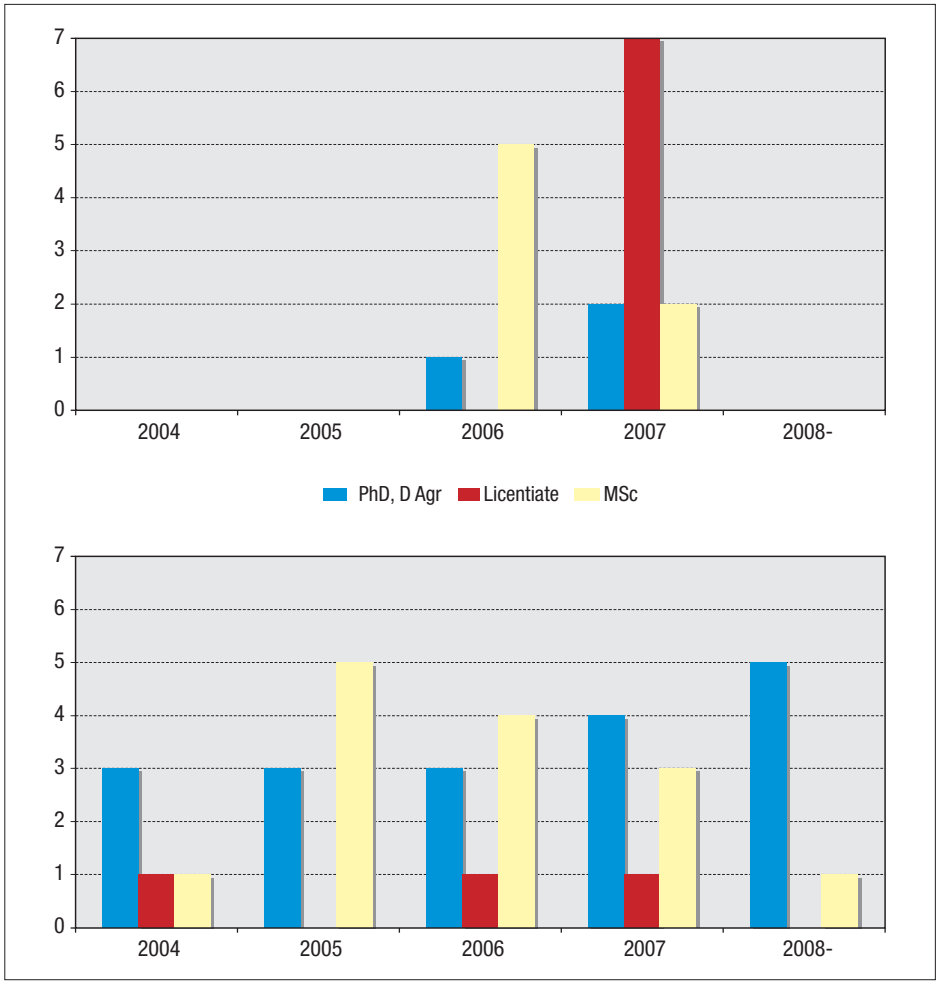


Figure 11. Number of degrees awarded to researchers during the WMS Programme, distributed per country and year. Source: WMS Programme final report

Table 3. Number of publications in the WMS Programme 2003–2007. Source: WMS Programme final report

Type of publication	Number of publications
Scientific publications	
Articles in international scientific journals with referee practice	127
Articles in international scientific compilation works, conference proceedings with referee practice	61
Articles in Finnish and Swedish journals with referee practice	4
Scientific monographs	12
Other scientific publications (such as articles in non-refereed journals and publications in university and institute series)	64
Other dissemination (such as text books, newspaper articles, TV and radio programmes)	206
Plans / under preparation	23
Total	497

wards earning their degrees. This does not seem to have been the case in the Swedish research groups. The same pattern can be seen for the other degree categories, as illustrated by figure 11.

The scientific output of the WMS Programme has been extensive, as illustrated in table 3.

The international evaluation panel carrying out the scientific evaluation (peer review) of the Programme found it to be unclear whether some of the cited publications were derived from the present projects or related to earlier research activities, or research activities funded by other sources.

There is a total of 192 articles published in publications with scientific referee practice, which gives an average of 12 refereed articles per project. The IMWO project stands out with 38 published refereed articles, followed by the WAW project (18 articles) and the VACHA project (16 articles). Two projects in the sub-programme for innovation-targeted research and development score notably higher than the others in that sub-programme: EcoMod and Innovood published 10 refereed articles each. Articles in international scientific compilation works and conference proceedings with referee practice are more evenly distributed, with no project presenting more than nine articles in that category.

Table 4. Seminars and meetings within the WMS Programme. Source: WMS Programme final report.

	2003	2004	2005	2006	2007	Total
Programme seminars	0	1	1	1	1	4
Project seminars	0	0	1	4	2	7
Meetings between the funding organisations	1	4	2	1	1	9
Programme Committee meetings	0	1	2	3	2	8
Project Advisory Board meetings	3	31	33	22	5	94
Total	4	37	39	31	11	112

In the category "other dissemination", two projects together make up for more than half of the presentations; SPWT mentions 66 presentations under this heading, and VACHA 49. Together with a third basic research project, WAW (33 presentations), the three cover some 70% of the total number of presentations in this category.

Finally, a number of seminars and meetings have been carried out at Programme and project levels. The overall numbers are summarised in table 4.

Most of the seminars and meetings were carried out in the three years between 2004 and 2006. The number of advisory board meetings varies considerably between projects. Three of the basic research projects had no advisory board at all, and in general fewer advisory board meetings were held in basic research projects than in the innovation-targeted research and development projects. In the VACHA project, for example, the advisory board met on only three occasions and in the IMWO and BUNDLE cases four times each. At the other extreme are the innovation-targeted research and development projects NanoCell and NewCell, where the advisory boards met on 13 and 12 occasions, respectively. Of the seven project seminars, two were held entirely or mainly in Finnish.

4.2.2 Achievement of Programme objectives and success of projects

The objectives of the WMS Programme were to:

1. Promote the sustainable use of natural resources
2. Strengthen the competitiveness of forest-based industries
3. Generate added value in the wood products industry
4. Establish a knowledge base for the development of innovative forest-based products
5. Intensify the transfer of new knowledge and technology from producers to users
6. Promote multidisciplinary research
7. Strengthen international research cooperation in the field of wood material science
8. Stimulate international mobility of researchers
9. Intensify research training in wood material science.

It is quite a challenge to assess objective fulfilment at the Programme level, partly since the projects did not form a coherent entity and partly because the objectives above were neither quantitative nor easily measurable. It is, for example, rather difficult to assess fulfilment of objective 6; would it be sufficient if some projects included researchers from more than one discipline, regardless of whether they collaborated in practice or not?

However, in a self-assessment survey, the Programme Committee suggests that the Programme as a whole only managed to fulfil objectives 6 and 7 to a significant degree, while fulfilment of objectives 2, 8 and 9 is poor; fulfilment of remaining objectives is inconclusive based on the Programme Committee self-assessment survey.

Naturally, the contributions of the individual projects to the Programme objectives vary greatly. The cross-country survey to project participants from universities and research institutes suggests that most projects have contributed significantly to objectives 4–7, while it appears as if projects have contributed only marginally to objective 9 and not at all to objective 8. The case studies carried out largely corroborate these impressions. It is possible that the projects, and thus the Programme, have contributed to fulfilment of objectives 1–3, but we have not been able to find any indications of such fulfilment.

The project objectives that the project participants from universities and research institutes have rated as most important are creation of scientific knowledge, problem solving, learning new research techniques, developing new research methods and equipment, addressing problems with an international dimension, sharing research results, deepening research cooperation in their own field and expanding cooperation to other fields. Coincidentally, project participants from universities and research institutes consider that their own project has fulfilled these objec-

tives quite well, i.e. there is an obvious correlation between importance of objectives and their fulfilment (and vice versa).

Based on the survey to industrial advisory board members, it turns out that they are clearly less satisfied with project results and rate objective fulfilment weaker than the project participants from universities and research institutes. There is no apparent correlation between importance of objectives and their fulfilment (as for the project participants from universities and research institutes).

The project participants from universities and research institutes rate their projects as strategically highly relevant for their own research group, whereas industry participants generally do not share that enthusiasm. This, of course, should come as no surprise; the WMS projects were initiated and led by researchers, and thus logically reflect the researchers' interests rather more than industry's. In most cases industry merely participated as observers, and in the cases where industry participation was more active there was usually a common history of collaboration between researcher and company representative.

In one of the projects selected for a case study (WAW) there was no industry involvement whatsoever, and in another two of the basic research projects (IDEST and MICROAN), no industrial advisory board was established. The latter project did, however, interact with industry.

Project objectives were in most cases quite challenging and sometimes turned out to be overambitious, especially bearing in mind the relatively modest project budgets. Moreover, researchers largely consider project objectives to have been very precisely defined, unambiguous and measurable.

Some projects were very successful in fulfilling their objectives and have had a clear medium to long-term impact on industry, while others have a potential to have an impact in the future. It is for several reasons difficult to identify success factors for project objective fulfilment and industrial impact on a more general level, but based on the in-depth case studies carried out, we venture to say that there are indications that such success factors may include:

- Researchers having a history of previous collaboration or at least knowing each other from before (few teething problems)
- Genuine complementarity amongst research groups (as opposed to opportunistically constructed consortia)
- The project being part of an ongoing, larger research effort
- Participating industry participant(s) having a clear strategy for exploitation of project results.

While all projects from necessity were bilateral, the extent of genuine bilateral collaboration varied significantly between projects. In either case, contacts were rarely frequent. This is in contrast to national contacts, which in most cases appear to have been rather frequent.

4.2.3 Innovativeness, industrial relevance and good science

The scientific evaluation of the Programme found the quality of research within the Programme to be varying and dependent on the nature of the discipline. For example, the chemical and biological sciences were executed at high scientific level with the participation of excellent researchers. The intricate structure of wood and its associated complex material science poses particular challenges; thus, when effective collaboration between acknowledged material scientists, structural and mechanical engineers and motivated industrial partners was realised, the degree of innovativeness and scientific and engineering quality was very high. Alternatively, similar projects with limited participation of such expertise were found to seriously suffer in these respects. A significant number of project consortia displayed a high degree of innovativeness with respect to the utilisation of the lignocellulosic substrate.

The interviews carried out largely confirm that the quality of research generally was acceptable, and in some research projects notably of high quality. "Some projects are successful, several are not – you never know beforehand", as one

funding agency representative sums it up. Another funding agency representative notes that some projects have resulted in new knowledge, alongside some ”dead-end projects” (scientifically speaking). However, this is a natural element of risk in research funding. It is also necessary to view the results in relation to the resources available.

There is additional external validation of the merits of at least two of the WMS projects. The project STDUT received the Austrian Schweighofer Wood Technology Innovation Prize in 2007, and the BUNDLE project received the highest scores of all industrial projects carried out by KCL during 2006 in an evaluation carried out by project partners.

A positive outcome of this Programme was the creation of new tools, methods and databases that will guide the community at both research and hopefully also at production levels in future endeavours. For example, the development of true microanalytical methods could significantly advance knowledge with respect to the large chemical heterogeneity usually apparent in wood. Another excellent example is the development of a large multi-sectoral database and model for predicting pulp and solid wood properties.

In the self-assessment survey, the Programme Committee considered the objective to promote the development of innovative forest-based products to be important, but objective fulfilment to have been unsatisfactory. Despite this, interviews point to some examples of innovative research and breakthroughs; research into nanofibers is one obvious example of this.

Although the impact is generated in the long term, industry has shown interest in these projects. However, the cross-country survey leaves a rather inconclusive impression as to industry’s utilisation and value added from the research results. The companies have been unevenly active in monitoring project progress, but seem to be using the knowledge from the projects in their own research work to a notable extent. Quite a few companies say the project work continues in an industrial R&D project, and several companies have invested in the development of new products or production processes based on project results. The researchers often have no opinion concerning the company use of IPR generated by the project, and when they do, the researchers generally believe that IPR from the project is used to a limited extent by the companies.

Arguably one of the most important aspects of a research programme such as this may be the graduates it produces. The WMS Programme produced a fair number of PhD and licentiate degrees, and these individuals will hopefully be useful for the forestry sector in both countries. Also, it has to be remembered that the cycles in the forestry sector in general are very long, often more than ten years. Thus, providing the researchers with an opportunity to get to work together is a result in itself that will lead to further projects and industrially relevant results in the future.

4.2.4 Appropriateness of the project portfolio

The interviews carried out provide relatively few critical comments on the project portfolio. Amongst those comments, one interviewee pointed out that the large number of funders and applicants made the project portfolio more fragmented than in comparable programmes, another said that WMS “could have been a more coherent programme”, and a third believed the funding organisations’ thematic limitations in combination with the limited resources hampered the possible impacts. Although the critical comments on the project portfolio are not in abundance, those interviewees expressing their explicit liking of the project portfolio are even fewer. Most interviewees simply do not have an opinion on the subject.

Thus, there is little hard evidence to suggest that the WMS project portfolio was the most appropriate in order to achieve the Programme goals. Neither the interviews nor the scientific evaluation support that opinion. The scientific evaluation panel concludes that the weaknesses in the Programme were mainly due to the lack of a sufficient number of material science and engineering experts. Future research calls should, in conse-

quence, be structured in such a way that they promote the participation of prominent material scientists and engineers that would not normally apply for their funding in this discipline. The scientific evaluation panel also noted an absence of techno-economic analysis. Even though there were two projects specifically devoted to such aspects, this type of analysis could, when required, have guided the research. The evaluation panel concludes that the evolution of future research calls in this area needs to encourage the inclusion of such elements to ensure the applicability of the research and to enhance the credibility of the process and the relations with industry.

The conclusion would be that the chosen project portfolio was not necessarily the most appropriate to achieve the goals of the Programme. Due to the thematic freedom provided by the call for proposals, several of the resulting projects did not have much in common with the other projects. This disparate collection of projects consequently resulted in a rather disparate programme and limited synergies emerged. The individual projects did to varying degrees contribute to Programme objectives, but there were limited programme-level synergies adding to objective fulfilment, despite the coordination efforts that took place. Programme-level initiatives to foster cross-country coordination and information exchange were also clearly less used and appreciated than project-level events.

4.2.5 Overall impact

The last of the five evaluation questions focussing on programme effectiveness concerned what kind of future impact the WMS Programme may be expected to achieve. In order to be able to tackle this, we must first understand what the purpose of the Programme was and through which mechanisms it was expected to achieve the desired impacts. This is sometimes referred to as a logic model.

The logic model presented in Figure 12 describes the mechanisms through which the Programme impacts were anticipated, and is the evaluators' perception of the key impact mechanisms in the WMS Programme in retrospect.

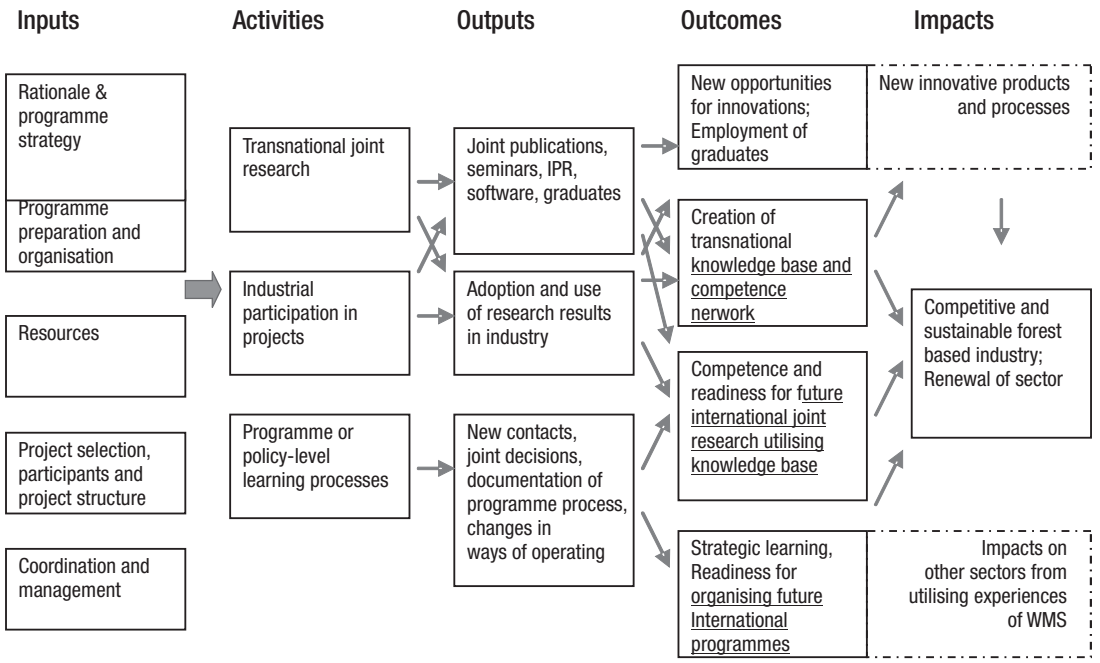


Figure 12. Impact model for WMS Programme developed by the evaluation team.

On the left of the impact model are the WMS Programme inputs – rationale, strategy, etc – followed by the concrete actions that were carried out in the Programme. Some activities are concrete, such as research projects, some more intangible, such as the learning process of organisers. In consequence, there are a number of verifiable Programme outputs, which again result in different kinds of outcomes, such as competence development. The final impact of the WMS Programme is categorised into four main categories: *a) new opportunities for innovations, b) creation of transnational knowledge base and competence networks, c) readiness for future joint research and d) strategic learning and readiness for organising future international programmes.*

The WMS Programme was designed to promote the competitiveness and sustainability of the forestry sector and the forest-based industries by building a multidisciplinary knowledge base enabling development of innovative, eco-efficient and cost-competitive products, processes and services. Establishing well-functioning collaboration between Finnish and Swedish wood material science researchers was seen as essential, since scientific innovations in this area rely on a large number of scientific disciplines, several of which lie outside the sciences traditionally associated with these industries. Active networking of producers and users of knowledge and technology was considered a prerequisite for speeding up product and process development in the forest-based industries. We have tried to capture these over-riding ideas in the logic model.

Arguably the most important impacts of the Programme for participants from universities and research institutes were the creation of better understanding of bilateral collaboration, building of joint track records and establishment of trust for future joint initiatives (such as within FP7). Creation of new scientific knowledge, scientific competence and technical know-how, as well as enhanced understanding of industrial realities, are other important impacts.

On a similar note, the most important impacts for the funding organisations appear to be better understanding of both bilateral collaboration and domestic interagency collaboration between research councils and mission-oriented funding agencies. These experiences may prove quite useful for example within ERA-NET initiatives.

For industry participants, impacts of the bilateral nature of the Programme appear scant, probably mainly due to the fact that there appears to have been very little international collaboration involving industry. There are examples of industry participants utilising Programme results in their own research, but the Programme yielded few results that have been directly exploited by industry.

Given that industry in many projects was not deeply involved in project initiation and with few exceptions appears not to have participated actively in the projects (except to monitor developments), it should not be particularly surprising that the Programme outcome as yet is not fully satisfactory from an industrial perspective.

4.3 Added value of Swedish-Finnish cooperation

The bilateral collaboration dimension in the Programme was covered by two broad evaluation questions:

What is the added-value, possibilities and obstacles of the Finnish-Swedish co-operation in strengthening the network of expertise needed for implementation of projects

- in creating a knowledge base enabling the development of innovative and eco-efficient forest-based products and processes?
- in disseminating the results and using them for promoting the competitiveness and sustainability of forestry sector and forest-based industry?

On a Programme Committee level, bilateral collaboration between the two countries was considered important, and strengthening the international research cooperation seen as possibly the most important goal of the Programme. Board members also perceive the achievement of this goal to be better than any other Programme goal.

Another relevant Programme goal in this context, researcher mobility between the countries, is given a relatively low priority – and scores equally low on perceived achievement.

Programme Committee members perceive that different types of Programme-level events on the one hand, and industry and researchers working together actively on the project level on the other, are the only really functional approaches to achieve cross-country collaboration. Other approaches, such as only researchers working together, or use of mainly national project modules, are not seen as being conducive to international collaboration. In the survey, Programme Committee members understand international collaboration to be an important goal for all 16 projects, with the possible exception of VACHA and BUNDLE. At the same time, however, they have little or no opinion as to the level of success of international cooperation in these projects. The few Advisory Board members that answered the survey addressed to them perceive the objective to tackle problems that have an international dimension to be relatively important, but with a relatively low level of achievement. The researchers responding to the cross-country survey view this objective as more important, and also consider it to have been achieved to a relatively large degree.

4.3.1 Scope and objectives of collaboration

Researchers' motives to participate were to deepen research cooperation and to share research results. Accessing research facilities and capabilities abroad and sharing of costs and risks with other research partners were of marginal relevance, with equally low objective achievement. Another motive was, quite simply that the Programme offered a funding possibility. Either it was (as in the WAW project) a case of jumping on a previously non-existent possibility, or it was (as in for example the ECOMBO and NanoCell projects) a matter of adjusting existing research and a research collaboration to a different set of constraints. Researchers often appreciate the need to collaborate in projects with players from another country – but given the choice, Swedish researchers would only rarely look for Finnish collaborators, and vice versa. They do lend some importance to the objective to tackle problems that have an international dimension, but from survey results as well as from interviews it could be argued that this could be achieved without explicit project collaboration between Sweden and Finland.

The WMS projects were initiated and coordinated by researchers, and with their main objectives for participating in mind it is no surprise to find that many of these projects were either set up specifically to be eligible for funding, or consisted of already planned projects that were adapted in order to comply with WMS rules. For some projects, the Programme merely provided a continuum of research funding. Three of the four case studies clearly were continuations of previous work in the coordinating organisation, and in one case even a project that already existed in that context.

Concerning industry's motives to participate, the general picture is one of safeguarding the company's interests. The WMS project was in most cases not in a core research field or area for the participating company and thus probably not of high strategic importance, which in turn meant that most companies in most projects entered the collaboration without a very clear picture of what they expected the researchers to achieve. Since most companies did not have a defined game plan for their participation, they often ended up as interested, but ultimately not very committed, bystanders. Participation involved a low risk of failure and relatively low costs for the companies, so the strategy of many was to take part in projects just in case, so as to participate if something useful emerged and often in order not to risk giving participating competitors a potential advantage.

In most cases, the bilateral collaboration built on existing contacts. According to survey responses, some 60% of the researchers had already cooperated with all or many of the other project participants before the WMS project, whereas less than 15% had not cooperated with any of the others before this project. This picture is corroborated by the interviews carried out with project participants from industry, universities and research institutes.

Having said that, it should be noted that there are some examples of new collaboration patterns across the border between researchers, or between a researcher in one country and a company in the other. These examples are direct results of the Programme, and many of these also seem to have possibilities of surviving in future collaborations and with funding from other sources.

4.3.2 Programme additionality for cross-country collaboration

It is obvious that the Programme opened up a window of opportunity. An overwhelming majority of the researchers believe the project would otherwise probably not have started at all, and had it started without the push the Programme provided, it would have been carried out on a less ambitious scale and progressed slower than it did. Also, significantly, it would not have included projects partners from abroad and would in general have involved fewer and/or different project partners. Several researchers unequivocally state that had it not been for the Programme, collaboration with players from the other country would not have taken place. Furthermore, participating in the Programme clearly provided the projects with better opportunities for publicity and awareness raising among industry, and also for goal attainment. The average responses to the question on Programme additionality is illustrated in Figure 13.

Out of the 16 projects, there are clear indications that at least ten would certainly or probably not have started were it not for the WMS Programme. In one case alone would it be possible to argue that the project would have been realised on a bilateral basis also without the Programme providing the enabling opportunity. For the remainder of the projects, parts of them would probably have started also without WMS funding, but none of them would have been set up as ambitiously as came to be the case. Some projects could possibly have been realised nationally, but then most likely on a more reduced scale.

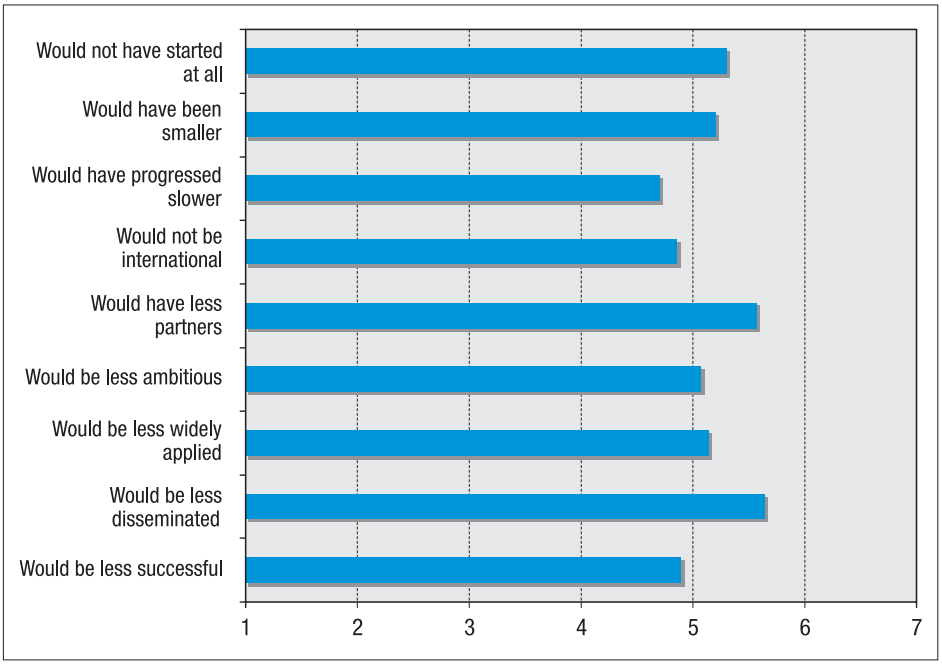


Figure 13. Researchers' perception of the additionality of the WMS Programme to the individual projects. "What would have happened if the project had not been part of the WMS Programme" (Scale: 1 =Strongly disagree,…, 7 = Strongly agree. N=28)

There are no important differences between the two groups of projects – those that certainly or probably would not have started were it not for the Programme, and those that probably would have come about anyway – in how participants view collaboration. The most remarkable difference is found in how the projects are perceived by the scientific evaluation panel. There is a clear tendency for the panel to view the scientific quality and innovativeness of the research as more satisfying in the projects that probably would not have started were it not for the Programme, with one project being the exception to the rule. The panel is less convinced of the scientific merits of the projects that would probably have started even without WMS funding. The scientific peer assessments of the projects that probably would have started even without WMS funding range from "good approach" to "low" and "lowest". Interestingly, none of the five projects the scientific evaluation panel singled out as very good or excellent belongs to the group of projects that probably would have started without WMS funding.

One possible conclusion could be that the model with several funding agencies did, after all, work well in assuring project quality. Another hypothesis may build on the scientific evaluation panel's finding that the quality of the leadership is positively correlated to the scientific quality of a given project. Experienced and strong scientific leaders have shown that it is possible to set up new project consortia also under new and not fully known constraints, without sacrificing scientific quality in the process.

4.3.3 Nature of collaboration

While all projects by necessity were bilateral, the extent of genuine bilateral collaboration varied significantly between projects. Some projects have provided an opportunity for cross-country collaboration on common issues, others seem to have practiced a division of labour along the border. In nine of the projects (three basic research and six innovation-targeted research and development projects) collaboration appears to have been genuine, and then mainly between researchers in the two countries.

The strongest cross-country collaboration was done at project-level events and in coordination of activities across the border. Programme-level events such as seminars were also important for the bilateral dimension, but too infrequent to have a significant impact. Four of the projects seem to have had very little cross-country collaboration of any kind. There was no industry participation at all in three of the 16 projects and in the projects that counted on such participation, the level of activity and involvement from industry varied.

National collaboration between researchers was the most important form of collaboration among WMS project partners. Collaboration between a researcher in one country and a company in the other was less frequent, and also less likely to occur than collaboration between researchers and companies in the same country. Bilateral industry-industry collaboration was very rare. Researchers in the same sub-project worked across the border to some extent. Frequency of actual cross-border collaboration was not high, partly due to these being projects with relatively modest budgets.

Dissemination on what was done 'on the other side' was not active at Programme level or, in many cases, not even on project level. In several projects, the work was carried out rather independently in sub-projects in each country without the even the project coordinator having a comprehensive view of developments.

Another way to measure the level of bilateral collaboration is to look at how subprojects within the 16 projects were organised. According to the cross-country survey, in seven projects, the work at sub-project level was carried out by unilateral project groups, with the bilateral dimension being effectuated through project-level meetings. Nine of the projects included subprojects with varying degrees of bilateral collaboration. The in-depth interviews carried out do not contradict these findings. There is no notable difference depending on whether projects were basic research or innovation-targeted research and development projects.

There is no clear correlation between previous collaborations and frequency of bilateral collaboration. However, the cross-country survey suggests that projects that were mainly carried out at a national level tend to involve collaborations where all or most project partners knew each other from before. One way to explain this may be that the previous collaborations were mainly national in character.

Contacts were rarely frequent across the border. This is in contrast to national contacts, which in most cases appear to have been rather frequent. In some cases, as for example in the ECOMBO project, the decision that the project would consist of two national, rather separate sub-projects was deliberate. The rationale for this was efficiency; it would be less complex and less expensive to manage and coordinate national sub-projects. As a result, national goals and emphases were reflected in the design of the project.

Figure 14 illustrates the competence areas in which researchers have found the greatest added value of the Programme. Second to the enhancement of the scientific competence is the understanding of cross-country collaboration, followed by understanding of technical know-how, industrial product and process competence and research culture abroad.

When describing added value of this bilateral collaboration effort, researchers involved at project level most frequently mention networking aspects. These aspects usually refer to strengthening and continuing already existing research cooperation networks, but also to getting to know new partners for potential or factual cooperation. In this respect, no discernable differences in appreciation between researchers from the two countries have been found.

An obvious value added covers various aspects of research collaboration and development. This sometimes has to do with the networking aspects mentioned above, but mostly refers to more specific advantages from collaboration. Some concrete examples that were mentioned by researchers were joint publications, sharing data for modelling and validation purposes and more gener-

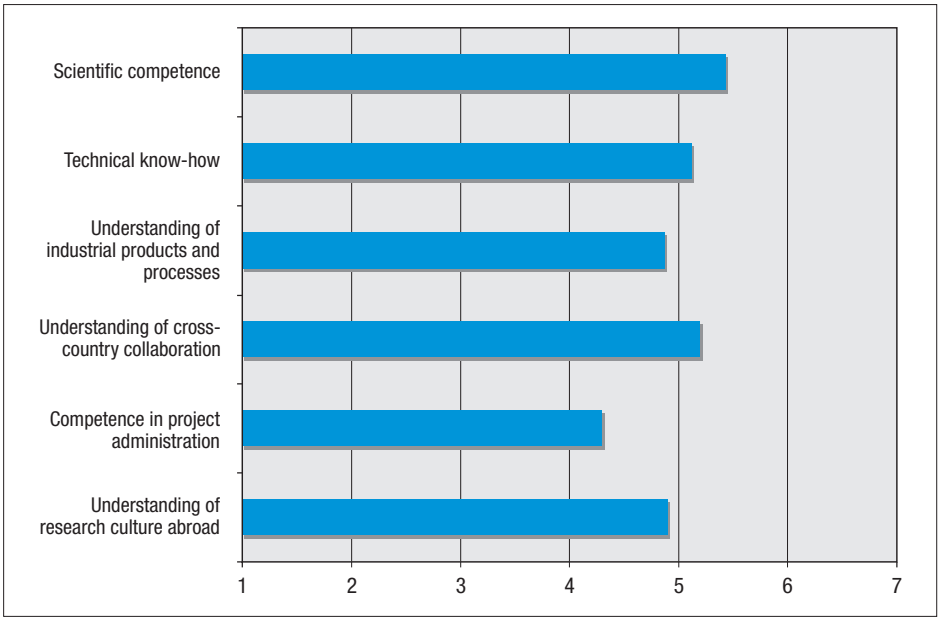


Figure 14. Researchers' perception of the areas of learning benefits from projects. (Scale: 1 =No effect,…, 7 =Competence strongly improved. N=39)

ally higher scientific quality of work. The latter aspect is mentioned by several researchers on both sides of the Baltic.

Survey results indicate that Finnish researchers to a larger extent than their Swedish counterparts consider industrial participation as a strong point in the Programme. Swedish researchers mention advantages of working together with industry only to a very limited extent, even though raising industrial awareness is pointed out by some as a positive effect of project collaboration.

As for industry, in the role of project participants or Programme Committee members, the perceptions of the merits of the Programme are mixed. Several industry representatives point out that a number of research groups have found new collaboration partners, and in some cases gone on to produce proposals to other calls. An often-repeated commentary is that the only way to cooperate effectively is by doing it, and for that to happen some basic conditions must be in place. This was the case with WMS; it provided the platform for collaboration. But if the collaboration structure is new, with partners that are new to each other, it takes some time to get to know each other and to find the functional working routines. According to one industry representative, "if the people meet the first time in an international project, much of the resources are used to practise the collaboration". Cross-border collaboration is simply more time-consuming, so patience and realistic expectations are needed.

When it comes to perceived weaknesses in the Programme, three inter-related issues stand out: administration, effects of the different research funding practices in the two countries and the short-term character of the funding. Even though these are weaknesses that concern the overall structure of the Programme, they are all to varying degrees relevant also from a more limited bilateral collaboration viewpoint:

The *administration* of the projects was perceived as somewhat complicated, not least regarding the consortium agreements. Several projects reported difficulties to prepare and ratify these. In at least one case, the lack of a consortium agreement prohibited exchange of results within the project, while at the same time the NanoCell project did not suffer from the fact that the agreement was never signed. It was also pointed out that consortia may mean conglomeration, making the project entity larger than necessary. This may hamper focusing on common and essential goals.

Different practices between Sweden and Finland related to e.g. agreements and industry involvement in projects caused tension and trouble. The two countries have different cultures in terms of project planning, monitoring and leadership, and the conditions for partner participation – especially for industry – differ.

The *short-term character of the funding* is, of course, nothing that singles out the WMS Programme from other research programmes, but it is still relevant in this cross-country collaboration context since other sources of funding for bilateral collaboration are more difficult to realise than funding for national projects or programmes. As one researcher put it, "when funding ended, all activity ended".

4.3.4 Results, benefits and lessons

Given the fact that traditional academic objectives were the true drivers for participation for the researchers, it is worth noting that none of the high-ranking projects in the scientific evaluation would have existed were it not for the opportunity provided by the WMS Programme. Several good or excellent projects were, thus, implemented thanks to the Programme. Moreover, in the cases where the Programme seems to have been little else than part of a continuum of research funding, the scientific quality and results are less impressive. There were obviously several excellent research projects waiting to happen, where the cross-country aspect provided a value added. On several occasions these led to sustainable collaboration that survives in different forms after the end of the WMS funding. The Programme thus had an impact on the creation of new research networks, and at least in qualitative terms this impact has been notable.

In quantitative terms, the impact of the Programme on creating new research networks may at first glance appear limited. However, bearing in mind the novelty of the approach, the funding construction, the limited duration and the project budgets, it would be unrealistic to expect new networks to form and flourish to any significant extent. Intense international collaboration tends to require that researchers work together physically, at least for part of the time, and such arrangements were not possible with the budgets provided. If collaboration of such intensity is desired, adequate financial resources need to be provided.

It is questionable whether the different models for industry participation significantly affected bilateral collaboration, but they certainly caused some friction and dampened enthusiasm, particularly since both industry and funding agencies in both countries appear convinced that their own national model is the one resulting in the highest level of industry commitment and exploitation potential. Separately organised national preparatory meetings also caused some discussion and occasionally friction.

Overall, collaboration between agencies worked well, but different prerequisites (available funding, previous experiences and top-level support) did create some problems. The WMS experience has led to a desire to pursue new joint initiatives, but then preparations and prerequisites should be harmonised from the onset. The whole experience has been very educating and has led to (according to at least Tekes, VINNOVA and Formas):

- Good insight into each others' operations
- Insight into each others' modus operandii
- Humble view of colleagues' situation
- Much better preconditions for future collaboration.

The Swedish and Finnish traditions and procedures for research funding are significantly different, e.g. in terms of industry participation. These differences were likely well known to the funding agencies, but were not sufficiently taken into account when setting up the WMS Programme, e.g. in terms of informing would-be participants of the differences. Funding agencies need to plan a programme well and thoroughly discuss what is to be achieved and how. If the programme owners do not have a common view, distrust and lack of commitment from the actors taking part in the programme may result.

WMS has been an important and useful learning process. It has increased understanding of bilateral collaboration on both sides of the Baltic, and has also increased understanding of the research culture in the other country. On project level, collaboration has provided participants with an increased understanding of cross-country collaboration, and a better understanding of the research culture abroad. "*This is a start – you shouldn't expect miracles!*," as one industry representative put it.

5 Conclusions and lessons learnt

5.1 Concluding remarks

The Wood Material Science and Engineering Research Programme 2003–2007 was, in many ways, a challenging and ambitious programme. The Programme management and the funding agencies were far-sighted with respect to programme design. Without this bilateral effort, Finland and Sweden would not now have such a central role in the current process of internationalisation of the forest-based sector, and would not be as well positioned to compete internationally in research in the field.

On the basis of the impact evaluation, we can conclude that the WMS Programme was successfully concluded and has had valuable impact particularly with regards to the following aspects:

- The Programme scope definition was systematic and project selection ambitious. The Programme managed to advance top-level research in fields that were considered relevant within academia, the five funding organisations and industry. In these areas, Programme scientific output was extensive (articles, degrees), particularly in relation to its rather limited duration and funding volume.
- There has been a positive contribution to bringing Swedish and Finnish researchers closer. Several excellent research projects would not have started were it not for the WMS Programme. The transnational research collaboration continues in many projects after the Programme, but rather at the individual level than at institutional or research group level. Existing networks have continued and been strengthened and some new cross-border collaborations have emerged. Researchers and industry value getting to know new partners for potential future collaboration.
- The competence and readiness of the five research funding agencies to organise transnational research programmes has significantly improved through the joint learning process of the WMS Programme. This has had immediate positive implications for their contributions in Nordic and European research programmes and collaboration platforms.

In some other respects, the WMS Programme was less successful in achieving the anticipated objectives and expectations, namely:

- There is little evidence of WMS Programme significantly contributing to the creation of a transnational knowledge and competence base beyond individual contacts. Insufficient amount of resources were allocated to the transnational collaboration at the project level. It is also likely that achieving major progress would have required more time and systematic measures.
- Considerable effort was invested in involving industry in the projects, but in the end, industry participation was passive in most projects. As a result, also the immediate industrial impact of most research projects remained rather limited. Closer involvement in the project initiation phase, clear functions for the project Advisory Boards and uniform industrial participation models would have facilitated increased industry involvement.

In addition, the evaluation of the WMS Programme provides a wealth of important lessons for future research programmes of international character, which are synthesised in the following chapters.

5.2 Lessons from the WMS Programme

5.2.1 Planning and organising transnational research programmes

There is a general trend that research programmes and related collaboration platforms are increasingly becoming international, not least due to the new mechanisms for building the European Research Area. The complexity of programme design, launch and management grows accordingly. This is a challenge foremost for national research funding agencies, rather than for the research community or industry.

One of the lessons provided by the WMS Programme is the recognition that the definition and organisation of joint research programmes is more difficult than it may seem. On an overall level, national programmes may appear similar between countries, but at the practical implementation level important differences between countries arise. Taking these into account and allocating sufficient time and resources to iron out such differences during programme definition and initiation is critical for success.

The WMS Programme funding was organised as a 'virtual common pot' in which one programme virtually combines different existing funding mechanisms into a joint programme. The benefit of this approach is in its flexibility at the programme level, but at the same time, the decisions and management of individual projects remains in the hands of each funding organisation. Eventually, a true common pot approach for funding of joint programmes would provide a better basis for programme management and coordination.

Whether pursuing a virtual common pot or a true common pot, rules for participation should be harmonised – as much as possible – between countries prior to programme launch. In the example with principles for industry participation, a programme-specific compromise between Swedish and Finnish rules should be struck, assuming that funding agencies cannot agree on accepting one of the existing principles. The equivalent differences regarding for example the mandate of the programme coordinator (and indeed whether there should be one), representation on advisory boards and contents of consortium agreement should be ironed out by the funding agencies beforehand.

The participatory approach in defining the project themes was good and innovative, but bringing together different research cultures is challenging and needs active facilitation. A balance need to be found between *a) strategic, top-down definition of priority areas*, *b) participatory, bottom-up definition of interesting themes for researchers*, *c) early industry involvement and possibility to influence priorities* (if programme is designed to be mission-oriented), and *d) equal level of preparatory work between participating countries.*

The dual programme structure (i.e. two calls and sub-programmes) did not significantly affect projects or partners and did not reflect very much on the nature of projects in the respective subprogrammes. The division was rather a pragmatic solution to the administrative challenges of different evaluation and funding traditions and rules between research councils and mission-oriented funding agencies. As such it appears to have been an effective approach and can therefore be applied to handle such differences if a mutually acceptable compromise cannot be reached. In contrast, the division of projects into unilateral subprojects may have facilitated administrative matters, but was likely detrimental to bilateral collaboration between researchers.

The final evaluation of the WMS Programme was divided into two; a scientific evaluation according to academic evaluation practices (peer review of experts) and an impact evaluation. Including both these elements in an evaluation exercise

clearly enhances the overall picture of a programme and is consequently a good approach. However, from an administrative point of view, it may be more functional to charge the supplier of the impact evaluation with also organising the peer review according to academic tradition (and with fully independent peers). Such a solution ensures that the processes are coordinated and that the full synergies between the two evaluation elements can be reaped. This concept has been used extensively before and has proven to be effective, while simultaneously fulfilling all academic requirements.

5.2.2 Coordination and management

The Finnish approach to programme management with active programme coordination has previously proven to be effective to reap programme-level synergies. Due to the disparate nature of the WMS project portfolio, the synergistic results in the WMS Programme appear to have been few and far between. A dedicated programme coordinator likely remains an approach worthwhile to try also in the Swedish context. With the experiences from the WMS Programme in mind, it would appear unwise to have more than one coordinator in multilateral programmes.

The role of the project Advisory Boards was important with regard to industrial involvement, ensuring of project relevance, up-take of research results and dissemination of knowledge. This is a good practice and should be encouraged. The personal contribution of Advisory Board chairpersons can be decisive to success. However, in international programmes due consideration of differing traditions for Advisory Board representation and mandate should be addressed before programme launch.

The role of the Programme Committee was unclear following the launch of the Programme. A mid-term evaluation of the Programme could have been a good way for the Programme Committee to assess developments and a possibility to strategically influence Programme direction. Without a meaningful function and mandate, the contribution and value of the whole Programme Committee diminishes.

Coordination of a programme with several funding agencies appears to have been more challenging in administrative terms than first expected. The WMS Programme served as an important learning experience to this end, but more substantial resources for intra-agency collaboration and coordination – particularly in the programme preparation phase – would enhance the chances of successfully executing and concluding a joint programme. The rules of the ERA-NET instrument may provide a starting framework that can be employed also in a bilateral setting.

5.2.3 Enhancing transnational collaboration

An important objective of an international research programme is to extend, or facilitate the extension of the research-base between participating countries. This has many benefits, ranging from project-level collaboration and increasing the quality and relevance of project portfolios, to enlarging the researcher resource base for industry. In order to properly support this, the mobility of researchers should be included as part of both programme and project objectives and sufficient resources should be provided for its execution.

On the experience for the WMS Programme and previous evaluations,[18] transnational collaboration at programme level is more demanding and takes more time than collaboration at project level. Coordination and transnational collaboration also requires extra resources – for joint preparation, management, follow-up and merely communication. It is therefore advisable that transnational research programmes be relatively better resourced than purely national ones. Should programmes also address a broader set of challenges (a collection of themes and objectives from participating countries) this should also be

18 E.g. Competitiveness through internationalisation, Tekes 2004.

taken into account in allocating programme resources. In general, a larger programme volume and a longer duration would facilitate the creation of a critical mass, synergy and eventually programme impact.

With respect to enhancing industrial participation in research programmes and the up-take of research results, early and systematic involvement of industry in programme and project initiation phases is important. A particular lesson of the WMS Programme concerns the different rules for industry's participation in projects in Sweden and Finland. As stated in the previous chapter, the practice of industry-led project Advisory Boards is a good one to this end. The research projects of the Programme generally aimed at a long-term impact and the immediate industrial benefit was therefore limited. In most cases, industry has taken the experiences gained onboard and has applied them in internal projects. For industry, an important potential benefit of the Programme was the extension of the resource base of researchers beyond the individual countries, but this is a slow process, to which one research programme can only contribute a little.

Annex 1

List of projects, subprojects and their funding sources

Ref	Project	Subproject leaders	Project budget (sources) in euros
The sub-programme for basic research projects			
1 IDEST	Identification of EST poly-morphisms and candidate genes related to growth and wood properties in silver birch	Skogforsk, SE University of Helsinki, FI	157 623 (Formas) 168 000 (Academy[1])
2 WAW	Wood and Wind – unlocking wood formation through ethylene signaling	SLU[2], SE University of Helsinki Umeå University, SE	295 000 (Formas) 191 790 (Academy) 152 030 (Formas, SSF)
3 VACHA	Value-chain analysis for forest management, timber purchasing and timber sale decisions	METLA[3], FI Skogforsk, SE METLA, FI Univ. of Joensuu, FI	555 893 (Academy, MAF[4]) 407 500 (Formas, Skogforsk) 617 279 (MAF, Metla) 172 840 (Academy)
4 IMWO	Impact of forest management and climate on wood quality	SLU, SE SLU, SE METLA, FI METLA, FI	251 000 (Formas, SLU) 300 000 (Formas) 554 000 (MAF, Metla) 500 140 (Academy, Metla)
5 SPWT	Specific wood and timber properties, competitive ability and advanced conversion of Nordic Scots pine in mechanical wood processing	METLA, FI SLU, SE SLU, SE	884 898 (Academy, MAF, Metla, etc) 80 000 (MAF, Setra Group, SLU) 364 095 (MAF, etc)
6 STDUT	Straight and durable timber	Luleå University, SE VTT[5], FI	300 000 (Formas, LU) 265 671 (Academy, VTT, industry)
7 MICROAN	Chemical micoranalysis of wood tissues and fibres	Åbo Akademi, FI SLU, SE	237 900 (Academy) 62 218 (Formas)

1 Academy of Finland
2 Swedish University of Agricultural Sciences
3 Finnish Forest Research Institute
4 Finnish Ministry of Agriculture and Forestry
5 Technical Research Centre of Finland

Ref	Project	Subproject leaders	Project budget (sources) in euros
8 BUNDLE	Fibre wall modelling	KCL[6], FI HUT[7], FI STFI-Packforsk, SE Karlstad University, SE	426 250 (Tekes, industry) 148 500 (Tekes) 255 000 (Formas, industry) 119 000 (Formas)
The sub-programme for innovation targeted research and development projects			
9 WoodBiocon	Value-added products from barks of Nordic species using bioconversion and chemical technology	Åbo Akademi, FI VTT, FI VTT, FI	435 000 (Tekes, VINNOVA) 452 000 (Tekes, VTT) 912 000 (Tekes, VINNOVA, VTT)
10 NewCell	New cellulose derivates from wood for high value products	KTH[8], SE Univ. of Helsinki, FI KTH, SE TUT[9], FI	1 078 800 (Tekes, VINNOVA, VTT) 1 175 000 (Tekes, VINNOVA) 847 866 (Tekes, VINNOVA, VTT) 835 000 (VINNOVA)
11 NanoCell	Nanostructured cellulose products	STFI-Packforsk, SE HUT, FI STFI-Packforsk, SE KTH, SE HUT, FI KTH, SE	328 800 (VINNOVA, industry) 246 200 (Tekes, industry) 202 400 (VINNOVA, industry) 404 800 (VINNOVA, industry) 258 200 (Tekes, industry) 404 800 (VINNOVA, industry)
12 ECOMBO	New eco-efficient, durable and high performance wood composites and wood-WPC hybrids for joinery products	SP[10], SE VTT, FI KTH, SE VTT, FI	301 000 (VINNOVA, Tekes, industry, etc) 174 000 (Tekes, VTT, VINNOVA, etc) 254 450 (VINNOVA, KTH, industry, etc) 103 730 (Tekes, VINNOVA, KTH, etc.
13 EcoMod	Eco-efficient modified wood products	VTT, FI SP Trätek, SE SP Trätek, SE Chalmers[11], SE SP Trätek, SE	316 500 (Tekes, VTT, VINNOVA, etc) 216 600 (VINNOVA, Tekes, industry, etc) 313 800 (VINNOVA, RCN[12], industry, etc) 78 900 (VINNOVA, Chalmers, etc.) 447 900 (VINNOVA, RCN, industry, etc)
14 InnoFireWood	Innovative eco-efficient high fire performance wood products for demanding applications	SP Trätek, SE VTT, FI VTT, FI SP Trätek, SE	250 000 (VINNOVA, industry, etc) 80 000 (Tekes, VTT, industry) 100 000 (Tekes, VTT, industry) 140 000 (VINNOVA, SP, industry)

6 Oy Keskuslaboratorio – Centralaboratorium Ab
7 Helsinki University of Technology
8 Royal Institute of Technology
9 Tampere University of Technology
10 SP Technical Research Institute of Sweden
11 Chalmers University of Technology
12 Research Council of Norway

Ref	Project	Subproject leaders	Project budget (sources) in euros
15 InnoLongSpan	Innovative design, a new strength paradigm for joints, QA and reliability for long-span wood construction	VTT, FI Växjö Univ., SE Växjö Univ., SE LTH[13], SE LTH, SE VTT, FI	260 000 (Tekes, VTT, Industry) 88 800 (VINNOVA, industry) 47 500 (VINNOVA, industry) 244 000 (VINNOVA, industry) 111 000 (VINNOVA, industry) 94 000 (Tekes, industry, VTT)
16 Innovood	Multi-sectorial database, model system and case studies, supporting innovative use of wood and fibres	STFI-Packforsk, SE Univ. of Helsinki, FI STFI-Packforsk, SE Södra Cell, SE VTT, FI Pergo Europe, SE Södra Cell, SE Univ. of Helsinki, FI VTT, FI Metla, FI	1 032 700 (Tekes, VINNOVA, industry, etc)

13 Technical University of Lund

Annex 2

List of interviewees

Absetz, Ilmari, Tekes
Agnemo, Roland, Domsjö Fabriker AB
Aksela, Reijo, Kemira Oyj
Ankerfors, Mikael, STFI-Packforsk AB
Berglund, Lars, KTH
Elg-Christoffersson, Kristina, Domsjö Fabriker AB
Esping, Eva, VINNOVA
Färnstrand, Eva, Södra Cell AB
Fossum, Greta, Swedish Forest Industries Federation
Hägglund, Björn, Stora-Enso AB (ex)
Hagström-Näsi, Christine, Finnish Forest Cluster Ltd
Heikurainen, Matti, Ministry of Agriculture and Forestry
Johnsson, Mats, SweTree Technologies AB
Kangasjärvi, Jaakko, University of Helsinki
Karlsson, Markku, UPM Kymmene Oyj
Kartovaara, Ilkka
Laine, Janne, Helsinki University of Technology
Larsson, Bengt, VINNOVA
Lehtonen, Markku
Liias, Pirkko, Oy Metsä-Botnia Ab
Lindström, Tom, STFI-Packforsk AB
Nordmark, Urdban, Sveaskog AB
Övrebo, Hans Henrik, Borregard A/S
Paavilainen, Leena, Metla
Poppius-Levlin, Kristiina, KCL
Puttonen, Pasi, Metla
Ritschkoff, Anne, VTT
Roos, Jaana, Academy of Finland
Saarenmaa, Liisa, Ministry of Agriculture and Forestry
Salmén, Lennart, STFI-Packforsk AB
Silén, Jouko, Stora-Enso Timber Oy
Sjöström, Karin, Södra Cell AB
Sundberg, Björn, Swedish University of Agricultural Sciences
Sundquist, Jorma
Svensson, Jan, Formas
Tamminen, Tarja, VTT
Thuvander, Fredrik, Karlstad University
Tuominen, Hannele, Umeå University
Viikari, Liisa, University of Helsinki
Vilkki, Markku, Conenor Oy
Wågberg, Lars, KTH
Wålinder, Magnus, SP-Trätek AB
Westin, Mats, SP Technical Research Institute of Sweden AB

Annex 3

BUNDLE case description

Overview of the BUNDLE project

Scope and organisation

BUNDLE was one of the basic research projects of the WMS programme studying the fibre strengths of wood cellulose. Fiber strength is a product of several factors, derived from fiber morphology, deformations and damage. Fiber morphology is defined during the growth of the tree and thus cannot be affected by process, contrary to the other factors. The BUNDLE project has identified factors that contribute to fiber strength and clarified how they are affected by chemical and mechanical damage during the process. The results have helped to understand the role of single fiber on paper performance.[14]

The BUNDLE project was lead by KCL[15] from Finland. Other partners were Swedish STFI[16], Helsinki University of Technology HUT and Karlstad University KAU. Like most other WMS projects, the BUNDLE project was organised into (4) separate subprojects, each lead by one of the partners. KCL's subproject focused on the fibre strength and morphology at this was lead by

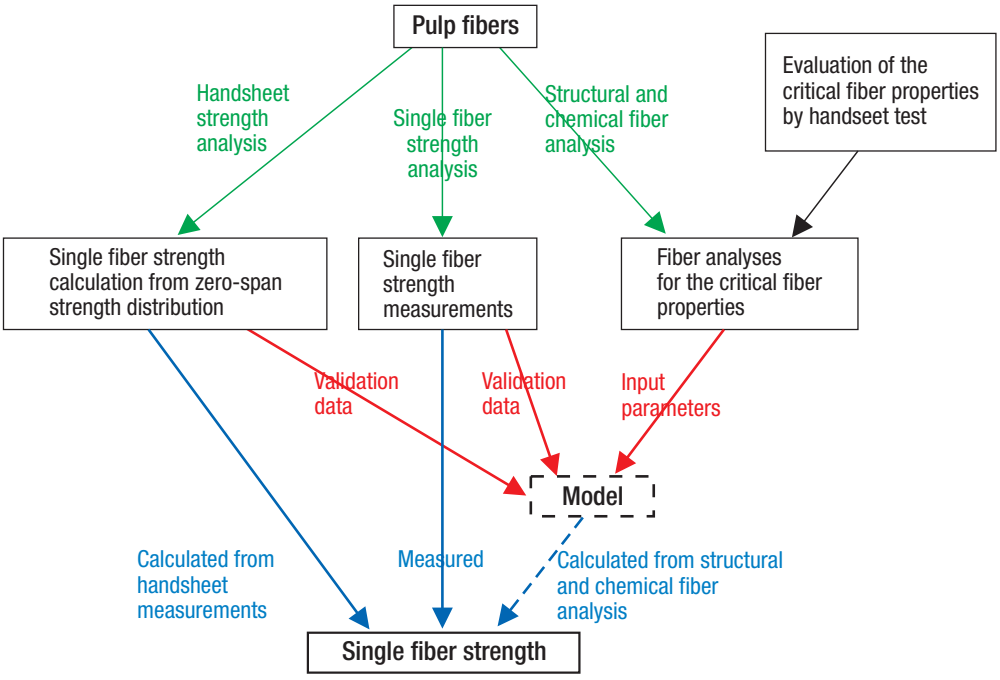


Figure 1. Illustration of the inter-connection of sub-project objectives in BUNDLE project

14 As defined in the WMS final report

15 Oy Keskuslaboratorio – Centrallaboratorium Ab.

16 STFI–Packforsk AB

Tarja Tamminen, who also coordinated the whole BUNDLE project. The HUT's subproject focused on the physics of fibre and was lead by Mikko Alava. The STFI subproject focused on the properties of wood components and their rheological behaviour, lead by Lennart Salmén, while the KAU subproject studied the strain to failure for wood fibres effect of morphology and process lead by Fredrik Thuvander. The below figure illustrates how the obectives of different subprojects link together in the modelling of fibre strengths in the BUNDLE project.

Initiation of the project

KCL and STFI, which are two similar industry-owned research organisations from Sweden and Finland, had tried to intensify their mutual cooperation. There was a four-year joint (pilot) research programme focusing on the production of pulp between the two organisations. BUNDLE was one of the projects within the KCL-STFI joint programme portfolio. The KCL-STFI programme continued in parallel for one year after the WMS Programme had started.

Within the STFI-KCL joint research programme, there were several subprojects under fiber research. Hence, this joint programme formed an important basis and core for the design of BUNDLE project, but the project itself was not a direct continuation of the already existing one.

The idea to this project grew out of discussions STFI and KCL had held over some time, based on the contacts that were consolidated by the close STFI-KCL collaboration. These discussions and interchanging of ideas were then continued by the two, separately, until it all eventually became the BUNDLE project idea.

Forest industry from both countries were closely involved (as the owners and financiers of STFI and KCL) in defining and approving relevant research topics. The topic of BUNDLE was among the ones proposed for co-funding under the newly started WMS programme.

Objectives of BUNDLE

The objective was to gain more basic knowledge on the interaction of polymers in fibre walls, and to create a model for this that could be used to better understand the chemical pulp processes and how they affect the material. The level of ambition was very high – but realistic, considering the conditions at the time the proposal was made.

The initial project objectives as well as sub-project objectives were considered very clear and ambitious. How the different sub-projects were to be knitted together was not so clear until the end-part of the BUNDLE project.

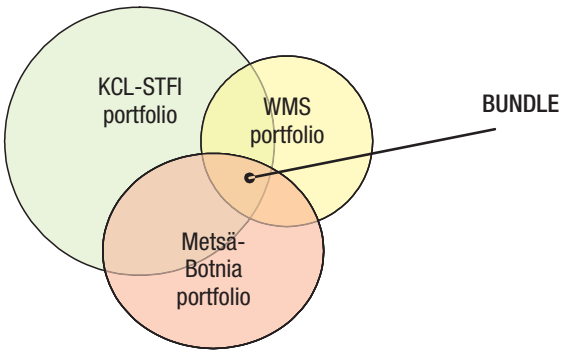


Figure 2. The positioning of the BUNDLE project from one industrial partners (Metsä-Botnia) viewpoint.

STFI was to produce a model during the first year of the project, and this model would be used in tests and measurements with KCL and other project participants.

Resourcing and administration

The budget on the Swedish side was cut in half as Formas informed that they did not have enough resources to this project. As a result, the STFI's initial objectives became unrealistic. The participants were asked to accept the initial goals, but had to reach them with half of the resources they had budgeted. This was considered unrealistic and ruining the foundations of the project. As STFI could not reach the initial objectives with less resources, they shifted emphasis onto carrying out more specialised analyses for KCL.

On the Finnish side, the researchers got the resources they had asked for. The overall project objectives remained, while the project *'walked with a limp'* and naturally reached much further on the Finnish side than it did on the Swedish side.

The project proposal also included two PhD students, one at STFI and one in KAU, but during the process this was cut down to one shared one. However, at the end the administration did not allow to share resources between STFI and KAU and the result was that no PhD students could be taken at all.

In December 2005 the KCL final report[17] of BUNDLE was produced. At that time the Finnish sub-projects had been completed, while the Swedish sub-projects were still going on due to their later start. KCL decided to fund a follow-up in 2006 to gather all pieces of information together. The complete final report was delivered at the end of 2006.

At the time of evaluation the project as such is finished and funding resources have been used, but some threads of it are still being worked on since the basic research question is not solved. Interesting and timely research questions remain, although to a lesser extent. What is left is a rather unique database and some research results that can be turned into further articles.

Research-industry collaboration

The KCL-STFI joint programme and the BUNDLE project in WMS had industry steering groups. This was also a practice in the previous Wood Wisdom programme. The KCL-STFI industry group was a very broad one, not concentrating very closely on individual projects, but both steering groups existed at the same time for about one year, before the KCL-STFI one ended.

The BUNDLE Advisory Board in the WMS programme stepped in at a time when the project was in practice running and there was little project definition to be done – mainly commenting on the progress and results.

Industry was there merely as a reference group for the project. Their role was to listen and give advice. They did not carry out any type of practical work in the project. This is the way the Advisory Board was planned to function from the very beginning.

Industry provided input as to the realism in the analyses that were carried out. The companies could not provide any opinions on the scientific research as such, thus the researchers could not use them as sounding boards in this respect. The discussion focused more on the value and meaning of the results achieved, and on the focuses of further evaluations.

The KCL-STFI joint programme also had an industry steering group, in which Metsä-Botnia, among others, was already participating. This is how they got into the Advisory Board of the BUNDLE project. Similarily, Södra Cell came into the project as a member of a STFI cluster. There was no other specific interest driving them. Formally, Stora Enso from both sides of the Baltic was part of the project, but in practice it was really only the Finnish side.

17 internal document of KCL and its industrial partners

The BUNDLE Advisory Board was stated to be rather active, but mainly from the Finnish part. They met every other time at STFI and KCL. Towards the end of the project, the Swedish industrial members of the Advisory Board became even less active.

There are many views why the Swedish industry was less (if at all) active in the project. For example Södra Cell did not participate in any of the Advisory Board meetings.

In one view, the companies are different in this area; Swedish companies are more inclined to go into details in projects, and look and ask for practical applications to the research. Finnish companies are more interested in basic research – they seem to ask themselves if the area as such is interesting or not for the company, and if so, if it is economically acceptable to go for it. If so, they then leave the researchers much more freedom to work.

Another view is that the weakening participation may have been a reflection of the overall lessening cooperation between STFI and KCL. Also the reason that the project was coordinated by the Finnish partner (KCL) may have lessened the industrial activity (of STFI) in Sweden.

Moreover, one reason may also have been that STFI had their own industry board in parallel to the Advisory Board of BUNDLE, in which the same projects are reported and the members were represented. Participation in BUNDLE Advisory Board would thus have been inefficient use of time.

Also, as STFI was not being able to reach their part of the goals due to cut resources, this may have had an effect on the industrial interest to the whole project on the Swedish side, too.

Altogether, it has been considered that the industry had a very realistic view of the project. They were well aware that this was a high-risk project with ambitious, long-term basic research goals, and that there was not to be expected an input in industrial processes more than in the very long term. But they were still interested and active; industry is relatively interested in keeping up-to-date also on the basic research.

The researchers also considered the opinions and comments of the industry very worthwhile, particularly when it comes to the overall results from the project. The development of cellulose fibre strength is very significant challenge to the industry. It has been important and topical research challenge for the industry for around 15 years. BUNDLE brought in one more element to this work. In this field, progress is typically made in incremental steps.

International collaboration

Getting other partners on board and defining objectives

Lennart Salmén from STFI and Tarja Tamminen from KCL had a working relationship already in the KCL-STFI research programme. They became the key people in defining and coordinating BUNDLE. New teams were searched to complement the core of these organisations. KCL proposed HUT since they had very close working relations with them and the topic was exactly in their field.

STFI proposed Karlstad University to be brought into the project, as they had seen Fredrik Tuvander from KAU to present an interesting research method at some conference. It was an experimental statistical method for counting fibres. They thought the method could nicely be applied in the project's fibre strength measurement part. Karlstad University was otherwise a new partner for both parties. Hence, Thuvander was invited to BUNDLE.

It was also very concrete and precise what Thuvander/KAU was about to do in the project: use the method he had developed to measure fibres, for statistical information and data.

The BUNDLE project was divided into four subprojects, each project being one partner's own part; one sub-project for KCL, one for STFI, one for KU and one for HUT. All sub-projects were

quite independent parts, except the STFI's one, which was a more horizontal topic. KCL took the overall coordination of BUNDLE.

Practical collaboration

Bundle project meetings were held three times a year. There were separate meetings for researchers only (STFI, KCL, HUT and KAU), with the industry representatives normally taking part in meetings directly after the researchers' meetings. The atmosphere in the meetings was considered open.

The collaboration was principally to take place between STFI and KCL. STFI served KCL with specialist analyses on some materials, all through the time of the project. There were quite a lot of contacts between STFI and KCL in order to collaborate and use materials for different tests. However, still not to the degree STFI had expected to; STFI received some data from KCL, but on quite an irregular basis.

The collaboration between KCL and HUT worked out particularly well, as they were physically located next to each other and were also collaborating in other research projects.

The KAU sub-project started late. Thuvander joined the project six months after others, and also had some difficulties in mobilising his colleagues to it. Still, he considers that at the end, the collaboration in BUNDLE was better than many other research projects he has been involved in. Much of the practical research work needs to be conducted separately anyway.

Although HUT and KAU seemed to have a bit different expectations from BUNDLE from the initiation, at the end part of project their collaboration seemed to work well and they were, for example preparing a joint article.

Organising the BUNDLE project between the two countries clearly extended the research base. On the Swedish side the researchers are part of the WURC –network, which was brought into the BUNDLE and the WMS programme. Without the Swedish networks the project would have probably been conducted differently.

There have not been basically any contacts between the BUNDLE project and the other projects of the WMS programme, while the annual seminars have been considered useful meeting places.

At the end, the BUNDLE project became more separate than probably originally intended. Towards the end part of the project, mutual collaboration became less and less active. The ambition from the start was clearly to make this genuine international research collaboration. In practice, this ambition was not fulfilled.

Domestic collaboration in Finland was intense. One reason for this was that there were PhD students working across the institutions. Having PhD students to work across all participants could have been an effective way to enhance collaboration more generally.

Value added of the project

The research objectives of BUNDLE were ambitious. Even the partners were not certain that such a functional overall model could be designed, which at the end happened to be the case. However, progress to that direction was made and important elements were created and those can be applied individually.

From the Finnish industry side, the BUNDLE was considered overall a very good project addressing an important topic that has been somewhat neglected in many programmes. Building broader, multidisciplinary research pools and keeping continuity in the development of competencies was very important to the industry.

KCL systematically evaluates its completed projects against a set of 14 key criteria. These include such elements as the project management, use of KCL competencies, co-operation, costs, etc. This evaluation is carried out by the partners, which have been involved in the particular project. In

the case of BUNDLE, these partners were in fact the same as the Finnish industrial representatives in the BUNDLE Advisory Board. In this evaluation, BUNDLE received the highest scores of all industrial projects carried out by KCL during 2006.

Also Metsä-Botnia made their internal utilisation plan of the project. Their direct conclusions from the BUNDLE were a) starting a practice of systematic assessments of fibre strength, b) evidence that the zero-span method is a reliable method for strength assessment and c) understanding of the fact that glucomannan has an important role for the strength of the fibre, which has further implications on the pulp process.

Although the main impression of the researchers is one of frustrated ambitions, some of the results of the project have lead to new project ideas that are now being worked on (but not to any greater extent). Some of these projects are pursued in-house, with resources culled from funds for basic research. There are also examples of projects derived from the BUNDLE project which are continued in STFI industrial clusters.

BUNDLE project has been considered strongly scientific. It has generated several spin off projects, also at the European level[18]. However, the main impact of BUNDLE was probably not generated through research articles, rather through the continuous work of some key researchers.

The BUNDLE project's larger ambitions were not achieved mainly due to Formas´ decision. This also reflected to the international collaboration; '*Had we been able to run the project as was originally intended, there would have been possibilities to continue a collaboration with these players. The conditions would have existed to establish a technology that we could have made use of together with the Finnish players, and made it possible to come even further in follow-up projects.*'

Lessons learned

BUNDLE was very complex and ambitious project. Apparently the work plan of the project could have been more clearly defined and concrete milestones set up for the project. Even breaking a long project into shorter ones could have been considered. Due to these, direction was a bit unclear, coordination was challenging and subprojects were lagging behind and the overall focus clarified only at the end of the project.

Better overall coordination

Distributing the project funding into many small sub-projects or activities is not efficient. If it was not possible to obtain the resources needed, the goals and milestones for the different sub-projects should have been re-formulated, taking as a reference point what the different participants could provide to it. This was not done, since the resources were already tied up on both sides. The goals and milestones were defined on the Swedish side and on the Finnish side, but they were not coordinated. The organizations focused too narrowly on their own goals, milestones and resources.

Complex research projects with ambitious objectives and several funding organisations involved do need to be well planned from the very start. It would also be wise to synchronise better sub-project financing in the project.

One lesson may have been that the research cultures, systems and infrastructures are very different in the two countries. The effects of this were probably not taken into account when cutting down the funding on one side.

18 For example: Cost Action E54: Characterisation of the fine structure and properties of papermaking fibres using new technologies, FINEFIBRE

Annex 4

WAW case description

Overview of WAW project

At a 2002 plant physiology conference, Björn Sundberg (Swedish University of Agricultural Sciences (SLU), Umeå, and Umeå Plant Science Centre (UPSC)) approached his old acquaintance Jaakko Kangasjärvi (University of Helsinki (UoH)) with the WAW project concept, encouraged by the then recently published WMS call. Sundberg and Kangasjärvi knew each other briefly, but had not previously worked together. In contrast, the third principal investigator (PI) of the project, Hannele Tuominen (Umeå University) had worked with both Sundberg and Kangasjärvi; first as doctoral student for Sundberg and then as researcher for Kangasjärvi and his colleague Tapio Palva. Although all PIs knew each other, the WMS call was clearly an enabling opportunity for a collaboration that otherwise would not have taken place, since the PIs do not work in the same field, but rather in adjacent and complementary fields. The central theme of the project was the effect of the plant hormone ethylene on wood formation, but addressed from different perspectives. While Sundberg, who became project coordinator, conceived the project concept, the proposal was jointly written by the three PIs. The project objectives were to:

- Understand the function of endogenous ethylene in wood formation
- Identify the molecular components in the ethylene-dependent signalling pathway that is responsible in stimulating cambial growth and fibre modification.

There was no direct industrial involvement whatsoever at any time during the course of this basic research project.

Project structure

The project was structured into three subprojects, each led by one of the three PIs. Each subproject included researchers from one country only, meaning that international collaboration took place at project level only. However, Sundberg's and Kangasjärvi's subprojects were intimately linked, where the work in one depended on the results of the other, and vice versa. The collaboration with Tuominen's subproject was more indirect, but the logic was that she worked with a cell model system and the other two with a tree model system. Tuominen's approach turned out successful, since it proved to be important to study the role of plant hormones in a simplified cell culture system and not only on intact large trees, which sometimes are quite complicated systems and not amenable to certain molecular techniques. Thus, the cell and the tree system approaches complemented each other well and added another dimension. Apparently, the PIs are all quite satisfied with the degree of collaboration and project-internal relations in general.

Main results

The main results of the project are that:

- The project has shown that ethylene is an important component of the signalling system inducing eccentric growth in response to wind and leaning of forest trees
- The project has demonstrated that ethylene affects wood production, fibre diameter and cell wall chemistry
- The project has demonstrated that this effect is mediated through the ethylene receptor, hence through a family of transcription factors denoted ethylene response factors (ERFs)
- The poplar genome sequence has been used to identify the key ERFs involved in wood modification.

Although industry representatives testify that the research results may be of significant interest to industry in terms of for example enhancing bio-

mass yield and modifying wood and fibre properties, it appears as if commercialisation is a long way off, meaning that a good deal of research likely remains before the concept has a chance to prove itself commercially. Moreover, the time perspectives are very long since for pine and spruce the time between planting and harvesting is 80 years in northern Europe; thus all pine and spruce that will be harvested for the next 80 years are already planted. On the other hand, if one considers other crops, such as poplar (~25 years to harvest) and eucalyptus grown in Brazil (6 years), the time perspectives are more attractive and there ought to be a more direct industry interest. Poplar is of interest as chemical base, energy and pulp; pulp is already made from ash (which is a poplar). Companies like UPM-Kymmene, Stora Enso and Aracruz (Brazil) have eucalyptus plantations in Brazil and they ought to have an interest in enhancing yield. One industry representative suggests that making pine and spruce resistant to various insects possibly could be of greater interest for a tree that is to be harvested in the 22nd century than increasing yield or tailoring other properties.

However, there are short-rotation (15–25 years) pine plantations in other parts of the world (e.g. in southern Europe, South America, Australia and New Zealand) and there may even be opportunities for short-rotation conifer plantations in northern Europe. Thus, project results may be of more immediate relevance if one looks beyond conventional forestry conditions in northern Europe.

Interviewees mention that there is an asymmetry in Swedish and Finnish forestry owners' likelihood of being interested in the results of the WAW project. In Sweden, forestry owners are dominated by a handful of large companies, while in Finland much of the forests are owned by private individuals who are unlikely to have an interest in increasing yield three generations later. Moreover, larger companies may, for public relations reasons, be unwilling to invest in research involving genetic modification.

While commercialisation of project results has not yet commenced, both Sundberg and Tuominen have previously committed themselves to exploitation of their research results through SweTree Technologies AB. Together with 42 other Swedish researchers in related fields, Sundberg and Tuominen own Woodheads AB, which has first right of refusal to all owners' inventions. Woodheads' inventions are then (selectively) exploited by SweTree Technologies AB, which Woodheads partly owns. It should be noted that despite the aforementioned concern among large companies regarding investments in research involving genetic modification, forestry companies Sveaskog, Bergvik Skog and Holmen in 2006 invested SEK50 million in SweTree Technologies together with the foundation JC Kempes Minne.

Industry participation

Although the industrial applicability appears to have been considered by the PIs from the onset, it was not explicitly articulated and there was no direct industrial involvement at any time during the course of the project.

International collaboration

Project meetings were held once or twice per semester and were very productive; they included all PIs, senior researchers and PhD students. All three PIs testify that collaboration between researchers in Sweden and Finland was very good and characterised by good personal chemistry. It appears reasonable to assume that part of the reason for the smooth collaboration may be sought in the fact that the three, completely national, subprojects complemented each other so well. That experiences of the WAW project were good is further testified by the ongoing collaboration of the PIs within other projects.

Significance of project for future international collaboration

It is obvious that the WAW project whet the participants' appetite for further collaboration. All three PIs have continued their research with domestic funding and continue to collaborate, partly within the UPSC and FuncWood frameworks. Kangasjärvi and Tuominen also continue

their collaboration within a Tekes-funded project until end of 2007. Sundberg and Kangasjärvi applied for a Woodwisdom ERA-Net project and their proposal received top scientific ranking, but the project was not funded since one of the three partner countries was unable to fund its share of the project.

It is obvious that despite the PIs knowing each other from before, the Swedish-Finnish research collaboration would not have commenced without WMS funding. Now that the PIs have established a joint track record and established trust, future collaboration is much more likely. Although there is limited evidence of ongoing joint projects, it seems likely that when a new opportunity for a joint project emerges, the former WAW colleagues will once again submit a joint proposal.

It is noteworthy that Sundberg has continued his research in the WAW project nationally in collaboration with researchers from KTH and STFI-Packforsk and with funding from Formas, the Foundation for Strategic Research and the Wallenberg Foundations.

Value added

The strategic value of the WAW project appears more direct for the Swedish participants than for the Finnish one, since forestry applications only constitute a small part of the latter's research. The project would not have been possible to carry out by either partner on its own due to lack of the complete set of appropriate competences. The PIs also testify that the aforementioned complementary nature of the subprojects meant that the project clearly accounted to more than the sum of its parts. Moreover, WMS funding was an enabling factor for the project to happen and the fact that these research groups now have established sustainable collaboration.

Although the project was relatively small in financial terms, all PIs stress the added value of international collaboration. Joining forces between Sweden and Finland results in a competitive advantage on the European and international scenes.

Lessons learned

From an administrative perspective, experiences differ. On the Swedish side, the project was perceived as a "normal" Formas project and little consideration appears to have been given to the fact that several funding agencies were involved. Some difficulty was caused by the fact that the Formas grants were for four years and started late, while the Academy of Finland grant was for three years (although Tekes eventually supported the Finnish research group for another two years). The PIs are of the opinion that a coordinated, longer-term planning perspective would have been desirable. Additionally, grants were seen as inadequate and not even sufficient for employing a doctoral student full time at each of the three organisations.

It was also pointed out that a small number of scientists simplifies collaboration and enhances quality and that a competent project coordinator (which the project had) is very important.

Annex 5

Ecombo case description

New, eco-efficient, durable and high performance wood polymer composites (WPCs) and wood WPC hybrids for joinery products (ECOMBO)

Overview of the project

The market for biomaterial-based composites has grown rapidly during the past ten years. Particularly in North America the production of WPC materials has increased significantly. In Europe the growth has been slower mainly because of different consumer preferences – the plastic-like appearance of WPC materials has influenced their demand. At the time of the WMS programme launch, WPC materials were nevertheless seen as one of the high-growth areas in joinery products. Being new materials, the properties of these materials were not yet well understood with respect to their usability in industrial products. For instance, some companies claimed that these materials were very durable and resistant to biological decay, but there was reason to believe that the benefits are overstated.

The ECOMBO project was established by VTT (VTT Building and Transport and VTT Procesess), KTH Building Materials and SP Trätek to study the properties of these materials and to develop new durable and high-performance wood polymer composites and novel wood-WPC hybrid materials for joinery products. The ECOMBO project was not any isolated project focusing on this area, but rather the participating research organisations had carried out earlier research in this field and the relation between these organisations were already established. However, some of the participating researchers were new to each other. In addition, neither party knew the emphasis and scope of the research activities in the other country very well. There was also an element of competition between the organisations in different countries – an issue which seemed to slow down the cooperative relationship in the beginning of the ECOMBO project.

The project was initiated by VTT Processes. Because bilateral collaboration was a prerequisite for participation in the programme, VTT decided to contact SP Trätek, with whom they had collaborated in an earlier EU-project. The consortium was established between VTT, SP Trätek, and KTH. The proposed research group and its research topic were considered to be a good match with the WMS programme. Had it not been for such a directed call, this collaborative project would not have been established.

Although the formal ECOMBO proposal consisted of two applications, one for Tekes and one for VINNOVA, the application process was a joint effort between the research organisations in both countries. It was deliberately decided that the project would consist of two national, rather separate sub-projects. The rationale for this was efficiency: it would be less complex and expensive to manage and coordinate national sub-projects. As a result, national goals and emphases were reflected in the design of the ECOMBO project. VTT coordinated the research work in Finland, while KTH was responsible for Swedish research activities.

The research work in the ECOMBO project started with producing WPC samples both by injection moulding and by conical extrusion technology. The different properties of these samples were then tested. The testing activities focused on the strength properties and the resistance against UV-radiation, water, biological factors and extreme temperatures, on different coating techniques, on the paintability and gluablity, as well as on micromorphology of the materials. Latter phases of the project focused mainly on the dissemination of the research findings.

Bilateral collaboration between research organisations

The nature of the collaboration between the research organisations in the two countries was strongly influenced by the project set-up and the manner in which the project was structured into national sub-projects. The work was organised so that in both countries researchers produced and worked mainly with their own material samples. In addition, the division of work was based on the competences of the organisations. The work of Swedish researchers focused more strongly on biological durability of products and one of the modification methods, while the emphasis of Finnish researchers was on cardio extruded materials, surface treatments and specific characteristics of the WPC products. Although formally there was a single bilateral project, in practice much of the work reflected national goals and interests in both countries.

Due to this project design, the bilateral collaboration mainly consisted of communicating and exchanging research results. The researchers met each other every six months in order to exchange knowledge and to steer the project further. During the meetings, information was exchanged openly. Between these meetings, the participants mainly worked with their national partners. In addition, some material samples were exchanged between the partners, but not in a very significant way considering the overall research effort. One of the interviewed researchers commented on the nature of cooperation in the following way: "The cooperation was not that intense. It was a matter of the Swedish part of the project doing its part and the Finnish its part, and then pooling the results."

This manner of cooperation appeared to be a deliberate choice made at the project outset. Its purpose was an efficient and inexpensive implementation of the project avoiding overlapping or sub-optimal research activities in the respective countries. It appears that this form of cooperation worked well with respect to goals set in the beginning of the project. It was a cost-efficient way for carrying out project tasks, for increasing the understanding of researchers on research competencies in the other country, and for exchanging knowledge. On the other hand, this manner of cooperating was subject to some criticism both by the project partners and the Advisory Board members. It was suggested that this type of project design does not result in real collaboration with strong relationships and increased learning between participants. It was recommended that consortium partners should focus on the same research questions in both countries, because only then the research activities converge in a significant way. In practise this could mean for the ECOMBO project that the research work is centred around the same material samples in both countries. It was suggested that this approach would provide a better basis for dividing the research work in such a way that the all partners could build on their own competences, but at the same time the research results produced by different partners would be more complementary to each other, thus enabling a more coherent synthesis of the findings. In the present case the testing was done on national samples resulting in somewhat separate research outcomes. As one interviewee called it, this results in "diverging" bilateral research.

Collaboration between researchers and industrial companies

The project set-up – how it was initiated by research groups in Sweden and Finland and funded by national funding organisation – also shows in the way industrial companies participated in the project and how they cooperated with researchers. Companies were not directly part of formulating the projects but, rather, researchers in both sides of the Baltic "listened to what the companies' interests were at this stage, and if the [project] ideas were something that the companies believed in." The companies brought their needs to the discussion, and these were reviewed when the project plan was made. The researchers did not approach companies as a consortium, but rather independently and on one-on-one basis in both countries separately. The project proposal was then finalised and at this stage researchers ensured that it would be feasible to carry out certain tasks in companies that would require for instance the use of the company production lines for testing. In addition to this initial stage, indus-

trial companies also participated in the evaluation of the project (however, these were a different group of companies). As a result, the ECOMBO project was selected to the WMS programme with no heavy modifications.

It appears that for many companies participating, the ECOMBO project was not strategically in the very core of the companies' business. Many of the companies participated as an "observer", and their interest to the project outcomes was not very strong. However, there were certain companies which were more actively cooperating with the researchers during the project.

The formal cooperation between companies and researchers mainly took place in the project Advisory board, which was composed of both Swedish and Finnish company representatives. This approach was encouraged from the part of the WMS programme management. However, in practise this form of cooperation was not very intense, as many companies often did not show up in the advisory board meetings. The interest for this type of cooperation was particularly weak in Sweden. On the other hand, there was "a core group of companies" that participated in the meetings and shared their views with the researchers. These were found to be valuable by the researchers, although there was some criticism from the part of the advisory board as to how receptive the researchers were for these views. It appears that there was some tension between companies who would have liked to focus the project on more industrially relevant issues and researchers that favoured more generic research. Nevertheless, the discussion in the advisory board was fruitful and created a forum also for the companies to exchange views between each other.

Instead of this formal collaboration mechanism, cooperation between researchers and companies took place through other means. In Finland companies were more eager to participate in the national dissemination meeting that was often organised before the advisory board meeting. This also partly became the forum in which companies shared their views on project implementation, taking on the role of the advisory board meetings. In Sweden, cooperation between researchers and companies took place informally and through one-on-one discussions. In sum, it seems that these other forms of collaboration were much more intense than the cooperation within the advisory board. One interviewee even stated that they "could have scrapped the advisory board altogether".

Due to the project set-up the bilateral collaboration between researchers and companies was weak. Some companies made material samples to the research group in the other country, and some new contacts were established, but within the project the cooperation was not very significant. For instance, when interviewed, project coordinator in neither country was able to describe how the companies in the other country had contributed to the project.

The bilateral collaboration between companies was even weaker, almost non-existent. This is not a big surprise, however, given the way the project was funded and organised and considering that companies are very sensitive about their development efforts.

Research outcomes and impacts

In most areas the project attained the objectives set for it, and resulted in some new research knowledge on the characteristics of WPC materials. First, the project showed that composite materials can be produced so that the share of natural fibres is as low as 70%, which is an important result with respect to sustainable development. Secondly, the project showed that not all WPC materials have suitable characteristics for industrial joinery products, but the use of these materials can even enhance the weaknesses of both plastic and natural fibre based materials. Modifications to the production process as well as heat treatment can be utilised to influence these characteristics. Thirdly, the project showed that the materials can be painted or glued if specific surface treatments are applied to these materials, which increases their industrial usability.

From the industrial point of view, perhaps the most concrete result was the understanding that these materials may have weaknesses, and that they are not as resistant as they are being marketed to be. "This is a ticking bomb if you don't ensure the resistance of the material combination. The products will rot and mould just like common wood does". The project thus made a contribution to improving the formulations for marketing. Overall, it seems that the project mainly increased the knowledge of the material characteristics of WPC materials in companies, rather than resulting in concrete new industrial solutions or applications. As many companies participated as observers in order to see what the potential implications of the project results to their own development work are, they often did not have any specific expectations for the project. As a result, the project was not considered a great success, but in general a "positive experience", as one company referred to it.

The research groups will continue the cooperation with some of the companies in further research projects. In Sweden the work will continue within the framework of the new national competence center ECOBUILD. The decision of Swedish companies to participate in ECOBUILD was partly influenced by the work carried out in ECOMBO.

As a result of the ECOMBO project research groups in both countries are now aware of the research competences on the other side of the Baltic, and researchers know each other. As one researcher put it, "it is today easier for us to find out what is going on in [the other country] and vice versa – and that's no mean feat." In addition, some contacts with foreign companies have been established, although this was not of major significance.

As for strengthening the research competence, it appears that in both countries the ECOMBO project has contributed to the increasing research efforts in the WPC research area. This bilateral project has supported the research groups in participating in further EU-projects. VTT for example is currently participating in 4 EU-projects in the area, one of which is coordinated by them.

Lessons Learned

The ECOMBO case highlights some specific issues related to the organisation of bilateral research projects. Perhaps most importantly, the objectives for the stronger bilateral / international cooperation should be clear from the outset. Internationalisation is not an end itself but rather a means to something. On a larger scale, the long-term goal of the forest-based industry is a more effective use of research resources in the Nordic countries. At the programme level one needs to ask, what are the best means to achieve this objective with respect to bilateral collaboration, and how should the programme evaluate and influence project-level goals for collaboration. Should projects focus on establishing new contacts and the creation of new research networks, should they be geared towards strengthening the cooperation between existing research partners, or should they leverage existing contacts to carry out cost-effective research by dividing the work between research groups? In addition one needs to ask, what the objectives for company participation in projects are.

In the present case, the WMS programme management encouraged projects which would advance the first two objectives described above, both the creation of new networks as well as strengthened collaboration among existing research partners. However, it seems that in practise the ECOMBO project did not strive for intensive cooperation but rather divided the work to both sides of the Baltic and then shared the results as they were obtained. There is likely to be many reasons for this. The resources for the ECOMBO project were rather limited, and therefore it was more appropriate and cost-effective to carry out the work more separately. Intensive cooperation requires researchers from different countries to work physically together, which is always costly – whether the collaboration is organised through meetings or through longer term researcher exchange. If such an approach to project structure

and design is desired, perhaps this should be communicated more strongly already in the programme call, and also sufficient incentives designed and implemented to support this.

As for project steering, it appears that the value added of the advisory board in the ECOMBO project was rather low. This is not so much due to the work of the company representatives in the board as it is to the way the project was organised. As the project was in practise composed of two national sub-projects, and research groups individually approached companies in both countries, this set-up did not create a very conducive starting point for the work of the advisory board.

Perhaps a better way to create a more active advisory board and to enhance bilateral collaboration between companies would be for the research groups to first set-up a bilateral consortium with an initial project plan and then to approach companies on both sides of the border with similar messages and to refine the project plan on the basis of this.

Another approach would be to initiate research projects based on needs common to companies internationally. This would support establishing an advisory board with a common interest and to enhance stronger collaboration between companies on the one hand and companies and researchers one the other. However, this would perhaps not be a feasible approach to agencies funding basic research, as the research topics would be bound to be more problem or application oriented.

Annex 6

Nanocell case description

Overview of the NanoCell project

Nanotechnology is one of the most promising areas of scientific and technological development. Recent developments in measurement techniques have made it possible to understand, control and manipulate materials and structures at the nanoscale. This allows new possibilities to introduce functionality into materials and products.

The topic of nanomaterials is rather sensitive to the industry, in terms of revealing information. Companies follow the development closely, and there are many areas for new applications and patenting of both materials and processes. The mikrofibrilar cellulose, for example, gives certain foodstuffs higher viscosity and can be used as texture agents, without adding sugar or proteins.

Tom Lindström at STFI-Packforsk, who had studied nanocellulose in the 1980s, took the initiative to the project. The researchers and some of the companies had worked together on nano-cellulose in an earlier projects (such as the KTH project BimaC, also led by Lindström), and the NanoCell project became a continuation of this. The research group in NanoCell consisted of "old pals" Lindström, Lars Wågberg, Lars Berglund and Janne Laine, with Olli Ikkala as the only new participant.

The NanoCell project counted three Finnish and eight Swedish industrial partners. As it was also part of the Paper Chemistry Cluster at STFI, another seven companies from Sweden, Austria, Brazil and Norway indirectly participated through those cluster activities. Another STFI-Packforsk member, Borregaard, joined the cluster in the summer of 2006, when the NanoCell project was already at the end of its existence, and according to the cluster rules Borregaard could collect IP during this cluster period. Basic new ideas of MFC production were developed before the NanoCell project.

Project structure

Within the NanoCell project new methods for production of microfibrillated cellulose (MFC) were developed and utilised. The program had three major objectives:

1. Well-characterized MFC from wood
2. MFC with tailored surfaces
3. New materials based on MFC

NanoCell was an external project partly funded by the STFI paper cluster, with most partners (but not all) also STFI members and part of that cluster. The project was divided into six national sub-projects, some with their own Steering Groups where companies and researchers met. A Steering Committee met 1-2 times/year to oversee the developments of the project as a whole. On the Finnish side, project management meetings were held to discuss practical issues and there was also a voluntary advisory board. Seminars organised by the programme served to meet new research groups that otherwise would not have been engaged in this field. A project intranet site is available for all participants. This structure ensured continuous contacts between the different sub-projects, although participants of one sub-project were not actively engaged in the research of the others. There was a sense of 'making progress', according to one researcher.

The main results of the project so far

The production methods for NanoCell have been patented; the patent rights of STFI-Packforsk are in the core activities.

There were few examples of industrial production and use of MFC before Borregaard joined the project. Borregaard has built a test site, and will with a proper factory for production have one or more commercial products in more than one field of utilization on the market in about three years' time (one probably being increasing viscosity in different food products). Kemira have developed nanofiber cellulose, using another technology, and M-Real have a few patents in this area and have worked on a process for paper production purposes. Eka Chemicals (member of the STFI-Packforsk cluster) has also filed a patent on MFC-production. Domsjö represents the other end of the scale, coming to the conclusion that this was not a core area for the company.

There are also indirect results of the project. The companies have learned more about cellulose, and will eventually use this knowledge in product development in various areas. One company representative points out that the cycles are long, and practical outcomes from research projects with universities should be expected after 5-10 years. Apart from this, the companies have increased their contacts with some researchers. These networks mainly include companies and researchers of the same nationality, but to some extent also Finnish companies and Swedish researchers.

One researcher claims there have been many spin off projects from the NanoCell, some of significant size. These have yet to be announced by the industry. Various researchers say the project was extremely successful in technical terms, as new application areas for microfibrils have been developed (support chemicals for paper manufacture, coatings for paper board, porous polymer foams, aerogels and filters).

Industry participation in project preparation and goal-setting

When the project started, nobody really knew what to expect or what they wanted – it was to a large extent curiosity-driven research rather than a mission oriented project with foreseen applications. With the exception of Borregaard that built a pilot plant, industry participation was as observers, to listen and discuss the research outcomes. According to one researcher, industry basically said NanoCellulose was so interesting that the researchers could do whatever they wanted; "industry didn't know what they wanted – now they do!".

Borregaard itself asked to be part of the STFI-Packforsk cluster in order to get information on production processes and IPR. The company had a clear idea of what they wanted to do, and they were not going to enter the project to do anything else but exactly that. The company direction put a good supply of fibres to work with as a condition, and for this reason a pilot site was built. The other STFI-Packforsk members participating in NanoCell were invited to use it for the project. There was no response to this – probably because the other companies were still in the laboratory stage and not ready for pilot testing.

Domsjö´s ambition was to get into a new production area, and ultimately to build a production plant at their own site. Mikrofibrillar cellulose is considered an interesting future production area. Today, it exists only on a laboratory scale. The first step in this would be the construction of a pilot plant. Kemira joined the project to collect ideas for new research openings as well as to widen their own perspective in NanoCellulose research.

The IPR questions have been no problem, as this was sorted out from the beginning between the researchers taking part in the project. The researchers knew each other well and there was trust between them. As for the companies, there have been no complaints about administrative issues.

Research-industry collaboration

As the topic of nanomaterials is rather sensitive, not all information was shared between industry partners. The companies did not reveal new information at project meetings, but rather kept it for the work at home.

One company states access to the technology as a reason for participating, another says they had the cellulose and the technology and wanted to get into a new production area to see what applications there could be. Finding new partners was not an objective for any of the companies we have talked to.

Borregaard came in to the collaboration at a later stage, and with a very clear view of what they wanted to do. From their point of view, this project has been a bilateral collaboration with STFI. Borregaard has not collaborated with other project partners.

International collaboration in the project

This project was a true international collaboration – between the researchers. The sub-project leaders had worked together before, with one exception, and there seem to have been few administrative problems due to the double-nation funding construction. One researcher points out that they were allowed to work freely without interference from VINNOVA or Tekes.

The companies did not participate very actively in the project. This is logical, as what is being done is still a bit far away from commercial use. The industry representatives have no feeling of this being a joint Swedish – Finnish effort, but basically collaborated with researchers of the same nationality. No collaboration between companies in Finland and Sweden emerged as a result of the project. As the sub-projects were national and then drawn together on the global project level, it is perhaps not surprising. Also, the cross-border aspect was not considered as important in itself. Despite this, there are indications of some emerging collaborations between research organisations in one country and companies in another, not only through the Sustaincomp project (see below).

The significance of the project for future international collaboration

The NanoCell project as such is finished, but much of the work is expected to continue in future EU projects. One of these projects, SustainComp, is already under way.

SustainComp: Development of Sustainable Composite Materials

Parts of NanoCell and other research directions will have its continuation in the 7th framework programme, with the Development of Sustainable Composite Materials (SustainComp) project. This project will also be coordinated by STFI-Packforsk and Mikael Ankerfors. The volume is some 10 MEuro, some 17 partners are participating.

The NanoCell network of senior researchers is clearly sustainable, as all five subproject leaders are included in this proposal. Two of the NanoCell partner companies take part in this new venture.

- Borregaard's role in SustainComp is the pilot-scale manufacturing of nanocellulose.
- SCA provides large scale applications of foams, end uses, market evaluations and demonstrators.

Value added of project

The NanoCell project was of unquestionable strategic value to the four sub-project leaders and researchers. The project continued the collaborations between these researchers, and brought a new and much appreciated participant into this circle of collaborators. This new collaboration also had the unexpected effect of getting one of the researchers to raise the academic stakes and publish in journals with higher impact factors, instead of continuing to publish exclusively in more narrow journals.

NanoCell also provided high value added to at least one industrial partner, curiously enough neither Swedish nor Finnish. Borregaard is a Norwegian company, but also an STFI-Packforsk member. NanoCell enters in several of Borregaard's projects, and feeds knowledge back to the company's technology platform. "If this had not been the case, we wouldn't have taken part in this (cluster)!" The STFI-Packforsk connection and collaboration is important in this aspect.

If it hadn't been for the participation in NanoCell, Borregaard probably would have pursued this line of work anyway – but with a different time aspect. "We were aware of this technology, and maybe would have bought it from outside. This, in turn, might have affected what (types of) projects we had chosen to pursue." NanoCell gave Borregaard a good start and the security that this technology actually can be used, and a better knowledge base for the future.

If WMS had not happened, STFI-Packforsk would have carried out this project regardless – but with different partners. They probably wouldn't have done it with Finnish collaborators if it wasn't for WMS putting that as a condition. There is nothing a priori stating that the Swedes would have collaborated with specifically the Finns in this case. But maybe just Swedish participation had not been enough. According to the project coordinator, it probably would not have been as an EU project at this point in time, though, as more people than strictly necessary should not be involved in the very high risk, early stages of development.

Lessons learned

For the project coordinator, this project was business as usual; it all comes down to finding people you feel good working with. If you do that, possible administrative obstacles are easily overcome. This happened in the case of NanoCell. Most other researchers involved in the project agree, and have mainly positive lessons to draw from this.

There is a clear need for a common set of rules. In this project, the Finns have had one rule book, the Swedes another, and it is difficult and time-consuming to handle a situation where you have to know the rules in the other country. The message to VINNOVA and Tekes would be to prepare a project of this kind more thoroughly next time, and to lay down a common foundation from which to work.

Another suggestion would be to have a common pot for projects like these. As it is now, the projects apply for funds from the same source, but once that has been approved they have to apply again for the national funding. This causes a slow process, and could mean that parts of the project have to be scrapped because they don't get (sufficient) funding in the national stage. This, of course, could have bearing on the overall project.

The companies seem to agree that they could have been more active in the project, but it is difficult to state that doing so the outcome would have been very different for these partners. In the case of Domsjö, for example, it was the company itself that decided to step down in order to concentrate on a limited amount of core activities. You could say that Domsjö represents a missed opportunity in this project, but when you take a decision on what to do you do it on the knowledge you have in that moment. Domsjö withdrew not because the project was going poorly, but rather due to a strategic decision that the company could not work in all fields.

Annex 7

Programme Committee self evaluation questionnaire

Impact Evaluation of the Finnish-Swedish Wood Material Science and Engineering Research Programme (WMS)
- Self-evaluation by the Programme Board

The Funding organisations of the Finnish-Swedish Wood Material Science and Engineering Research Programme have commissioned an *impact evaluation* of the Wood Material Science and Engineering Research Programme, which will be competed by the end of 2007. The scientific evaluation of the programme will be carried out in parallel.

The impact evaluation is jointly carried out by Advansis Oy (www.advansis.fi) and Technopolis Group Ltd (www.technopolis-group.com).

The impact evaluation begins with the following self-evaluation by the Programme Board. Its purpose is to collect key stakeholders' expectations and views with regard to the operation and success of the programme. Please fill in the questionnaire according to your best estimate and knowledge. Each respondent's results will be kept anonymous.

We kindly ask you to respond to this questionnaire by 16th April 2007.
The survey outcomes will be presented and discussed in the Board Meeting of 20th April 2007.

For more information, please contact Kimmo Halme tel: +358 50 463 4405 or kimmo.halme@advansis.fi

Thank you for your co-operation!

A) BASIC INFORMATION

1. Name of respondent

2. Organisation

B) EFFECTIVENESS OF THE PROGRAMME

3. According to your personal view, what have been the three most important results of the programme so far?

4. How would you estimate the importance of the following programme goals?

Please evaluate on a scale 1 = low importance; 5 = very high importance.

	1	2	3	4	5	Do not know
To promote sustainable use of natural resources	○	○	○	○	○	○
To raise the competitiveness of forest-based industries	○	○	○	○	○	○
To promote the development of innovative forest-based products	○	○	○	○	○	○

To intensify the transfer of new knowledge and technology from its producers to the users	○	○	○	○	○	○
To add value in the wood products industry	○	○	○	○	○	○
To promote multidisciplinary research	○	○	○	○	○	○
To strengthen the international research cooperation in the area of wood material science	○	○	○	○	○	○
To stimulate mobility of researchers between the countries	○	○	○	○	○	○
To intensify researcher training	○	○	○	○	○	○

5. How well has the programme succeeded in achievement of its goals?

Please evaluate on a scale 1 = low success; 5 = very high success.

	1	2	3	4	5	Do not know
To promote sustainable use of natural resources	○	○	○	○	○	○
To raise the competitiveness of forest-based industries	○	○	○	○	○	○
To promote the development of innovative forest-based products	○	○	○	○	○	○
To intensify the transfer of new knowledge and technology from its producers to the users	○	○	○	○	○	○
To add value in the wood products industry	○	○	○	○	○	○
To promote multidisciplinary research	○	○	○	○	○	○
To strengthen the international research cooperation in the area of wood material science	○	○	○	○	○	○
To stimulate mobility of researchers between the countries	○	○	○	○	○	○
To intensify researcher training	○	○	○	○	○	○

6. Was the chosen project portfolio appropriate to achieve the goals of the programme? How would you have shifted the focus of the programme portfolio in retrospect?

C) OPERATIONAL PERFORMANCE

7. According to your view, what were the main challenges in managing and coordinating the programme?

8. How well did the following stakeholder groups facilitate and contribute to international cooperation in the programme?

Please evaluate on a scale 1 = modest contribution; 5 = very significant contribution.

	1	2	3	4	5	Do not know
Funding organisations	○	○	○	○	○	○
Programme board	○	○	○	○	○	○
Programme coordinator	○	○	○	○	○	○
Advisory groups	○	○	○	○	○	○

9. How important were the following approaches in achieving international cooperation in projects?

Please evaluate on a scale 1 = low importance; 5 = very high importance.

	1	2	3	4	5	Do not know
Project modules or work packages involving mainly national work, with the project leader coordinating the work across the Finnish-Swedish border?	○	○	○	○	○	○
Mainly researchers but not others actively working in the same modules or work packages across the border?	○	○	○	○	○	○
Mainly industry but not others actively working in the same modules or work packages across the border?	○	○	○	○	○	○
Both industry and researchers actively working in the same modules or work packages across the border?	○	○	○	○	○	○
Events (coordination meetings, seminars etc) to coordinate across the border within or between modules?	○	○	○	○	○	○

10. How successful were the following stakeholder groups in integrating and managing a programme consisting of both basic research oriented and innovation targeted projects?

Please evaluate on a scale 1 = not successful; 5 = highly successful.

	1	2	3	4	5	Do not know
Funding organisations	○	○	○	○	○	○
Programme board	○	○	○	○	○	○
Programme coordinator	○	○	○	○	○	○
Advisory groups	○	○	○	○	○	○

11. How successful were the following stakeholder groups in supporting research-industry cooperation?

Please evaluate on a scale 1 = not successful; 5 = highly successful.

	1	2	3	4	5	Do not know
Funding organisations	○	○	○	○	○	○
Programme board	○	○	○	○	○	○
Programme coordinator	○	○	○	○	○	○
Advisory groups	○	○	○	○	○	○

12. How could the coordination and management of the programme have been further improved?

13. What is your perception, how important a goal was international cooperation for the programme's projects?

Please evaluate on a scale 1 = low importance; 5 = very high importance.

	1	2	3	4	5	Do not know
IDEST - Identification of EST polymorphisms and candidate genes for growth and wood properties in silver birch	○	○	○	○	○	○
WAW - Wood and Wind – unlocking wood formation through ethylene signalling	○	○	○	○	○	○
VACHA - Value-chain analysis for forest management, timber purchasing and timber sale decisions	○	○	○	○	○	○
IMWO - Impact of forest management and climate on wood quality	○	○	○	○	○	○
SPWT - Specific wood and timber properties, competitive ability and advance conversion of Nordic Scots pine in mechanical wood processing	○	○	○	○	○	○
STDUT - Straight and durable timber	○	○	○	○	○	○

MICROAN - Chemical microanalysis of wood tissues and fibres	
BUNDLE - Fibre wall modelling	
WoodBiocon - Value-added products from barks of Nordic wood species using bioconversion and chemical technology	
NewCell - New cellulose derivatives from wood for high-value products	
NanoCell - Nanostructured cellulose products	
ECOMBO - New eco-efficient, durable and high-performance wood composites (WPS's)	
EcoMod - Eco-efficient modified wood products	
InnoFireWood - Innovative eco-efficient, high-fire-performance wood products for demanding applications	
InnoLongSpan - Innovative design, new strength paradigm, QA and reliability for long-span wood products	
Innowood - Multi-sectorial database, model system and case studies, supporting innovative use of wood and fibres	

14. What is your perception of the success of international cooperation in the programme's projects?

Please evaluate on a scale 1 = not successful; 5 = highly successful.

	1	2	3	4	5	Do not know
IDEST - Identification of EST polymorphisms and candidate genes for growth and wood properties in silver birch						
WAW - Wood and Wind – unlocking wood formation through ethylene signalling						
VACHA - Value-chain analysis for forest management, timber purchasing and timber sale decisions						
IMWO - Impact of forest management and climate on wood quality						
SPWT - Specific wood and timber properties, competitive ability and advance conversion of Nordic Scots pine in mechanical wood processing						
STDUT - Straight and durable timber						
MICROAN - Chemical microanalysis of wood tissues and fibres						
BUNDLE - Fibre wall modelling						
WoodBiocon - Value-added products from barks of Nordic wood species using bioconversion and chemical technology						
NewCell - New cellulose derivatives from wood for high-value products						
NanoCell - Nanostructured cellulose products						
ECOMBO - New eco-efficient, durable and high-performance wood composites (WPS's)						
EcoMod - Eco-efficient modified wood products						
InnoFireWood - Innovative eco-efficient, high-fire-performance wood products for demanding applications						
InnoLongSpan - Innovative design, new strength paradigm, QA and reliability for long-span wood products						
Innowood - Multi-sectorial database, model system and case studies, supporting innovative use of wood and fibres						

D) ADDED VALUE OF INTERNATIONAL PROGRAMME

15. What was the main added value of the Swedish-Finnish cooperation in the programme?

16. What were the strengths and weaknesses of this particular programme structure?

17. What are the most important lessons learned for the organisation of future international programmes?

E) EXPECTATIONS FOR THE EVALUATION

18. According to your perception, what are the key issues this evaluation should address?

19. How can the evaluation best support decision-making within your organisation by providing further information, evidence and deeper understanding?

Annex 8

Cross-country survey questionnaire

Impact Evaluation of the Finnish-Swedish Wood Material Science and Engineering Research Programme (WMS) - Cross-country survey

This cross-country survey is part of the impact evaluation of Wood Material Science and Engineering Research Programme 2003-2006 (WMS) and is commissioned by the Finnish and Swedish funding agencies.[1] The impact evaluation is jointly carried out by Advansis Oy (www.advansis.fi) and Technopolis Group Ltd. (www.technopolis-group.com). A scientific evaluation of the programme is conducted separately.

The purpose of this cross-country survey is to collect information on the WMS programme implementation and its results and impact. It will be complemented by personal interviews and case studies to provide deeper analyses.

The survey is targeted at all researchers and project managers having received funding from the WMS programme. The questions focus on participants' experiences regarding programme management and implementation, the project's outcomes and particularly the extent of networking and collaboration in the programme.

Please fill in the questionnaire according to your best estimate and knowledge. If you have been involved in several projects under the WMS programme, respond for each project. Each respondent's results will be kept anonymous.

We kindly ask you to respond to this questionnaire by ***October 12, 2007***.

For more information, please contact Kimmo Halme tel: +358 50 463 4405 or kimmo.halme@advansis.fi

Thank you for your contribution!

[1] Tekes, Vinnova, Formas, MMM and the Academy of Finland

A) BASIC INFORMATION OF THE RESPONDENT

1) Name of respondent

2) Organisation

3) Name of the research project under the WMS programme

If you have been involved in more than one project, please select the one you are most familiar with and respond to the questions based on your experience with this project.

Please select one

4) Role in the research project

Please select one

B) PROJECT SET-UP AND DEFINITION

5) Thematic focus of the project

Which of the following programme focus areas did the project have strongest links to? Please allocate 100 % to the following areas:

Forest research

Mechanical wood processing

Chemical wood processing

Other (area, percentage)

6) Definition of project objectives

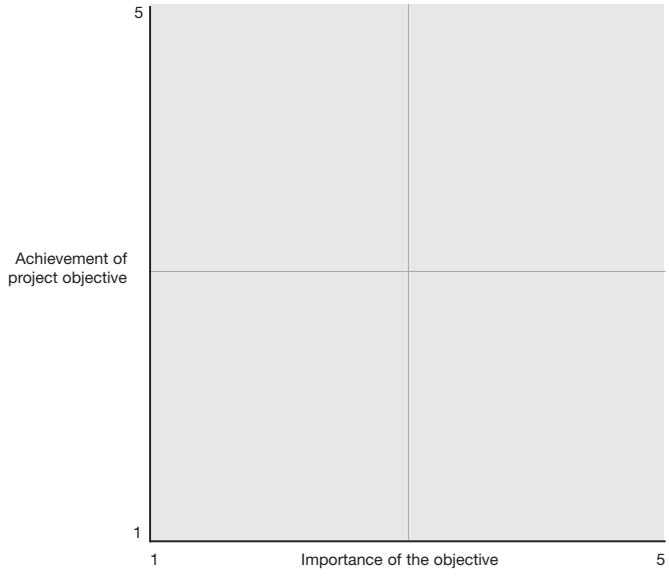
How were the project objectives defined? Please indicate the extent to which you agree or disagree with the following statements. (1=Strongly disagree, 7 =Strongly agree).

	1	2	3	4	5	6	7	Do not know/not applicable
Project objectives were very precisely defined and unambiguous.	○	○	○	○	○	○	○	○
Project objectives were measurable.	○	○	○	○	○	○	○	○
Project objectives were redefined to meet the programme goals better.	○	○	○	○	○	○	○	○
Project advisory board strongly influenced project goals at the outset of the project.	○	○	○	○	○	○	○	○

7) Project objectives and their attainment

Please describe the importance of the following objectives to you or your organization when engaging in this project on the X-axis (1 = not important, 5 = highly important) and the extent to which these objectives have been achieved on the Y-axis (1 = not at all, 3 = as defined in the project plan, 5 = highly exceeded objectives).

1. To create new scientific knowledge
2. To solve practical problems with new knowledge
3. To familiarise oneself with new research methods and techniques
4. To develop new or substantially improved research methods and equipment
5. To develop new or substantially improved products
6. To develop new or substantially improved production processes
7. To access research funding
8. To access capabilities abroad
9. To access facilities abroad
10. To share the costs / risks associated with the project
11. To tackle problems that have an international dimension
12. To share and utilise research results
13. To deepen research cooperation in our field of study
14. To expand research cooperation into different fields of study



8) Strategic relevance of the project

Please tick each of the following scales to characterise the nature of the project from your own organisation's perspective.

	1	2	3	4	5	6	7	
In a peripheral research field or area	○	○	○	○	○	○	○	In a core research field or area
In an area of low strategic importance	○	○	○	○	○	○	○	In an area of high strategic importance
Part of short term development activities	○	○	○	○	○	○	○	Part of long term development activities
Low cost to own organisation	○	○	○	○	○	○	○	High cost to own organisation
Low risk of project failure	○	○	○	○	○	○	○	High risk of project failure

9) Earlier cooperation with project partners

Had you cooperated earlier with the project partners?

- ○ We had already cooperated with all or most project partners
- ○ We had cooperated with most or many of project partners
- ○ We had cooperated with only few project partners
- ○ We had not cooperated with any of the project partners.

C) PROJECT IMPLEMENTATION

10) Cooperation within the project

How would you characterise the intensity of the cooperation carried out in the project? Please indicate the intensity of cooperation with respect to the following types of cooperation. (1= not at all intensive, 7= very intensive)

	1	2	3	4	5	6	7	Do not know/not applicable
Cooperation between researchers nationally	○	○	○	○	○	○	○	○
Cooperation between researchers and companies nationally	○	○	○	○	○	○	○	○
Cooperation between companies nationally	○	○	○	○	○	○	○	○
Cooperation between researchers across the border	○	○	○	○	○	○	○	○
Cooperation between researchers and companies across the border	○	○	○	○	○	○	○	○
Cooperation between companies across the border	○	○	○	○	○	○	○	○

11) Organisation of international cooperation

How well do the following approaches describe the nature of international cooperation in your projects? (1 = not well at all; 7 = very well)

	1	2	3	4	5	6	7	Do not know/not applicable
Sub-projects involving mainly national work, with the project leader coordinating the work across the Finnish-Swedish border?	○	○	○	○	○	○	○	○
Mainly researchers but not others actively working in the same sub-projects across the border?	○	○	○	○	○	○	○	○
Mainly industry but not others actively working in the same sub-projects across the border?	○	○	○	○	○	○	○	○
Both industry and researchers actively working in the sub-projects across the border?	○	○	○	○	○	○	○	○
Project-level events (coordination meetings, workshops, etc) to coordinate across the border within or between sub-projects?	○	○	○	○	○	○	○	○
Programme-level events (seminars etc) to coordinate across the border between projects?	○	○	○	○	○	○	○	○

12) Frequency of international collaboration

How often were you in contact with your foreign project partners?

- ○ A few times a week
- ○ A few times a month
- ○ Monthly
- ○ A few times a year
- ○ Annually

13) Support from programme management

How successfully did the WMS programme management and project advisory boards support your project? Please indicate the extent to which you agree or disagree with the following statements. (1=Strongly disagree, 7 =Strongly agree).

	1	2	3	4	5	6	7	Do not know/not applicable
Programme coordinator provided valuable input to steer the project	○	○	○	○	○	○	○	○
Programme coordinator supported the realisation of project goals	○	○	○	○	○	○	○	○
Programme coordinator facilitated the international cooperation in the programme	○	○	○	○	○	○	○	○
Programme coordinator monitored the progress of the project	○	○	○	○	○	○	○	○
Programme coordinator supported the utilisation of research results	○	○	○	○	○	○	○	○
Project advisory board provided valuable input to steer the project	○	○	○	○	○	○	○	○
Project advisory board supported the realisation of project goals	○	○	○	○	○	○	○	○
Project advisory board facilitated the international cooperation in the programme	○	○	○	○	○	○	○	○
Project advisory board monitored the progress of the project	○	○	○	○	○	○	○	○
Project advisory board supported the utilisation of research results	○	○	○	○	○	○	○	○

14) Programme additionality

In what way would the project and its outcomes have differed if the project had NOT been carried out under the WMS programme? Please indicate the extent to which you agree or disagree with the following statements. (1=Strongly disagree, 7 =Strongly agree).

	1	2	3	4	5	6	7	Do not know/not applicable
Project would probably not have started at all	○	○	○	○	○	○	○	○
Project would have been carried out on a smaller scale	○	○	○	○	○	○	○	○
Project would have progressed slower	○	○	○	○	○	○	○	○
Project would not have involved international collaborators	○	○	○	○	○	○	○	○
Project would have involved different and/or fewer collaborators	○	○	○	○	○	○	○	○
Project would have had less ambitious goals	○	○	○	○	○	○	○	○
Results would not have been applied as widely	○	○	○	○	○	○	○	○
Project would not have received as broad publicity / awareness	○	○	○	○	○	○	○	○
Project would have not succeeded so well to meet its objectives	○	○	○	○	○	○	○	○

D) PROJECT PERFORMANCE AND OUTCOMES

15) Learning benefits

How did the project benefit your research units / organisations competence development and future prospects in the following areas? (1=No effect, 7 =competence strongly improved).

	1	2	3	4	5	6	7	Do not know/not applicable
Scientific competence	○	○	○	○	○	○	○	○
Technical know-how	○	○	○	○	○	○	○	○
Understanding of industrial products or production processes	○	○	○	○	○	○	○	○
Understanding of cross-country collaboration	○	○	○	○	○	○	○	○
Competence in administrating projects	○	○	○	○	○	○	○	○
Understanding of the research culture abroad	○	○	○	○	○	○	○	○

16) Industrial utilisation of research outcomes

To what extent have the project results been adopted and/or utilised by companies? Please indicate the extent to which you agree or disagree with the following statements. (1=Strongly disagree, 7 =Strongly agree).

	1	2	3	4	5	6	7	Do not know/not applicable
Companies are actively monitoring the progress of the project	○	○	○	○	○	○	○	○
Companies are utilising the new knowledge or research results in their own research work	○	○	○	○	○	○	○	○
The IPR generated by the project is being utilised by companies.	○	○	○	○	○	○	○	○
Project work is being continued by an industrial R&D project	○	○	○	○	○	○	○	○
Companies have invested in the development of new products or production processes based on the project results	○	○	○	○	○	○	○	○

E) LESSONS LEARNED

17) Added value of bilateral cooperation

What was the main added value of the Swedish-Finnish cooperation in the project?

18) Strengths and weaknesses

What were the strengths and weaknesses of the WMS programme structure for your project?

19) Organisation of future international projects

What are the most important lessons learned for the organisation of future bilateral/international projects?

Annex 9

Advisory Board survey questionnaire

Impact Evaluation of the Finnish-Swedish Wood Material Science and Engineering Research Programme (WMS) - Advisory board survey

This advisory board survey is part of the impact evaluation of Wood Material Science and Engineering Research Programme 2003-2006 (WMS) and is commissioned by the Finnish and Swedish funding agencies.[1] The impact evaluation is jointly carried out by Advansis Oy (www.advansis.fi) and Technopolis Group Ltd. (www.technopolis-group.com). A scientific evaluation of the programme is conducted separately.

The purpose of this advisory board survey is to collect information on the WMS programme implementation and its results and impact. It will be complemented by personal interviews and case studies to provide deeper analyses.

The survey is targeted at company representatives in project advisory boards. The questions focus on experiences regarding project implementation and impact.

Please fill in the questionnaire according to your best estimate and knowledge. If you have been involved in several projects under the WMS programme, respond for the project you are most familiar with. Each respondent's results will be kept anonymous.

We kindly ask you to respond to this questionnaire by ***October 19, 2007***.

For more information, please contact Kimmo Halme tel: +358 50 463 4405 or kimmo.halme@advansis.fi

Thank you for your contribution!

[1] Tekes, Vinnova, Formas, MMM and the Academy of Finland

A) BASIC INFORMATION OF THE RESPONDENT

1) Name of respondent

2) Organisation

3) Name of the research project under the WMS programme

If you have been involved in more than one project, please select the one you are most familiar with and respond to the questions based on your experience with this project.

Please select one

B) PROJECT IMPLEMENTATION AND IMPACTS

4) Definition of project objectives

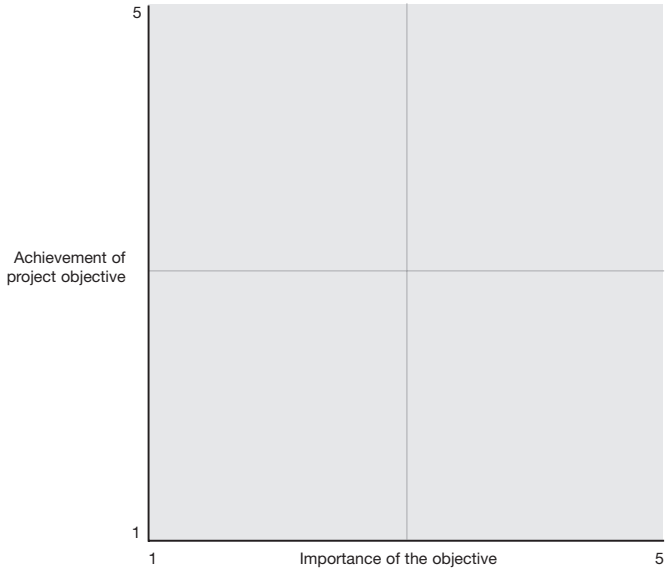
How were the project objectives defined? Please indicate the extent to which you agree or disagree with the following statements. (1=Strongly disagree, 7 =Strongly agree).

	1	2	3	4	5	6	7	Do not know/not applicable
Project objectives were ambitious/challenging	○	○	○	○	○	○	○	○
Project objectives were very precisely defined and unambiguous.	○	○	○	○	○	○	○	○
Project objectives were measurable.	○	○	○	○	○	○	○	○
Project objectives were redefined to meet the programme goals better.	○	○	○	○	○	○	○	○
Project advisory board strongly influenced project goals at the outset of the project.	○	○	○	○	○	○	○	○
Project objectives had high strategic importance to our company	○	○	○	○	○	○	○	○

5) Project objectives and their attainment

Please describe the importance of the following objectives to your organization when engaging in this project on the X-axis (1 = not important, 5 = highly important) and the extent to which these objectives have been achieved on the Y-axis (1 = not at all, 3 = as defined in the project plan, 5 = highly exceeded objectives).

1. To solve practical problems with new knowledge
2. To familiarise oneself with new research methods and techniques
3. To develop new or substantially improved products
4. To develop new or substantially improved production processes
5. To share the costs / risks associated with the project
6. To tackle problems that have an international dimension
7. To share and utilise research results
8. To deepen research cooperation in our current core business area
9. To expand research cooperation outside our current core business area



6) Cooperation within the project

How would you characterise the intensity of the cooperation carried out in the project? Please indicate the intensity of cooperation with respect to the following types of cooperation. (1= not at all intensive, 7= very intensive)

	1	2	3	4	5	6	7	Do not know/not applicable
Cooperation between researchers nationally	○	○	○	○	○	○	○	○
Cooperation between researchers and companies nationally	○	○	○	○	○	○	○	○
Cooperation between companies nationally	○	○	○	○	○	○	○	○
Cooperation between researchers across the border	○	○	○	○	○	○	○	○
Cooperation between researchers and companies across the border	○	○	○	○	○	○	○	○
Cooperation between companies across the border	○	○	○	○	○	○	○	○

7) Industrial utilisation of research outcomes

To what extent have the project results been adopted and/or utilised by companies? Please indicate the extent to which you agree or disagree with the following statements. (1=Strongly disagree, 7 =Strongly agree).

	1	2	3	4	5	6	7	Do not know/not applicable
We have actively been monitoring the progress of the project	○	○	○	○	○	○	○	○
We are utilising the new knowledge or research results in our own research work	○	○	○	○	○	○	○	○
The IPR generated by the project is being utilised by us	○	○	○	○	○	○	○	○
Project work is being continued by an industrial R&D project	○	○	○	○	○	○	○	○
We have invested in the development of new products or production processes based on the project results	○	○	○	○	○	○	○	○

8) Added value of bilateral cooperation

What was the main added value of the Swedish-Finnish cooperation in the project?

9) Organisation of future international projects

What are the most important lessons learned for the organisation of future bilateral/international projects?

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