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Impact of Tekes' grants for applied technical research

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Foreword

The Apply project was initiated in 1997 when Tekes contacted the VTT Group for Technology Studies with a request to conduct an evaluation of the impact of Tekes' grants for applied technical research. Tekes' technology programs, which constitute one part of the Tekes grants for applied technical research, have been evaluated by external evaluators on a continuous basis. The other part of the grants, i.e., the grants for non-tied goal-directed research projects, had, on the other hand, never been evaluated. Thus, there was a strong call for this type of a study, and the Apply-project was launched in 1997. Now the project has come to an end, and the results of the project are ready to be presented.

The Apply-project has been an extensive research project, with three separate studies as well as three separate researchers conducting the studies. Several parties interested have been involved in the project, providing the project with information from several points of view. The empirical data for the project have been collected from Tekes' personnel, researchers at research institutes and universities, as well as from companies representing a broad spectrum of Finnish industry. Thus, the results of the study should have the potential to give valuable information to these parties who are concerned with the issues brought forth in the study. As noted, the Apply-project has been a large and challenging task. Several people have contributed to its successful implementation. First of all I would like to thank Tekes for providing the necessary funding for the project. The two other researchers who have worked with the project before me, Ms. Eija Ahola and Ms. Minna Tuppurainen, have contributed significantly to the project by carrying out the first two phases. The director of our group, Mr. Tarmo Lemola, has given me valuable support throughout the project, as well as insightful comments on previous drafts of the report. I would also like to thank Dr. Terttu Luukkonen and Ms. Eija Ahola for their comments and help with designing the survey questionnaire. Ms. Phoebe A. Isard deserves my warmest thanks for her prompt work with improving the language of the report. Finally, on the behalf of myself as well as Ms. Eija Ahola and Ms. Minna Tuppurainen, I want to express our warmest gratitude to the respondents of the study, who have provided us with important and necessary information for this study.

Otaniemi 31.5.2000

Maria Bergenwall

Abstract

This report documents the results of the third and final phase of the Apply-project, i.e, the evaluation of the success and impact of Tekes' grants awarded to universities and research institutes for applied technical research. The projects which are awarded these grants are non-tied goal directed research projects, in other words, they are not connected with any of Tekes' technology programs. The third phase focused on investigating the expectations, goals and experiences of company representatives who participate in the work of research project steering groups. The data were collected through a postal survey sent to 266 company representatives, and the response rate of the survey was 54%. Attached to this report are also summaries of the results of the two previous phases of the Apply-project, the first of which investigated the opinions of Tekes' personnel responsible for awarding the grants, and the second of which studied the opinions of researchers at universities, polytechnics and research institutes.

Results of the study show that the grants for non-tied goal-directed applied technical research projects are important financing resources, from the point of view of both researchers and companies. Companies are interested in participating in these projects, both at the steering group level and in the actual research project. Companies may participate as experts, equal research partners and as co-funders. The majority of the companies indicated that they were willing to continue research co-operation with research groups in these types of projects. Companies find participation in this type of co-operation important for many reasons. For example, companies perceive that participation in a research project provides them with information about the developments in their area of interest, as well as with important contacts to the research community, customers and competitors, all of whom may participate in the steering group work. Furthermore, companies find the increase in knowledge an important reason for participating in steering groups of non-tied goal-directed applied technical research projects.

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1 The aim of the study

The Group for Technology Studies at VTT has been assigned by Tekes to study the impact of Tekes' funding of R&D-activities. The Tekes funding may be divided into three main categories: 1) grants for companies, 2) loans for companies [industrial R&D loans and capital loans], and 3) grants for applied technical research carried out at research institutes and universities. The third category, i.e., the grants for applied technical research, are rewarded to research projects carried out either within technology programs or as non-tied goal-oriented research. The awards granted for applied technical research carried out as free goal-oriented research are the focus of this study. In other words, the impact of these grants is studied and evaluated. These particular grants are awarded to research institutes and universities in order to support research aimed at strengthening the technological and scientific knowledge base in Finland (http://www.tekes.fi/rahoitus/laitos.htm).

The research project (called the APPLY-project) was carried out in three separate phases. The first two parts were carried out in 1997 and 1998 by two separate researchers. Ms Eija Ahola was responsible for the first phase, in which representatives of Tekes' personnel responsible for awarding grants for non-tied goal-free research projects were interviewed. Ms Minna Tuppurainen carried out the second phase of the research project, which focused on studying the opinions of researchers at research institutes, universities and polytechnics, where research projects funded by these grants are carried out. The first two phases of the research project have been reported on by the researchers mentioned above. The present author carried out the third phase in which the opinions of representatives of companies taking part in the steering groups of applied technical research projects were studied through a mail survey. The third phase of the project consists also of synthesising the results from the three separate phases of the complete study. This report documents the third phase of the research project, in other words, the results of the survey are presented and analysed.

1.1 Data collection

The third phase of the project began in March 1999. The idea was to complete the investigation of the "whole set" of actors involved in and affected by the awarding of Tekes' grants for applied technical research. In other words, besides investigating the opinions of Tekes' personnel and university/research institute researchers, it was found important to study the opinions of company representatives taking part in the research project as members of projects' steering groups. As noted above, the

data collection was performed as a mail survey directed to a sample of company representatives of steering groups. Information on these company representatives was not available in advance in any database. Therefore, contact information on the sample of the mail survey was gathered through an email survey directed at project managers of a number of applied technical research projects, which received Tekes' funding in 1998.

The sample for the email survey was gathered from Tekes' brochure 'Tätä tutkitaan 1998. Tekesin rahoittamat soveltavan teknisen tutkimuksen hankkeet'. In this booklet all those projects, which are financed through Tekes' funding for applied technical research, are listed. The target group for the email survey was selected randomly from the booklet by the researcher. In the booklet, the research projects are listed according to the area of research: 1) information technology (info), 2) chemical technology and biotechnology (che/bio), 3) production technology and energy technology (prod/ener), and 4) technology policy (technpol). The email survey was sent to 248 project managers of projects which were in progress and funded by Tekes during 1998. Eighty-seven project managers replied to the email survey, with a response rate of 35 per cent. Information was received on 94 projects. This response rate is rather low, but the responses managed to yield contact information for 266 company representatives taking part in research project steering groups. This sample size was considered to be acceptable for the actual mail survey. The actual mail survey was directed to these company representatives, who participated in steering groups of 83 research projects. The reason for discarding 11 projects was that: 1) one project had only foreign company representatives in its steering group, and 2) 10 projects did not have any company representatives in their steering groups.

The majority of the research projects were conducted within the area 'chemical/biological technology' (42 projects) whereas the number of projects representing 'information technology' (24 projects) and 'production/energy technology' (25 projects) was about the same. The fourth and smallest research area was 'technology policy' with only three projects representing this area. The majority of the research projects (60) were carried out at universities, and VTT was the second most common organisation where research projects were conducted (24 projects).

1.1.1 The mail survey

The mail survey was conducted by sending a questionnaire to 266 company representatives of research project steering groups. The survey was conducted in three phases during the autumn of 1999. The first questionnaire mailing was done on October 5th 1999. **96** (**84**) responses were returned. The second mailing (the first reminder mailing) was done on October 28th, and the third and final mailing (the second reminder mailing) was posted on November 30th. The second mailing yielded a response rate of **40** (**37**) returned questionnaires, and **24** (**22**) questionnaires were returned as a result of the third mailing. The parentheses show the number of usable responses. In other words, among the returned responses (∑ **160**), **17** of the questionnaires were not usable for analysis. Non-usable responses include re-sent survey forms, e.g., due to false postal address or because the respondent no longer was an employee of the company, and, consequently, not involved in the focal research project. The total response rate was 60%, and the response rate for the usable responses was 54%. This response rate was considered to be acceptable for the survey. Table 1 depicts the statistics on the survey responses.

Table 1. Statistics on the survey responses

n = 266				
	mailing 1	***mailing 2***	***mailing 3***	***total ∑***
∑ responses				
Usable	84	37	22	**143**
Not participated in the project	6	1	1	8
Not reached resp.(e.g., due to false address)	3	0	0	3
Resp. no longer employee of the company	3	0	0	3
Re-posted unanswered survey form	0	1	0	1
Unidentified respondent	0	1	1	2
total ∑	***96***	***40***	***24***	***160***

2 The Tekes R&D-funding

Tekes (the National Technology Agency) is the main organisation responsible for the financing of applied and industrial R&D in Finland. Tekes was founded in 1982 as a result of the restructuring of Finnish technology policy undertaken by the Ministry of Trade and Industry (Tekes-työryhmän loppuraportti, 1996). Tekes' main goal is to create and sustain favourable circumstances for advancing the competitiveness of Finnish industry through the means of technology. Furthermore, Tekes aims at developing versatile production structures, and at increasing productivity. By these activities, Tekes aims at creating a solid basis for employment as well as economic and social well being in Finland. In order to achieve the aims described above, Tekes has developed a variety of means. Below, the means and activities employed by Tekes are listed.

Tekes is responsible for:

- funding of R&D-activities (applied technical research and risk-intensive industrial R&D-projects).
- planning, co-ordination and financing of technology programs
- activating the utilisation of technology, the co-operation between companies and the internationalisation of companies
- financing and co-ordination of international technology co-operation

(http:/www.tekes.fi/tekes/index.htm)

A more general activity, which Tekes is engaged in, is the preparation, development and implementation of technology policy in Finland.

2.1 Tekes funding - main instruments

Tekes states its aim of providing various forms of funding for R&D-activities in the following way:

> Tekes provides grants and risk loans to research and development that lead to internationally competitive products, production processes or services.

Tekes offers the following means of research financing to universities, research institutes and companies for their R&D-activities.

- industrial R&D-grants for companies
- industrial R&D-loans for companies
- capital R&D-loans for companies
- grants for applied technical research for universities and research institutes (technology programs and non-tied goal-oriented research)

(http://www.tekes.fi/eng/information/stat.htm)

Below, these funding categories are briefly presented. The text is based on the information on the funding categories presented on Tekes' homepage (http://www.tekes.fi/eng/information/funding.htm).

Grants for companies

Tekes' industrial R&D-grants for companies cover from 25 % to 50 % of the costs included in the research project. These costs are, e.g., salaries, raw material, machinery, subcontracting, travel costs and patents.

Risk loans for companies

The loans for companies may be divided into two subgroups, 1) industrial R&D-loans and 2) capital R&D-loans. The loans may cover up to 60 % of the costs included in the research project (salaries, raw material, machinery, subcontracting, travel costs and patents).

Grants for applied technical research at universities and research institutes

Tekes provides funding for applied technical research conducted at universities and research institutes. Tekes makes the funding decisions according to certain principles, which vary depending on the type of organisation conducting the research, as well as on the type of research project. The principles for funding directed to research institutes (e.g., VTT) and to universities vary in some ways, as can be noted in Table 2 and Table 3 below. Table 2 depicts the funding principles

for financing of applied technical research at research institutes (e.g., VTT). In the table, column 1 depicts the type of project, columns 2-5 depict the financers and their financing shares (% of expenditures). The sixth column depicts contributions to the project which are not monetary.

Table 2. Tekes' principles for research funding to VTT and other research institutes

	Tekes	**European Commission**	**Own funding**	**Company and other funding**	**Contribution of companies, e.g. equipment**
Applied technical research	50-60	0	0-50	0-50	supporting
National technology programs	60-70	0	0-40	0-40	supporting
EU research programs	0 or 20	50	0-50	0-50	supporting

Source: Tekes' internal document (10.12.1998)

Tekes applies the following principles on the funding of research projects conducted at VTT and other research institutes:

1. Tekes provides funding for applied technical research (non-tied goal-oriented research) covering 50 % of the costs, and for national technology programs covering 60 % of the costs. The remaining part of the funding is either own funding or company/other funding.

2. Tekes' funding may be 10 % higher in projects where the participation of small and medium sized industries (companies) is considerable.

3. Tekes may participate in the financing of EU-projects with an additional funding ranging to 20 %. This additional funding requires substantial company participation, as well as considerable potential utilisation of the results of the research in Finnish business.

Tekes' principles concerning funding of research projects directed to universities are somewhat different. Research projects conducted within the domain of applied technical research (non-tied goal-oriented research) or national technology programs receive 70-100 % of their funding from Tekes. When additional funding is required, own funding or company/other funding cover this need. Tekes does not participate in the funding of EU-projects, because the European Commission offers 100 % funding for these types of projects. Table 3 depicts Tekes' principles for research funding directed to universities.

Table 3. Tekes' principles for university funding

	Tekes	**European Commission**	**Own funding**	**Company and other funding**	**Contribution of companies, e.g. equipment**
Applied technical research	70-100	0	0-30	0-30	supporting
National technology programs	70-100	0	0-30	0-30	supporting
EU research programs	0	100	0	0	supporting

Source: Tekes' internal document (10.12.1998)

In general it is pointed out by Tekes that research projects funded by the various forms of funding should be characterised by networking with other companies, e.g., by forming joint ventures. Also using local SME subcontractors in the case of research projects carried out by larger companies, and participation in national technology programmes are recommended and supported. Furthermore, Tekes finds it important that research projects involve contracting of services from Finnish research institutes and universities, and that the projects promote international co-operation.

2.2 Some statistics on the amount of Tekes' R&D-funding

The total amount of research funding awarded by Tekes has increased steadily since the beginning of the 1990's. Figure 1 depicts the total funding awarded by Tekes during years 1992-1999, and the share of the total funding allocated to the funding of applied technical research.

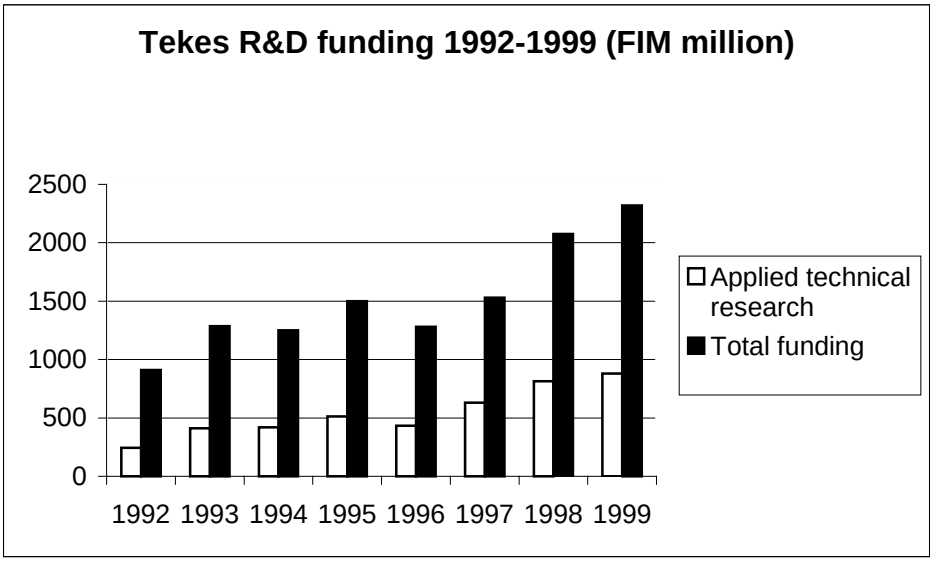

Figure 1. Tekes' R&D funding 1992-1999, and the amount of funding directed to applied technical research

Source: http://www.tekes.fi/tekes/valtuudet.htm and Tekes' brochures 'Tätä tutkitaan' (1992-1998)

The total amount allocated for R&D-financing 1999 was FIM 2,4 billion (EUR 400 million), and the total number of research projects was 2 404. The numbers for 2000 show that the financing trend has continued, with the total Tekes R&D-funding amounting to 2,3 billion FIM (EUR 383 million). The amount of FIM allocated in 1998 for each funding category is shown below in Figure 2[1].

[1] The subsequent two figures show statistics for the year 1998, because the research projects, which are in focus in this study, were in progress during 1998.

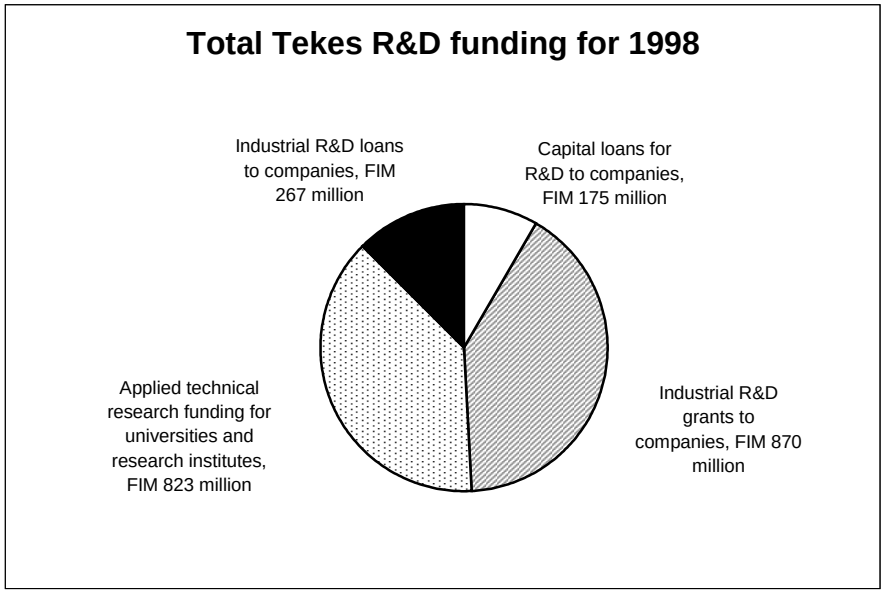

Figure 2. Allocation of Tekes' total R&D funding 1998

Source: http://www.tekes.fi/eng/information/stat.htm

The applied technical research projects were awarded FIM 823 million in 1998 (EUR 137 million). Of this total, FIM 431 million (EUR 72 million) were tied to technology programs, whereas FIM 392 million (EUR 65 million) were allocated to non-tied goal-oriented research projects. For 1999 the figures show a slight increase in the amounts awarded for applied technical research. FIM 912 million (EUR 152 million) were awarded to universities and research institutes; FIM 506 million (EUR 84 million) to research projects tied to technology programs and FIM 415 million (EUR 69 million) to non-tied goal-directed research projects.

Tekes has organised its funding structure according to technology divisions. In other words, research projects are categorised into technology divisions according to the area of research. These technology divisions are 1) information technology, 2) chemical technology and biotechnology, 3) production technology and energy technology, and 4) other funding (e.g., technology policy research). Figure 3 depicts the total Tekes R&D funding for 1998 by technology divisions.

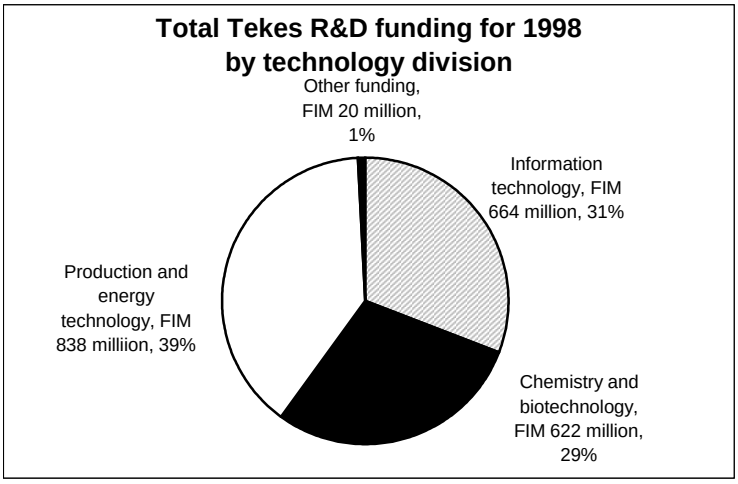

Figure 3. Allocation of Tekes' total R&D funding 1998, by technology division

Source: http://www.tekes.fi/eng/information/stat.htm.

3 Results of the survey

In this section of the report, the results of the survey are presented and discussed. The results are presented according to the grouping of questions in the questionnaire. The design of the questionnaire is presented more detail in Appendix 2.

3.1 Background information about the respondents

The company representatives who took part in the survey represent a wide range of industries. The largest number of responses were obtained from representatives of companies within the metal industry (f=22), the energy and oil industries (f=16), the telecommunications industry (f=12), the machine industry and the chemical industry (f=11 for both types of industry). Thirteen respondents were classified as representing 'other' types of industries. This category includes e.g. the plastic industry (1 respondent), and the building industry (2 respondents). Six respondents did not give any information on the industry of their company. Table 4 below depicts the type of industries represented in the survey.

Table 4. Type of industry represented by the companies participating in the survey

Type of industry (n = 143)	***freq.***	***Type of industry (n = 143)***	***freq.***
Medical	8	Software	4
Telecommunication	12	Consulting business	5
Machine	11	Banking and Financing	3
Energy and Oil	16	Mining and Minerals	4
Metal	22	Materials	4
Chemical	11	Multi-industry	4
Forest and Paper	7	Others	13
Consumer goods	6	No response	6
Electronic	7		

The companies which took part in the survey may be categorised according to the size of their personnel and annual turnover. This categorisation is depicted below in Table 5.

Table 5. Size of personnel and annual turnover of companies participating in the survey

Personnel		**Turnover (FIM 1000)**	
categories	n	categories	n
< 100	31	< 10000	16
100-500	25	10000-100000	11
500-1000	12	100000-500000	21
1000- 5000	27	500000-1000000	15
5000-10000	9	1000000-5000000	16
> 10000	7	> 5000000	28
missing	32	missing	36

The respondents were also asked to indicate their position in the company. Table 6 depicts the results. 52% of the respondents represented the middle management of their company.

Table 6. Respondents' position in the company

n = 143	***freq.***	***%***
Top management	24	17
Middle management	74	52
Experts	23	16
Business persons, enterprisers	3	2
Other	2	1
No response	17	12

3.2 Project stage

This question was intended to elicit the stage of the projects, that is, whether the project was in progress or whether it had ended at the time of the survey. One hundred and twenty two of the respondents answered this question, whereas 21 respondents did not. Among the 122 responses, 78 projects (64%) were in progress and 44 (36%) had ended at the time of the survey.

3.3 The origin of the research project

Two multiple-choice questions[2] cover this topic. The first question states the originator of the research idea, and the second question investigates who suggested that the respondent participate in the work of the steering group.

Research ideas originate, in most cases, from either one single researcher or a research group, or ideas may result from co-operation between researchers/research groups and companies. Purely company/industry based research ideas are not that common in applied technical research projects. Tekes was the originator of the research idea in 7 cases. The last category 'other' includes, e.g., the Ministry of Trade and Industry and the steering group of the research project.

Table 7. The origin of the research idea

n = 143	***freq.***	***%***
Researcher/research group	65	45
Company/industry	27	19
Researcher(s)/research group and company in co-operation	43	30
Tekes	7	5
Other	7	5

The majority of the respondents take part in the work of research projects' steering groups on the initiative of company management or at the request of university researchers. It was also quite common for the respondent to take the initiative personally to become a member of the steering group. As in the question concerning the origin of the research idea, it was not very frequently reported that the initiative came from Tekes. The category 'other' in this question includes, e.g., the Ministry of Trade and Industry; a group of companies; the respondent stepped in for another person; at the request of another company.

[2] Respondents were allowed to choose one or multiple alternatives.

Table 8. The initiative for respondents' participation in research projects' steering groups

n = 143	***freq.***	***%***
At the request of researchers	66	46
Own personal initiative	31	22
Initiative of company management	44	31
Tekes' initiative	7	5
Other	8	6

3.4 The role of the respondent (the company) in the research project

Company representatives in research projects' steering groups seem to have other roles in the research project as well, besides being a member of the steering group. The fourth section of the questionnaire investigated this issue. The three alternative roles 'partner' (f=61), 'financer' (f=65) and 'expert' (f=61) all yielded about the same frequency of answers. Only a few see themselves as assistants or subcontractors in the research project. The last category 'other' includes a variety of other roles that companies perceive that they have in a research project. For example, the company may function as the target for the whole research project, as the initiator of it or as an end user of the results of the research project. Other roles that were mentioned were: consultant, researcher and technology commentator.

Table 9. Respondents' role in the project

n = 143	***freq.***	***%***
Partner	61	43
Assistant	5	3
Subcontractor	4	3
Financer	61	43
Expert	65	45
Other	9	6

3.5 The steering group

The first question in this section was designed to investigate two dimensions of the time that participation in the steering group, as well as in the research project,

requires. First, the respondent's allocation of time (in days) both directly for work in the steering group and for other tasks related to functioning in the steering group, e.g., reading project reports, was investigated. Second, the time allocated by the company (in weeks) for a) the project itself, and b) the diffusion and utilisation of results of the research project was investigated. The mean, median and standard deviation were calculated for the responses to these questions.

The calculations show that respondents allocate roughly 5 days per year for participation in the work of the steering group, e.g., taking part in meetings. The same number of days per year is allocated for other tasks related to working in the steering group. The question on the time companies spent participating in the project itself has a mean of 4,6 (weeks/year). Concerning the diffusion and utilisation of the results of the research project, the mean is 1,4 (weeks/year). However, the standard deviations for the means show that there are huge variations in the responses to these questions.

Table 10. Time allocated for different research related tasks

	mean	med	sdev
Steering group participation, e.g., participation in meetings (d/a)	4,7	4	3,1
Other tasks, e.g., reading reports (d/a)	4,9	4	5,2
Company effort in the project itself (w/a)	4,6	1	12,5
Diffusion and utilisation of research results within the company (w/a)	1,4	0,5	3,5

The second question in the section dealt with the number of steering groups of Tekes-funded projects in which the respondent has participated during the five previous years. On average, respondents have participated in 2,5 steering groups during this time.

The third and fourth question in the section dealt with the number of members in the steering group, and the respondents' opinions on the size of the group. On average, steering groups have 8 members. One hundred and seventeen respondents found the size of the steering group adequate. Only 2 respondents considered the size of the steering group as being too small, whereas 12 respondents thought that the size of the group was too large.

The final question in this section of the questionnaire investigated the composition of the steering group. Producers (f=73) and end users (f=74) seem to be the most

frequently represented other parties concerned in steering groups. However, competitors (f=41), subcontractors (f=36) and consultants (f=48) also participate rather frequently in the work of research projects' steering groups.

Table 11. Other parties concerned as members of the steering group

n = 143	***freq.***	***%***
Competitors	41	29
Subcontractors	36	25
Producers	73	51
End users	74	52
Consultants	48	34

3.6 Impact on the project and its progress

This section of the questionnaire covers the respondents' opinions on 1) whether they are willing to influence different aspects of the project, e.g., the application phase, choice of researchers and practical implementation of the project, and 2) whether they (the respondents) are able to influence these aspects. Seven attributes were measured in the question on the dimensions 'willingness to influence' and 'ability to influence'. A scale 1-4 was used, where 1 indicated that the respondent did not want to influence/was not able to influence the aspect at all, and 4 indicated that the respondent wanted to influence the aspect very highly, and that the respondent was able to do so. Some of the respondents did not use the scale (1-4) to indicate their opinions, but instead they marked the specific aspect they found to be important with a cross in the boxes in the questionnaire. This was interpreted in the data analysis phase in the following manner. A cross was coded in the statistical calculations as 3,5 and an empty box as 1,5.

Results show that respondents have the strongest willingness to influence the orientation of the project, the utilisation of the research results and the practical implementation of the project. The ability of the respondents to influence these aspects indicate a similar trend, i.e., there does not seem to be any major discrepancy between the willingness and the ability of the respondents to influence these aspects of the project. The choice of researchers and the constitution of the steering group, i.e., the choice of the members of the steering group, seem to be the least interesting aspects of the research project from the respondents' point of view.

Interestingly, these aspects also seem to be the ones which respondents have the least influence on.

Table 12. Impact on the project and its progress

attribute	***willingness to influence***			***ability to influence***		
	mean	med	sdev	mean	med	sdev
Application phase	2,2	2	1,0	2,3	2	1,0
Start up of research project	2,2	2	1,0	2,3	2	1,0
Orientation of the project	3,1	3	0,9	3,0	3	0,7
Choice of researchers	1,7	1,5	0,8	1,6	1,5	0,7
Constitution of the steering group	1,9	1,5	0,9	1,9	1,5	0,9
Practical implementation of the project	2,8	3	0,9	2,5	2	0,8
Utilisation of the research results	3,0	3	0,9	2,8	3	0,8

An open-ended question concerning the respondents' opinions on the added value that the steering group brings to the research project was connected to this question. Ninety four respondents answered this question, and presented different points of view on this matter.

Three major categories describing the added value of the steering group to the research project were identified. These categories are: 1) directing and controlling the research project, 2) bringing the research project closer to reality, and 3) negative opinions on the added value. Extracts from respondents' answers describing these categories are listed below. Additionally, some quotations, which may be considered to be of specific interest, but which did not quite fall into any of the above listed categories, are presented. In some of the quotations words have been added to the original text in order to make the text more fluent. These additions are marked with []. Also note that the quotations were translated from the original Finnish text into English by the researcher.

1. Directing and controlling the research project

The opinions of 42 respondents may be considered to fall into this category as described by the quotations below. Several respondents phrased their opinions in a very similar manner.

"The task of the steering group should be to control that there is a balance between the goals and the resources, and to follow up how the project proceeds according to its time table (and take measures if necessary). Furthermore, the steering group has to be very rigid in controlling IPR related issues and the commercialisation of the results." (medical industry)

"The steering group delimited "impossible" products from the project (price, size, etc.). The steering group directed the research into the desired direction. [The steering group] controls that important issues are being studied." (stevedoring/shipping)

"The steering group decided on the subject of the research and prepared the research plan. Results were discussed in the steering group and feed-back was given to the researchers." (telecommunications industry)

"Directing the work towards essential issues." (food industry)

"Direction and follow up of the project, control of the research target." (plastic industry)

"Directing [the project] towards the interests of the company." (medical industry)

"The steering group keeps track of the progress of the research and, if necessary, it may direct the research into commercially and scientifically interesting areas." (electronic industry)

"Directing the research project, controlling the implementation of the project, a support group for the project group; FUNDAMENTAL." ([capitals by respondent] machine industry)

"The steering group directs and maintains the work, otherwise the work would often get stuck. L. [the project manager] is such a great researcher that the role of the steering group is very easy." (metal industry)

"The steering group specified [the aim of the research project], expressed its standpoints and made some choices as the project progressed. The commitment of the members was good only concerning a few [members]. The clear visions

of the project manager helped/supported the rest of the steering group." (chemical industry)

2. Bringing the research project closer to reality

Eleven respondents presented views on the added value of the steering group, which may be considered to fall into this category. Examples of these are presented below.

"The steering group brought the views of the area and the end user [to the research project]." (materials industry)

"The contribution of the steering group was the practical experience and opinions (from 10-15 years [of working with related issues]) about the research subject." (banking & financing)

"The steering group directs the project more towards practical implementation, brings the views of the industry [to the project]." (consumer goods)

"Provided the project management with the needs of the reality [practical needs] and challenges, and a more business-like direction of the goals." (paper industry)

"The steering group was able to contribute with knowledge on problems faced by users, and on alternative solutions." (electronic industry)

"People working within the industry bring field information [to the project] (problems, possibilities, need)." (metal industry)

3. Negative opinions on the added value of steering groups

Four respondents presented opinions, which fall into this category. Two of these respondents merely stated that the added value of the steering group to the research project was "minor". The two other respondents phrased their views as shown below.

"The steering group did not bring any notable added value to the research project (the meetings were held seldom, concentrated on reporting the work that had already been done)." (electronics industry)

"The meetings in the steering group were more or less follow-up meetings for the project, to which a company representative did not have much to comment." (machine industry)

A few respondents presented a large variety of factors, which, according to their view, bring added value to the steering group. The following quotations describe the views of these respondents.

"Taking into account company needs, commitment, continuance/perseverance, emphasis on the importance of co-operation, planning of the future/new ideas, increase in knowledge." (metal industry)

"The steering group evaluates the usability and appropriateness of the required results and planned recommendations, and it functions, if necessary, also as a more general discussion forum. The steering group is a kind of "ad hoc task force", which checks, besides the technical and research related issues, also the financial/administrative issues of the project." (energy industry)

"Analysing the results of the research project, and activating the implementation of innovations that have been developed [as a result of the research project]. Co-ordinating and supervising the project. Deepening the co-operation between companies. Questioning and deepening the results/solutions." (electronic industry)

"In the steering group, members from both the industry and universities were very well represented. The differing opinions and background of these members were reasonably well integrated in the research project. The company representatives were very varying, and, as a consequence, the issues/decisions were refined in the course of the project's progression." (metal industry)

"Without the steering group, every project loses its direction, the goals get blurred, the timetables are not kept any more, the costs are exceeded, in other words, there cannot be any successful project without a steering group." (machine industry)

Finally, a few briefly phrased opinions, which do not fall into any of the categories above, are presented below.

> "The members of the steering group represented several different parties concerned, and with this a broad handling and understanding of the issues was guaranteed." (energy industry)

> "Due to the personal relationships between the members of the steering group, the information that was necessary for the project was received easily and fast." (consultant)

> "The contribution by the building companies was that the results [of the research project] were published, which was not the case in the previous project." (chemical industry)

> "Broadens the views of the researchers, and makes the information search easier." (energy industry)

> "A lot of contacts to customers." (assembly industry)

3.7 Co-operation between the members of the steering group

The seventh section of the questionnaire covered the topic of co-operation in the steering group. Three specific questions investigated this issue. First, the characteristics of the co-operation between the members of the steering group and the researchers in the project were investigated as to nine different attributes. These attributes were measured on a scale from 1 to 4, where 1 stands for 'not at all' and 4 stands for 'very well'. Results show that co-operation seems to function quite well in the steering group, with averages mostly amounting to 3. However, the means for attributes 'tension' (mean value=2,0) and 'contradiction' (mean value=1,7) are not extremely low, and, thus, it may be noted that at least in some way these characteristics seem to influence the co-operation between the members of the steering group and the researchers.

Table 13. Characteristics of the co-operation in the steering group

attribute	mean	med	sdev
Openness	3,4	3	0,6
Smoothness	3,1	3	0,6
Tension	2,0	2	0,9
Trust	3,3	3	0,6
Contradiction	1,7	2	0,8
"Fair play"	3,3	3	0,8
Professionalism	3,1	3	0,7
Trouble-free	2,8	3	0,7
Creativity	2,7	3	0,7

The subsequent question in this section dealt with possible problems in the research project. Again, the attributes were measured on a scale 1-4, where 1 stands for 'no problems at all' and 4 stands for 'very many problems'. The calculated averages indicate that the most problematic issues in the research project have concerned the general ability to follow the pre-stated timetable for the research project, and differences in the goals of the companies and the researchers, in other words, differing views concerning important issues in the project. Respondents' own commitment to the project has also yielded a mean value above 2,0. The question of ownership of and sharing the obtained research results has been the least problematic issue in the projects.

Table 14. Problems in the project

attribute	mean	med	sdev
Ownership and sharing of the research results with the researchers	1,4	1	0,7
Reliability of the researchers in performing tasks of the research project	1,6	1	0,7
Commitment of the researchers to the project	1,8	2	0,9
Respondent's own commitment to the project	2,1	2	0,8
Differences in the ways of working and communicating	1,9	2	0,7
Ability to follow and keep the time table	2,3	2	0,8
Differences in the goals of the companies and the researchers	2,2	2	0,8

At the end of the list of attributes shown in Table 14 respondents were given the possibility to choose the alternative 'other'. Fourteen respondents answered this part of the question. Three major groups of problems were identified in the answers. The following quotations describe typical examples of problems occurring in each of these three groups. Again, in some of the quotations some words have been added to the original text, in order to make the text more fluent (marked within []).

1. *Differences between the goals set for the project by the researcher/research group and the company*

   "The goal of the company was to have access to prototype testing in a production environment. The goal of the researcher: to find an alternative method when the original method apparently did not work." (plastic industry)

   "The goals were in the beginning identical, but they changed during the research project. It is impossible for the steering group to control these kinds of changes, because it meets seldom and it functions outside the university." (telecommunications industry)

2. *Ability to follow and keep the time table*

   "It is difficult for the researchers to share responsibility. [This has led] to work overload and delays in certain parts of the project." (consultant)

"Because the project has not yet ended, I cannot say anything definitive about keeping the time table." (energy industry)

3. Problems in several aspects of the project

"[Because of] difficulties in the beginning [with] the goals of the project, the kick-off/time table was too tight. [This led to] clarification of the research project [which led to] a very broad research idea. The broad and difficult issue [resulted in] a vague end result." (multi-industry)

"The motivation was sometimes lost, the activities slow, the diffusion of information was weak (secretive), the project was too much steered into basic research, however, the results were partly useful." (machine industry)

"Communicating was complex due to the very difficult English language used by the researcher. The performed measurements have been poorly prepared and they have taken an unreasonable amount of time." (machine industry)

"A clear understanding of the financer's commercial realities would help the researcher in his job. Research competes, in reality, with the other financial investments of the company." (chemical industry)

A separate question also measured the characteristics of the co-operation between the different company members of the steering group. No specific attributes were measured, but instead respondents reported an overall judgement of the co-operation on a scale 1-4, where 1 stands for 'very bad co-operation' and 4 stands for 'very good co-operation'. The results show that respondents find that the co-operation between company members of steering groups functions very well. The calculated average amounts to 3,3 with a standard deviation of 0,7.

3.8 Expectations and goals

This section of the questionnaire investigated the expectations and goals of the respondents for participating in the work of steering groups. Two main questions covered this topic.

First, the respondent was asked to evaluate his/her expectations for the research project on six specific attributes along a continuum with opposite end-statements. The attributes and the construction of the continuums are depicted below in Table 15. The weight of the end-statements of the continuum was measured on a scale 1-

4, where 1 refers to the end-statement on the left hand and 4 to the end-statement on the right hand of the continuum. Numbers 2 and 3 indicate that the respondent views the attribute in question as something between the end-statements.

Table 15. Measures of respondents' expectations for the research project

Attribute	**Continuum (1-4)**
Results of the project	scientific - industrially exploitable
Starting-point of the project	researcher driven - company driven
Implementation of the project	researcher based - company based
Degree of publicity of the results	public - confidential
Exploitability of the results	wide focus, general - narrow focus, significant
Tekes' role in the project	strongly influential - weakly influential

Results show that, in general, respondents' expectations for applied technical research projects may not be placed on either ends of a continuum with specific attributes describing the characteristics of the project. Respondents seem to expect that research projects have ingredients from both ends of the suggested continuums.

Concerning the type of research results, respondents seem to expect that results of the projects will be more usable within the industry in question, rather than only being scientifically significant. When planning a research project, the starting point is expected to be influenced both by researcher and company driven interests. Respondents expected that the actual implementation of the research project would be slightly more researcher driven than company driven. Concerning the degree of publicity of the research results, results indicate that respondents expect an equal amount of publicity and confidentiality. A similar view on the exploitability of the research results may be detected in respondents' answers to this question. In other words, respondents seem to expect neither widely usable general results, nor narrowly focused significantly important results from the research projects, but rather results falling somewhere in-between these two. The final attribute dealt with Tekes' role in the project. According to the results, respondents seem to expect that Tekes will not have any considerably strong or influential role in the research project.

Table 16. Respondents' expectations for applied technical non-tied goal-directed research projects

attribute	***continuum***	mean	med	sdev
Results	scientific (1) - industrial (4)	3,0	3	0,9
Starting-point	researcher (1) - company (4)	2,8	3	0,8
Implementation	researcher (1) - company (4)	2,3	2	0,8
Degree of publicity	public (1) - confidential (4)	2,5	3	1,0
Exploitability	wide (1) - narrow (4)	2,6	3	0,9
Tekes' role	strong (1) - weak (4)	3,0	3	0,9

In the subsequent question respondents were first asked to evaluate the importance of fifteen attributes describing goals suggesting why the company participates/participated in the research project (the steering group). Second, respondents were asked to evaluate to what extent these goals had been fulfilled at the point of responding to the questionnaire. Finally, respondents were asked to evaluate to what extent these goals may be fulfilled in the future. Respondents indicated their evaluations on a scale 1-4. Similar to the question on respondents' willingness and ability to influence certain aspects of a research project (section 3.6 in the questionnaire), some respondents did not indicate their opinions by using the pre-stated scale. Instead they used crosses to indicate the importance of the listed attributes. These answers were coded as in section 3.6, in other words, a cross was coded as 3,5 and an empty box was coded as 1,5.

Table 17. Goals, outcomes and expectations for participating in research projects

attribute (goals for participating in the research project)	***importance of goal***			***fulfilment of goal***			***expected fulfilment of goal***		
	mean	med	sdev	mean	med	sdev	mean	med	sdev
Increase of knowledge	3,2	3	0,7	2,6	3	0,7	2,8	3	0,9
Maintenance of expertise in a research area	2,9	3	0,9	2,6	3	0,8	2,6	3	0,9
Understanding a phenomenon	3,0	3	0,9	2,7	3	0,8	2,6	3	1,0
Problem solving	3,0	3	1,0	2,2	2	0,8	2,5	3	1,0
Monitoring the scientific and technological development in own area	3,0	3	0,9	2,7	3	0,8	2,6	3	1,0
Development of the quality of existing products	2,8	3	1,0	2,1	2	0,9	2,4	2	1,0
Expansion of product line	2,2	2	1,1	1,8	2	0,9	2,1	2	1,1
New product	2,2	2	1,2	1,8	2	0,8	2,1	2	1,1
Increased productivity	2,4	2	1,1	1,8	2	0,9	2,2	2	1,0
Development of new or essentially improved production methods	2,4	3	1,2	1,8	2	0,9	2,2	2	1,0
Development of a new technology	2,6	3	1,1	2,0	2	0,9	2,4	2	1,1
Start-up of new business operations	1,7	1	1,0	1,6	1	0,9	1,9	1	1,1
Creation of new co-operation contacts	2,6	3	1,0	2,3	2	1,0	2,4	2	1,0
Co-operation with universities and research institutes	2,9	3	0,9	2,7	3	0,9	2,6	3	1,0
Co-operation with other companies	2,6	3	1,0	2,2	2	0,9	2,5	3	1,0

Results indicate that an increase of knowledge is considered to be the most important goal for participating in the research project (in the work of the steering group). Other important goals for participation are the understanding of a phenomenon, problem solving and monitoring the scientific and technological development in their own area. These attributes all yielded a mean value of 3,0 or above. Concerning the fulfilment of these goals, respondents' evaluations varied.

However, when looking at the calculated means for the attributes, none of these goals were considered to have been totally fulfilled (means ranging from 2,2 to 2,7 and medians varying between 2 and 3). Concerning respondents' expectations for possible future fulfilment of these goals, a somewhat positive trend may be detected. In other words, respondents expect that even if the goals have not been fulfilled at the time of answering the questionnaire, they have a slight hope that the goals will be fulfilled in the future. However, interestingly, mean values for these attributes, as well as for the other attributes listed, do not show that great a difference between evaluations of already fulfilled goals and expectations of fulfilment of the goals.

The least important goal for participating in the project is the start-up of new business operations (mean 1,7 and median 1). Nor, do the expansion of an existing product line (mean 2,2 and median 2) or the development of a new product (mean 2,2 and median 2) seem to be particularly important goals for the respondents.

3.9 The usefulness of participating in the work of the steering group

Two questions covered this topic in the questionnaire. The first question investigated the respondents' opinions of the usefulness of participating in the work of the research project's steering group on a yes/no scale. Results show that the majority of the respondents (109 respondents) find it useful to take part in a steering group and its work. According to 30 respondents both positive and negative aspects can be found in participating in the activities of steering groups. None of the respondents thought that there was no use whatsoever in participating in steering groups.

An additional open-ended question was connected with this question as well. Respondents were asked to further describe their opinions on the usefulness of steering group participation. The following statements have been extracted from the written opinions provided by 88 respondents. In general, it can be observed that the answers to this question were similar to the opinions expressed in the question on the added value that the steering group brings to the research project presented in section 3.6 above. The opinions stated by the respondents may be categorised into three main groups. These are: 1) co-operation, contacts and diffusion of information, 2) directing and controlling the work in the research project, and 3) problematic issues with working in the steering group.

1. Co-operation, contacts and diffusion of information

Twenty six respondents presented opinions which may be categorised in this group.

> "An opportunity for co-operation, networking, adopting new information." (machine industry)
>
> "Direct contacts [between] the research organisation and companies (even competitors)." (metal industry)
>
> "During the process you get personal contacts to the project and its progress, as well as to the researchers. Furthermore, you get valuable information about the other companies, which are involved in the project." (engineering works)
>
> "It is possible to acquire the newest information in the field about issues, which would not yet be possible to publish in scientific journals." (telecommunications industry)
>
> "In practice, it is the only way to get information and it is also a reasonably good way to get your opinions out in public." (energy industry)
>
> "The co-operation with different parties is easier this way." (energy industry)
>
> "Direct contact to the researchers, discussion about the results, opportunity to influence, increase of own knowledge." (energy industry)
>
> "The project needs a competent steering group for support. From the point of view of the members of the steering group, information is available for other parties concerned." (laboratory industry)
>
> "You get more in-depth information also about problems and goals of other companies." (metal industry)

2. Directing and controlling the work in the research project

Twenty two respondents presented opinions on the usefulness/non-usefulness of working in the steering group, which may be categorised in this group. It should be

noted that these opinions are very similar to those opinions stated in section 3.6, regarding the added value of the steering group to the research project. Therefore, only a few quotations are presented in this connection.

> "The steering group keeps track of the progress of the research and steers the researchers into doing the right [and] essential things, and it keeps an eye on the financial aspects." (stevedoring/shipping)

> "The steering group is in this kind of research projects a fundamental directing body, a link between the real working life and the research institute." (energy industry)

> "With the support provided by the financer (Tekes), the steering group is able to direct the activities into a favourable direction from the companies' point of view." (medical industry)

> "The follow-up of the project is more active, which is a benefit to the company; the opportunity to direct the project." (metal industry)

> "The steering group is able to end pointless projects and/or intervene in the choice of researchers during the project." (mining industry)

3. Problematic issues with working in the steering group

Seven respondents stated that there are problemtic issues connected with the work in the steering group.

> "There is no use to decide on the directions [of the project] in project meetings where there are a lot of young researchers/students." (electronic industry)

> "Working in the steering group is useful concerning the follow-up and direction of projects. However, researchers do not (dare to) present problems with the project to the steering group. [As a consequence of this] all the needed information is not available to the steering group." (telecommunications industry)

> "[It would be useful] if all the members at least once would be present at the same time. Especially the absence of Tekes' representative made the functioning difficult." (machine industry)

"In general, a very few companies have participated in the work of the steering group. Due to this the work has been somewhat 'half-way'." (ceramics industry)

"It felt pointless to travel hundreds of kilometers to a meeting, where one's own participation was delimited to drinking coffee." (machine industry)

"The contact to the research group was very shallow." (electrical and optical equipment industry)

One respondent presented a very broad view on the usefulness on working in the steering group. According to this respondent "Participating in the steering group makes it possible to observe the progress of the companies taking part in the research project, and an overall review of the innovations. [The steering group is] a forum for co-operation between representatives of participating companies. [The steering group enables] participation in generally directing the project, as well as giving a possibility to influence the diffusion of the research results." (electronic industry)

3.10 Previous and future research co-operation

One part of the questionnaire dealt with the previous and possible future research co-operation between the company (represented by the respondent) and the researcher/the research group. Furthermore, the type of co-operation was investigated by a multiple-choice question.

In 95 cases there had been previous research co-operation between the company and the research group, whereas in 44 cases the focal project was the first time the company and the researchers had used research co-operation. Regarding future research co-operation, 92 respondents stated that future co-operation was possible. According to 21 respondents, joint research projects were not currently planned for the future.

Table 18. Type of research co-operation; previous and future

n = 143	***previous***		***future***	
	freq.	%	freq.	%
Publicly funded research project, in which the company is a member of the steering group	52	36	38	27
Publicly funded research project, in which the company participates as a financer	40	28	38	27
Publicly funded research project, in which the company performs research tasks together with a research group	23	16	27	19
Company funded research assignment to a group of researchers	29	20	26	18
No concrete research project, but knowledge exchange on a general level	16	11	31	22
Other	5	3	6	4

Two types of research co-operation between companies and research groups were most often employed. These were 1) research projects funded through public sources, in which the company participates as a member of the steering group, and 2) research projects funded through public sources, in which the company participates as a financer. These two types of projects are the most common in companies' possible future co-operation with research groups as well. However, future co-operation was also characterised by not involving any concrete research project, but instead knowledge exchange between the parties on a general level. In the category 'other', the following types of co-operation were mentioned: other types of research projects[3], measuring services for machine tools, jointly funded smaller projects, customer relationship and national groups for co-operation.

3.11 TEKES

This section of the questionnaire dealt with respondents' opinions about Tekes' activities and about different services provided by Tekes in their financing activities for applied technical research. Additionally, this section investigated respondents' opinions about the allocation of Tekes' grants for goal-directed

[3] No further explanation of the characteristics of the projects was given.

research, as well as respondents' opinions regarding the share with which industry, in general, should participate in the financing of different types of research.

Results show that, in general, Tekes' activities and services are evaluated as being of a quite acceptable standard[4]. The mean values range between 2,5 and 2,9 and the median for each attribute is 3. Respondents seem to give the highest value to Tekes' flexibility concerning the activities, as well as to the existing guarantees for continuity.

Table 19. Evaluation of Tekes' activities and services

attribute	mean	med	sdev
Information	2,6	3	1,1
Follow-up of research projects	2,5	3	1,0
Flexibility of activities	2,9	3	1,0
Offering contact networks	2,5	3	1,2
Technological expertise	2,6	3	1,1
Guarantee for continuity	2,9	3	1,0
Period of application	2,5	3	1,2
Application process for funding	2,5	3	1,2
Advice	2,5	3	1,3

A question on the allocation of Tekes' funds for goal-directed research was included in this section of the questionnaire. The respondents were asked to indicate their opinions of how the Tekes' funding should be allocated (in %) to five different types of research.

The values calculated for this question are mean, mode and standard deviation. Of the total amount of Tekes' funding (100%), respondents think that on average 14% (mode 10[%]) should be allocated to basic research. Applied research should receive an average of 29% of the total funding (mode 30[%]), whereas research on technological break-throughs in new areas should be given on average 21% of the funding (mode 20 [%]). The allocation of funding to industrial high risk research

[4] Respondents evaluated the attributes on a scale 1-4.

amounts to 18% (mode 20 [%]) of the total funding, whereas the development of research based innovations should on average get only 7% of the funding (mode 10 [%]. The standard deviations for this question are extremely large, indicating that there is a considerable variation in the respondents' answers. The mode may be a more interesting calculation for this question giving a better insight in the respondents' opinions.

Table 20. Allocation of Tekes' funding for goal-directed research

Types of research (%), n=143	mean	mode	sdev
Basic research (strengthening of the research knowledge)	14	10	9,8
Applied research (applying technology in industry)	29	30	12,5
Technological break-throughs in new areas	21	20	10,1
Industrial high risk research	18	20	10,6
Development of research based innovations	7	10	9,7

This question included also a category 'other', where respondents were given the opportunity to give their own alternatives for the allocation of Tekes' funding. The following suggestions were made. Each suggestion was made by only one respondent and the %-values within the parenthesis show how much of Tekes' funding, the respondent in question thinks that should be allocated to the focal type of research.

- market research (10%)
- product research (20%)
- production aid to design products (10%)
- commercialisation (10%)
- strengthening of national know-how (25%)
- supporting of the development of innovations generated by practical experience (10%)

A question concerning the amount of financing which industry should contribute to funding of different types of research in Finland was also included in this section of the questionnaire. The following results were obtained from the analyses of the respondents' answers.

Table 21. Share of industry participation in the financing of research projects

Types of research (%), n=143	mean	mode	sdev
Basic research, industry share	13	10	14,9
Applied research, industry share	40	30	18,5
Technological break-throughs in new areas, industry share	28	30	16,3
Industrial high risk research, industry share	33	30	20,7
Development of research based innovations, industry share	29	30	19,4

On average, respondents were of the opinion that industry should participate with the largest amount of financing in applied research, whereas basic research was considered not to belong that clearly to the financing responsibilities of companies. The mean value for the other categories ranged to about 30. This means that the share with which industry should participate in this kind of research amounts to 30% of the total funding directed to these types of research projects. In this question, the category 'other' included the following suggestions:

- research concentrating on the focal area of the company and its industry (30%)
- support the development of innovations generated by practical experience (5%)
- market research (50%)

It has to be noted that also in this question, the standard deviations show that the opinions among the respondents vary to a very large extent. Therefore, it is difficult to present any clear categorisations of the views presented by the respondents.

3.12 Familiarity of the R&D-funding possibilities for companies

The final section of the questionnaire investigated the level of familiarity of different existing R&D-funding possibilities for companies. Table 22 depicts the different funding categories, which were included in the questionnaire, as well as the frequency according to which companies use these funding possibilities in their R&D-work.

Table 22. Examples of R&D-funding possibilities and companies' utilisation of them

n = 143	freq.	%[5]
Funding provided by Tekes		
1. industrial R&D-loans for companies	39	27
2. industrial R&D-grants for companies	87	61
3. capital loans for R&D for companies	13	9
Funding provided by Sitra		
1. funding directed to technology companies	10	7
2. regional funds	3	2
EU research programs	41	27
Other	15	11

The industrial R&D grants are the most common source of funding provided by Tekes which companies use when financing their R&D-activities. Sixty one per cent of the respondents reported that their company had used this type of funding. The funding provided by Sitra had been utilised by only 13 companies taking part in the survey. Forty one companies had utilised the possibility of financing their R&D-activities by taking part in some of the research programs provided by the EU. The category 'other' included the following factors:

- own financing
- grants provided by the Ministry of Trade and Industry
- The Finnish Work Environment Fund
- risk financing (risk investment)
- Finnvera[6]
- investments by insurance companies

[5] Note that the respondent was allowed to choose between several alternatives.

[6] Finnvera was formed in the beginning of 1999, when the activities of KERA and the Finnish Guarantee Board were mergered. One respondent mentioned KERA as a financing source for their R&D-activities.

The final question in the questionnaire dealt with respondents' satisfaction with the existing possibilities for financing company R&D-activities. The mean value for respondents' judgements is 2,4. This would indicate that their satisfaction is on a medium level. This is supported by the median, which is 3. An open-ended question was posed in this connection, in order to further elaborate respondents' judgements on the single-item scale. The open-ended question was phrased in the following manner:

> If you are not satisfied with the existing financing possibilities, describe (with your own words) the reason for your dissatisfaction.

Respondents stated the following opinions.

> "We are a small firm owned by an international concern. We have not received financial support. The competitive situation becomes DISTORTED when domestic firms of the same size receive support and financing, even unprofitable companies receive these." (plastic industry [underlining and capital letters by the respondent])

> "The funding provided by the Employment and Economic Development Centres are always finished when we ask for them, somewhat reluctant attitude." (machine industry)

> "The application procedure is complicated." (energy industry)

> "Usually SMEs do not know where to get [funding] and the application process is complicated." (chemical industry)

> "Applying for EU-funding is troublesome and obviously an expensive process. The power is concentrated to a few decision-makers that cannot be experts on the whole, very wide, range of research areas. The applications are, therefore, neither unambiguous nor exact. Apparently this leads to several fruitless research projects as well." (energy industry)

> "Financing possibilities for SMEs are provided by the Employment and Economic Development Centres, TEKES, Sitra etc. SMEs have minimal resources because they have to decide whether to apply for funding or to do real business. The customer is usually closer than the bureaucracy (in other words the funding from the above mentioned organisations)." (process industry)

"VTT functions today as a consultant in many areas. Aims at and has aimed at preventing similar private consultants from participating in public research programs! Tekes has not taken measures against this, but instead VTT has been given the opportunity to conduct fruitless research of issues we already know about. In the future, Tekes has to control VTT's aspirations to acquire monopoly status." (consultant)

"Tekes' share could be higher in high risk projects." (chemical industry)

These quotations show that respondents find the application processes complicated, and the principles for funding are also regarded as somewhat unfair. Furthermore, there seems to be a queston of a trade-off between either applying for external funding for doing R&D in the company or doing "real" business. In other words, the resources are limited, especially in smaller companies, for employing both types of activities in the companies.

4 Conclusions

This report documents the third and final phase of the APPLY-project conducted at the VTT Group for Technology Studies. The planning and implementation of the final phase of the project was carried out during 1999. The focus of the project was to study the experiences and opinions of company representatives taking part in the work of steering groups of non-tied goal-directed technical research projects, which were carried out at universities and research institutes during 1998, and financed by Tekes' grants for applied technical research.

4.1 Key results of the study

One of the primary aims of the study was to investigate the expectations and goals of company representatives for participating in the work of the steering groups. Thus, no direct question was posed concerning the company representatives' opinions on the impact of the type of funding on the success vs. lack of success of the research project. Instead, it was considered important to gather information on what expectations companies have when participating in the steering group as well as what their goals are, i.e., what do companies want to achieve, by allocating time for steering group participation.

The results of the study indicate that companies have rather broad goals for participating in the work of steering groups.

Table 23 below depicts the five most and least important goals of the companies. Companies do not seem to have actual commercialisable products or startups of new businesses as goals when they get involved in a research project, but instead they strive at increasing the general level of knowledge and getting information about the current developments in their area. Companies seem to consider that working in the steering group gives them access to vitally important information on the latest break-troughs and developments in the area of their interest. Co-operation with universities and research institutes is also considered to be an important goal for companies.

Table 23. Company goals for steering group participation (most and least important goals)

Most important goals	Least important goals
increase in knowledge	starting a new business
understanding a phenomenon	expanding an existing product line.
solving an problem	developing a new product
monitoring the scientific and technological developments	development of new/essentially improved production methods
co-operation with universities/res.institutes	increased productivity

Concerning the actual research projects and their end-results, and what companies expect of these, the following main results were obtained in the study. In contrast to how companies define their goals for participating in the work of the steering groups, companies expect that the results of the applied technical research projects should be to a greater extent industrially exploitable, than merely scientifically valuable and significant. In other words, companies expect concrete end-results of the projects, which they may exploit and use in their business activities. When planning the research project, companies expect that both researchers and company representatives have an equal role, whereas the actual implementation of the research project is expected to be more a responsibility of the researchers. Companies do not seem to expect that Tekes, although being the funder of the project, would have any particularly active role in the project at any stage.

An interesting result of the study was that companies obviously have other roles in an applied technical research project besides being a member of the steering group. Forty five per cent of the responding companies take an active part in the actual research project as experts, and 43 % act as equal partners in the project. Forty three per cent of the respondents also reported that the company acts as a co-funder of the research project. Thus, it is obvious that companies do have their own, often very strong, interests in the research project, and they are, consequently, very involved in assuring the success of the projects. From the universities' and research institutes' point of view this attitude among companies gives valuable support also for future research projects, as these institutions are more and more dependent on external financing. The future research co-operation between the parties

investigated in the present study seems to be on a solid ground as 92 of the respondents (64 %) indicated that future co-operation is possible and very likely to be implemented.

Company representatives agree on the importance of taking part in the work of steering groups. One hundred and nine respondents (76 %) find this work useful whereas none of the respondents think that there is no use whatsoever in participating in steering groups. This high level of perceived usefulness may be related to the fact that respondents find that they are able to influence different aspects of the steering group. For example, companies are able to influence the orientation of the research project, the utilisation of the research results and the practical implementation of the project. An important added value of the steering group was, in fact, the possibility of bringing the research project closer to reality, in other words, to the real problems and challenges faced by the company. Respondents' answers to an open question yielded the following categories on the usefulness of steering group participation: 1) co-operation, contacts and diffusion of information, and 2) directing and controlling the work in the steering group. A third category labelled 'problematic issues with working in the steering group' was also identified. However, in general, the co-operation between the company representatives and the researchers seems to function very well. Nevertheless, some sort of tension and contradiction may be detected, e.g., concerning the diverging goals of the researchers and the company representatives. Problems with keeping time-tables were also mentioned by the respondents.

Concerning company representatives' opinions on the services and functions of Tekes, the results show that companies seem to value Tekes very highly. Especially, Tekes' flexibility and the guarantees given for continuing support are regarded as Tekes' strengths. Regarding the allocation of Tekes' funding, companies agree that the largest part of Tekes' funding resources should be directed to applied research and to risk funding. Respondents seem to be very well aware of the various R&D-funding instruments in Finland, and the funding instruments provided by Tekes were the most frequently used financing resources utilised by companies.

It may be stated that the steering group has a very important role in the complete research process. This statement may be illustrated by a quotation of one of the survey respondents who stated that "The representatives of the industry may, on their behalf, direct the progress of the research project in order to possibly link it to subsequent product development projects. [This leads to] better and closer contact

between applied technical research projects and [concrete] product development." The respondent illustrated his thoughts as shown in Figure 4.

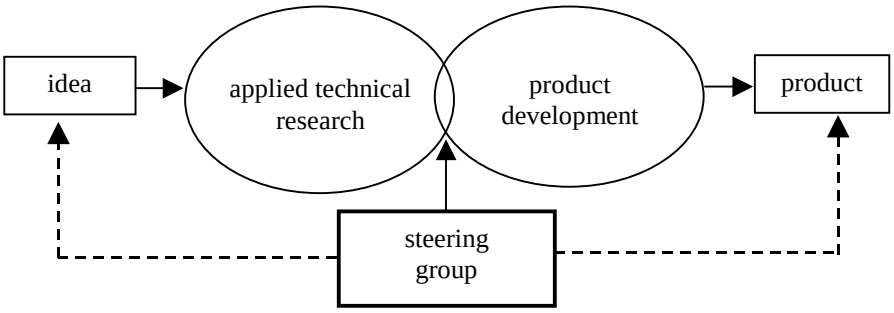

Figure 4. The role of the steering group in the research process

Thus, the steering group may function as an important contact link between the applied technical research project and the subsequent process of product development. As can be noted in respondents' statements of the function of the steering group, which have been presented in this report, the steering group may influence the generation and development of the research idea, as well as it may have an effect on the end-result of the total research process, i.e., the concrete product. These levels of influence are indicated in Figure 4 by the dotted arrows.

Finally, this study has revealed that the grants for applied technical research awarded to non-tied goal-directed projects are important financing resources, not only for the universities and research institutes, who are the actual receivers of the grants, but also for companies, who can take part in the research project at different levels. Companies are interested in participating in these projects, both at the steering group level and in the actual project as experts, partners and co-funders of the project. Companies find this type of research co-operation important for their own activities, in respect of increase in knowledge, acquisition of important information about developments in their focal area of interest, and development of contacts with researchers, customers and competitors.

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Appendix 1: Summary of the Apply-project (phase one and two, 1997-1998)

This section presents a brief summary of the first two phases of the Apply-project. It is attached to this report, which documents the third phase of the project, i.e., the company survey, in order to provide an overview of the complete project.

Background of the Apply-project

The Tekes R&D-funding may be divided into three main categories: 1) grants for companies, 2) loans for companies, and 3) grants for applied technical research carried out at research institutes and universities. These grants for applied technical research may, in turn, be divided into two groups of grants: technology programs and non-tied goal-directed research projects. Tekes' technology programs are evaluated on a continuous basis. The non-tied goal-directed research projects have not been evaluated, and therefore the Apply-project was planned. The project started in 1997. The project has been carried out by the VTT Group for Technology Studies. The aim of the Apply-project was to evaluate the success as well as the impact of non-tied goal-directed research projects.

The Apply-project was planned as a three-phase study[7]. In the first phase, the focus was on investigating non-tied goal-oriented research projects that were completed during the years 1992-1995, from the point of view of the Tekes personnel responsible for making funding decisions for the projects. One hundred and forty two research projects were investigated in the study (the total number of projects was 620), and the data were collected by interviewing 18 Tekes representatives. Thirty two interviews were done, in other words, with a few exceptions, each person was interviewed twice during the course of the study. The Tekes representatives chose the projects which were studied. The choice was made according to the level of successfulness of the project. The study was carried out by Ms. Eija Ahola in 1997.

[7] Due to the turnover of the personnel at the VTT Group for Technology Studies, three separate researchers have taken part in the implementation of the research project. Each researcher has carried out her own separate part of the complete project.

The second phase of the Apply-project focused on studying non-tied goal-directed research projects that were completed during years 1993-1995. Seventy five research projects were considered in the study. These projects were extracted from a sample of 134 goal-directed research projects. The researchers' opinions regarding the success of the projects were the focus of the interviews. The empirical data were collected by interviewing 70 researchers at universities, polytechnics and research institutes. The study was carried out by Ms. Minna Tuppurainen in 1998.

The third and final phase of the Apply-project was carried out during 1999. The study focused on investigating the opinions (including expectations, goals and general experiences) of company representatives taking part in the steering group work of non-tied goal-directed research projects funded by Tekes during 1998. The data for the study were collected through a postal survey. The survey was sent to 266 company representatives, who participated in steering groups of 83 non-tied goal-directed research projects. The survey yielded a response rate of 54% (n=143). The study was carried out by Ms. Maria Bergenwall.

Key results of the first two phases of the Apply-project

The success and the impact of non-tied goal-directed research projects

The Tekes personnel evaluated the importance of the research projects in the interviews. Their opinions were categorised in the following way:

a) Very important projects, in which the aim is to develop entirely new production processes. These new production processes, in turn, may have an extensive impact on different aspects of Finnish industry, e.g., by revolutionising current technologies, increasing the competitive strengths of central industries or by acquiring essential new technologies and technological know-how for Finland.

b) Important projects, which may be expected to result in new products or even new business activities, improved production processes, the implementation of a new technology in Finland, new collaborative research groups, and the joining of new company consortia in the steering groups of research projects.

c) Fairly important projects, e.g., projects in which company consortia improve products by joint efforts, or projects which aim at solving an industry-related

problem. Completely new technologies or completely new research themes are, however, not within the scope of these projects (trial and demo projects).

d) Other projects, in which the aim is to conduct a follow-up of the development of a technology, without any direct aims of utilising the technology.

The majority of the research projects investigated in this study were classified as either important or fairly important. The most distinct profile was, however, possible to create for the very important projects (14 projects were classifed as very important). These projects are characterised by the following features:

- Six projects were connected with technology programs, and three projects had preceded technology programs
- Funding was awarded according to Tekes' opinion of the project and its results, in other words, Tekes expected that 1) the project should be an important future technology, 2) the technology should be a true novelty, and 3) the project should have a notable potential for commercialisation. The participation and commitment of companies was not considered to be an essential criterion for awarding the funding.
- The aim of the project was defined as "producing an innovation" in ten of the projects that were categorised as very important. Steering groups consisted mostly of producers; in some cases end-users also participated in the work of steering groups.
- The added value that Tekes has brought to the project is connected with the active start-up and direction of the research project. Nearly all projects that have been launched by Tekes may be categorised as very important projects.
- The results of all of the very important projects have been further utilised.

Researchers at universities, polytechnics and research institutes were asked to evaluate the success of the research projects. In order for a project to meet the requirements of a successful project, it should transfer and develop new technology for industrial use, serve the needs of companies, support the application of new technologies, and recognise possible new forms of technology-related business as well as new forms of international co-operation. According to the researchers, 49 of the 75 projects may be classifed as successful, whereas 26 projects were classified as not being very successful. The successful projects had resulted in: six new

companies, 19 new products and eight new technologies. Products and methods had been developed in 15 projects and 27 projects led to results which may be characterised as useful for technology on a general level. Fourteen projects produced academically important results, according to the researchers.

Other areas of interest in the two studies

Opinions of Tekes' personnel (focal topics of the interviews)

1) Grounds for awarding funding

The most important grounds for awarding funding are, according to Tekes' personnel, the background and aim of the research project, the level of technology, the usability of the results, the resources for the implementation of the project, and the resulting pattern of co-operation. Furthermore, it is of importance to predict what kind of consequences the funding decision may have. Below, the most important actual grounds for funding decisions are listed:

- the level of company participation in and commitment to the research projects
- the research project is considered to cover an important future area, from Tekes' point of view
- large potential for commercialisation of the research results
- the research project creates and strengthens the strategic know-how of the research group
- the maintenance of research in the area and within the group
- a new research and technology area
- a new research group (for Tekes)
- a new type of co-operation between researchers or with industry
- "lookahead" (the novelty of technology and research)
- "see it through" (the researchers know that the funding will not be continued)

2) Classification of the projects according to their contents

The non-tied goal-oriented research projects vary according to their nature, and their goals and tasks are often defined in a very technical manner. Nevertheless, an effort was made to classify the projects according to their possible impact. The following categories were defined:

- Technology transfer: projects in which a piece of equipment or a method is acquired in order to test and investigate its applicability from the point of view of products and methods used in Finland, or projects in which a technology, which has been developed within another area, is utilised in a completely new area.
- The utlisation and application of information technology in the activities of companies other than IT-companies (e.g. tailored software)
- The solving of companies' problems: projects which have aimed at explaining e.g. problems with certain products or at improving some features of products (there is typically a continuous and long-term co-operation between companies and researchers in these kind of projects).
- The development of innovations: long-term projects that result in the development of completely new products and processes.
- The development of measuring equipment (a very small number of the projects).

3) The nature of the research

The majority of the projects were characterised as applied research projects (61 projects). The second most common type of projects include those that were characterised by strong features of product development (49 projects). Thirty two research projects were characterised as being of a basic nature.

4) The participation of companies in the research project and the structure of the steering group

The most usual way in which companies participate in a research project is to take part from the very beginning of the project. (115 projects). In 13 projects, companies joined the project during the course of the actual research. Only four projects were characterised by the fact that companies did not join the project until

the commercialisation phase. Ten projects did not involve companies in any phase of the research process. The structure of the steering groups was described in the following way: 1) producers, 2) end-users, 3) groups of producers-users-researchers, and 4) other, e.g., researchers. Usually, the company members in steering groups represented end-users (in 52 projects). In ten projects, the steering group consisted of only researchers. In general, 3-5 companies were involved in the research projects.

5) The utilisation and adoption of the research results

Research results have usually been adopted in companies without any further refinements of the results (47 projects). The second most common opinion on the utilisation of the research results was that it cannot yet be stated whether the results will be utilised or not. This depends on the long-term nature of the goal-oriented research projects (34 projects). A few of the projects led to a further development of a more general research result in a subsequent step of the research process, when a company is also more involved in the process. These further development efforts are implemented either with Tekes funding or by other types of funding (15 projects). Fourteen research projects had resulted in a new company or business at the time of interviewing. Twenty eight projects had, however, ended with results that were not utilised in any way.

6) The added value brought to the research project by Tekes

The added value that Tekes brought to the project was difficult to explain and make concrete, according to Tekes' personnel. However, the Tekes representatives thought that most of the projects would not have been carried out without the funding for goal-oriented research projects. Therefore, the funding itself is seen as an important aspect of Tekes' added value. Concerning the majority of the projects, the Tekes representatives had felt that they did not want to interfere with the details of the research project (75 projects). In 23 projects Tekes had had a guiding role, e.g., in the recruitment of industry partners. Tekes also functioned actively as a partner directing the research project, as well as a negotiator between companies and researchers when diverging opinions existed between the parties in the project. In only six projects, Tekes had taken the initiative for the actual research and also for the collaboration.

Opinions of researchers (focal topics of the interviews)

1) The starting points of the research projects

The idea of launching a research project is, according to the researchers, usually generated among the researchers themselves based on earlier research conducted by the research group. Research ideas also have their basis in the co-operation between researchers and companies. Research ideas are less often solely based on industry initiatives. Tekes had been the initiator of the research idea in only a couple of research projects. A general conclusion was that the more strongly the industry is involved in the research project from its very beginning (from the generation of the research idea), the more likely it is that the project will be successful.

2) The role of companies in a research project

Researchers were asked about their opinions on the role of companies as funders of the research project. If a company participates in a project as a funder, it is more likely that the project will be successful and lead to results. A prerequisite for this is often that the researchers have to "sell" their research idea to the companies, but according to the interviewed researchers this is something quite common in the scientific community nowadays. In general, researchers feel that company participation in the project is a positive thing, and that it gives a more practical direction, as well as a concrete view, to the project. On the other hand, the role of companies is usually limited to steering group participation.

3) Problems in the co-operation between researchers and companies

Problems between the parties in the research project have, according to the researchers, appeared concerning the setting of the goals for the project, the expecations of companies for what the project may lead to in respect of its end results, and the reporting of the research results. Furthermore, companies have, usually, expressed fairly low commitment for the project if they have not participated in it as co-funders.

4) The research group

The actual research group (the researchers) does not seem to pay any specific attention to developing a strategy for the research group. Strategies are clearly considered to be more related to business activities, than being part of a research insititute and its activities. Research groups utilise different financing possibilities quite well. Tekes and the grants for applied technical research (non-tied goal-directed research) are familiar to researchers, who use these as means of acquiring funding for their research projects.

5) Tekes

Concerning the funding, reserachers estimated that, if Tekes had not funded the research projects, 57% of the projects would not have been implemented. Researchers characterise the steering groups as being, in general, active, supportive and significant. Steering group meetings are seen as occasions where researchers and company representatives have a chance to discuss research related issues, and where competing companies also work for a joint goal and discuss it openly. In some cases, companies tried to make as much use of the research results as possible, without wanting to invest anything else in the project. This was problematic for the work in the steering group, and it also influenced the actual research activities. According to the researchers, the role of Tekes was often very passive in the steering groups. The Tekes representative was often present only at the first and the last steering group meetings. The change of Tekes representatives during the project was also seen as very disturbing. Regarding the added value of Tekes, researchers stated that Tekes is seen as a pure financer of the project. During the planning and implementation phases, Tekes is seen as a supportive actor. Tekes' network of contacts is also regarded as an added value of Tekes. The researchers expressed a wish that Tekes would be more active and take a stronger position as a contact link between researchers and companies, and that Tekes would give more information about research that is carried out in different areas. Furthermore, the researchers stressed that it would be important that Tekes would control currently running research projects, in order to focus the research in a sensible way, and thus, avoid overlapping. Additionally, the researchers stressed that Tekes should be more flexible and assure a certain continuation of the funding, as well as express their own goals more clearly to the researchers.

Appendix 2: The design of the questionnaire

The questionnaire was designed as an eight-page questionnaire, and the following topics were covered:

1. *Background information about the respondent*
2. *Project stage*
3. *The origin of the project and the initiative to participate in the steering group*
4. *The role of the respondent (the company) in the research project*
5. *The steering group*
6. *Impact on the project and its progress*
7. *The co-operation between the members of the steering group and the researchers*
8. *Expectations and goals*
9. *The usefulness of participating in the work of the steering group*
10. *Previous and future research co-operation between the company and the research group*
11. *TEKES*
12. *Familiarity of R&D-funding possibilities for companies*

The questionnaire included a total number of 28 questions. The questions were of four different types. These types were:

1) Multiple choice questions. The respondent chooses between one or more alternatives given in the questionnaire.

2) Yes/no questions. The respondent chooses between these two alternatives.

3) Multi-attribute questions. The respondent evaluates e.g. the importance of an attribute on a scale. In the survey, a measurement scale from 1 - 4 was used, where 1 indicated the most negative end of the scale and 4 the most positive one. In one question, in section 7, where possible problems in the project were investigated, the scale was reversed, in other words, 1 indicated that no problems at all had occurred in the project, whereas 4 indicated the occurrence of many problems.

4) Open-ended questions. Three open-ended questions were also included in the questionnaire. Besides these, some of the multiple-choice questions included an open-ended alternative for the respondent to choose if the given alternatives did not match his/her opinions.

Appendix 3: List of tables

Appendix 4: List of figures

Working Papers

1. Reijo Miettinen & Torsti Loikkanen, *Teknologiapolitiikasta yritysten teknologiastrategioihin* (From technology policy to company technology strategies). Espoo 1993.

2. Sirkka Numminen-Guevara, *Katsaus teknologiaohjelmien arviointiin* (Review of the evaluations of national technology programmes). Espoo 1993.

3. Sirkku Kivisaari & Raimo Lovio, *Suomen elektroniikkateollisuuden merkittävien innovatiivisten liiketoimintojen menestyminen 1986 - 1992* (Success of the major innovative businesses in the Finnish electronics industry 1986 - 1992). Espoo 1993.

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6. Tuomas Hölsä, *Ulkomaiset T&K-yksiköt Valmetin paperikoneteollisuudessa ja Ahlströmin konepajateollisuudessa 1983 - 1993* (Foreign R&D units in Valmet paper machinery and Ahlstrom engineering industries 1983 - 1993). Espoo 1994.

7. Kimmo Halme & Eija Ahola, *Pkt-yritykset ja innovaatioiden tukijärjestelmä Suomessa* (SME's and innovation support system in Finland). Espoo 1994.

8. Eija Ahola & Kimmo Halme, *Innovaatiotoiminta pkt-yritysten strategiana* (Innovations as a strategy for the SME's). Espoo 1994.

9. Harri Luukkanen, *Ulkomaiset teollisuusyritykset ja niiden tutkimustoiminta Suomessa 1984 - 1991* (Foreign industrial firms and their R&D in Finland 1984 - 1991). Espoo 1994.

10. Tuomas Hölsä, *Suomalaisten suuryritysten ulkomainen T&K-toiminta* (Foreign R&D of Finnish multinational corporations). Espoo 1994.

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12. Sirkku Kivisaari, *Terveydenhuollon elektroniikan liiketoimintojen kehitys Suomessa* (Development of health care technology in Finland). Espoo 1994.

13. Reijo Miettinen, *Sosiologian ja toiminnan teorian näkökulma teknologiatutkimukseen* (A sociological and activity theoretical approach to technology studies). Espoo 1994.

14. Sirkku Kivisaari, *Management of continuity and change in Finnish health care technology: the Datex and Polar Electro cases.* Espoo 1995.

15. Reijo Miettinen, *Finnish biotechnology innovations in the 1980s and the 1990s: A preliminary study on innovative activity of the Finnish biotechnology sector.* Espoo 1995.

16. Mika Kuisma, *Pölypäästöistä kasvihuoneilmiöön: energiantuotantoon liittyvien ilmansuojeluliiketoimintojen kehityksestä ja kehitysmahdollisuuksista Suomessa* (From local dust emissions to global warming: the development and potential of the Finnish air pollution control and air quality measurement business and their relation to energy sector). Espoo 1995.

17. Jorma Lievonen, *Teknologia ja työllisyys* (Technology and employment). Espoo 1995.

18. Eija Ahola & Timo Siivonen, *VTT tuotekehittäjänä. Kertomus automaattisen sivuntaitto-ohjelmiston kehittämisestä VTT:ssä* (Product development at VTT: the case of automated paper making system). Espoo 1995.

19. Mika Kuisma, *Kasvihuonekaasut Suomen energian tuotannossa: haasteita uuden teknologian kehittämiselle* (Green house gases in the Finnish energy production: challenges for the new technology development). Espoo 1995.

20. Sakari Luukkainen, *Toimialan arvoketjun rakenteen ja kehitysdynamiikan vaikutus suomalaisen tietoliikenneteollisuuden kansainväliseen kilpailukykyyn vuosina 1990 - 1995* (Value chains in Finnish telecommunications industry). Espoo 1996.

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23. Tarmo Lemola & Sirkku Kivisaari (eds), *Muoteja ja murroksia* (Trends and discontinuities). Espoo 1996.

24. Kimmo Halme, *Biotekniikka uusien yritysten toimialana.* Espoo 1996.

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26. Jorma Lievonen, *Kansainvälisiä tekniikan kehitysarvioita* (International science and technology foresight). Espoo 1996.

27. Reijo Miettinen, *Julkista päätöksentekoa palveleva teknologian arviointitoiminta Euroopan maissa: ehdotus teknologian arviointitoiminnan järjestämiseksi eduskunnassa* (Technology assessment serving public decision-making in European countries: parliamentary proposal for the organisation of technology assessment). Espoo 1996.

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34. Mika Kuisma, *Teknologian siirron ja kaupallistamisen nykytilanne Suomessa* (The present state of technology transfer and commercialisation in Finland). Espoo 1998.

35. Jorma Lievonen, *Tekniikan mahdollisuudet - erikoistapauksena televiestintä* (Technological opportunities - case telecommunications). Espoo 1998.

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Impact of Tekes' grants for applied technical research

This report investigates the impact of Tekes' grants for applied technical research directed to non-tied goal-directed research projects conducted at universities and research institutes. The focus of the study was on investigating the experiences and expectations of industry representatives in steering groups of non-tied goal-oriented applied technical research projects. Furthermore, the experiences of Tekes' personnel responsible for awarding the grants and the opinions of researchers conducting the research projects were summarised in the study.

The non-tied grants for applied technical research are seen as important instruments for financing research projects at universities and research institutes. Companies agree upon the fact that steering group participation provides them with increased knowledge and important information about technology developments in their fields of interest as well as with useful contacts to the research community, customers and competitors. Companies often have other roles in the research projects besides being a member of the steering group. Companies take part in the project actively, e.g. by co-funding it, and consequently companies have strong interests in assuring the success of the research project. This fact gives valuable support for successful implementation of applied technical research projects, which is important for the research community.