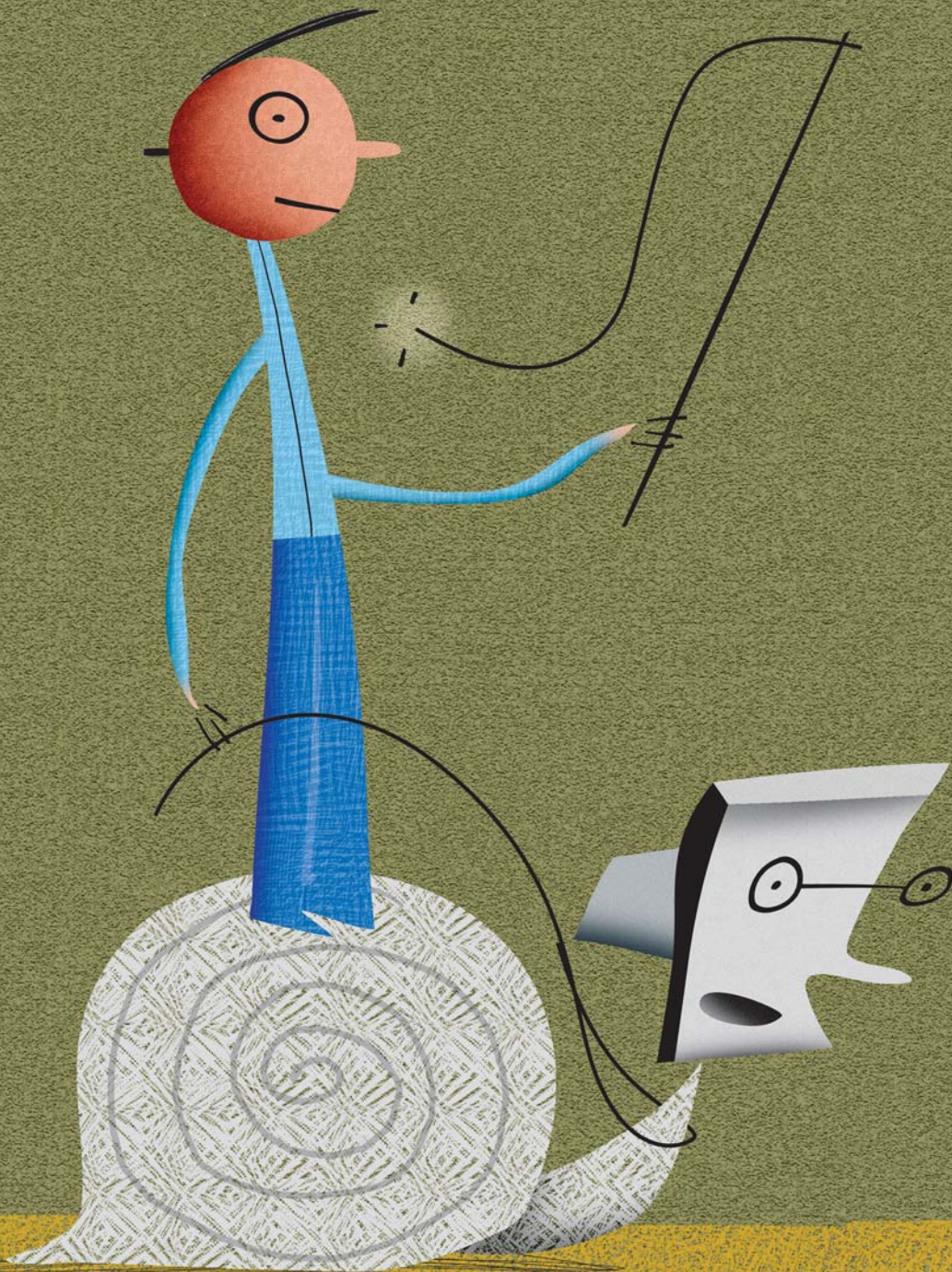


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Innovation studies



Impact Evaluation of Spinno Programme in 2001–2006



8 | 2007



Impact Evaluation of Spinno Programme in 2001–2006



Implications for the EU Structural Funds
Programming Period 2007–2013



Robin Brighton and Andrea Kells

December 2007



Innovation studies



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Foreword

The role of university as a research organisation and educational institution has changed considerably during the last couple of decades as a result of the transition to a knowledge-based economic and social model. The role of universities in actively participating in the economic activities of countries and companies as well as the socially balanced regional development is increasingly being taken into consideration. The aforementioned processes depend directly on the supply of new knowledge and its successful application, the transfer of knowledge through educational systems and, above all, our readiness to consume the products and services created on the basis of the new knowledge.

The developments in the European Union related to the implementation of the Lisbon Strategy have provoked an increasingly lively debate on the topic of “enterprising universities” – a concept featuring remarkable differences compared to the classic treatment of the university as simply a research organisation and educational institution. The transformation of universities and other R&D institutions into the driving forces behind innovation in regions and companies is evident primarily in the USA and UK, but also in continental Europe and Asia though on a smaller scale. These developments are supported also by the broad-based innovation strategy *Putting Knowledge Into Practice: A Broad-Based Innovation Strategy for the EU*, adopted by the European Union in autumn 2006, and the Estonian R&D and innovation strategy *Knowledge-Based Estonia* for the years 2007–2013, adopted by the Estonian Parliament at the beginning of 2007. Both documents have established knowledge and technology transfer as one of the most important areas of activity.

Although Estonian universities have hitherto contributed to the development of our economy and society mainly through providing highly qualified labour, this approach might not be successful in itself in the longer run and especially on the international level. The provision of high quality education certainly has been and will continue to be one of the most important means for universities to introduce new knowledge and skills to industry and society. Meanwhile, Estonian R&D institutions will be compelled to recognise the increase in competitiveness in the global market among students, researchers and business partners. The high-level R&D which serves to motivate both students and researchers requires the existence of business partnerships that, in turn, can bring along significant additional financial resources. It is also worth mentioning that in addition to increasing budgetary means, business partnerships also provide an important input into the R&D and teaching conducted at universities.

Since 2001, Estonia has invested nearly 100 million kroons (6,4 million EUR) through the SPINNO programme into the establishment of the knowledge and skills base required by the Estonian R&D institutions and institutions of applied higher education for putting the knowledge and technologies they have created into business practice. The goal of this process has been primarily to bring about a qualitative change in the supported institutions by motivating the membership of the institutions, improving their knowledge and skills, and also developing the structures and regulatory framework to facilitate mutually beneficial collaboration with companies.

The aims of the study were to assess the efficiency, effectiveness and efficacy of SPINNO programme funding and to make recommendations for its future structure, funding and management. The study was commissioned by the Ministry of Economic Affairs and Communications for Estonia and undertaken by the UK consultancy SQW Limited. The report is based on: a review of background information and documents; consultations with universities and others during two one-week visits to Estonia; and a workshop attended by participants in the SPINNO programme. The study is a follow-up on the mid-term appraisal of the first phase of the SPINNO programme, conducted in 2003.

Division of Technology and Innovation
Ministry of Economic Affairs and Communications for the Republic of Estonia





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Kokkuvõte

SPINNO programmi mõjuhindamine perioodi 2001–2006 tulemuste alusel sisaldas järgmisi uurimisteemasid:

- Programmi/toetatud projektide juhtimise efektiivsus EAS-is ja toetust saanud organisatsioonides
- Prognoositud tulemuste saavutamine toetuse saajate poolt
- Programmi vastavus riiklikele T&A ja innovatsioonipoliitika eesmärkidele

Hindamise tulemused rõhutasid programmi tulemuslikkust eelkõige kvalitatiivsete eesmärkide saavutamisel, st toetatud T&A asutuste liikmeskonna motiveerimisel, nende teadlikkuse ning oskuste arendamisel. Samuti hinnati positiivseks T&A asutustes väljakujundatud struktuure ning regulatiivset keskkonda, mis hõlbustab liikmeskonna koostööd ettevõtetega.

Arvulistest eesmärkidest saavutati ja ületati programmis osalevate T&A asutuste poolt lepingulisest T&A koostööst ning ettevõtetele osutatud konsultatsiooni- ja koolitusteenustest saadud tulule püstitatud eesmärgid. Programmis osalevate T&A asutuste tulu T&A kommertsialiseerimisest tervikuna on alates 2001. a.-st kolmekordistunud, ulatudes 2006. a. juba üle 90 miljoni krooni. Programmi kaasatud seitse üli- ja kõrgkooli osutasid 2005. a. ettevõtetele koolitus-, konsultatsiooni- ja uurimistöö teenuseid kokku ca 91 miljoni krooni eest ning 2006. a. 130 miljoni krooni eest.

Samas ei ole programmi tulemused täielikult ootustele vastanud – patentide kaitsmine ja litsentside väljastamine on jäänud oodatust tagasihoidlikumaks, probleeme esines ka tehnoloogiasirde funktsiooni mehitamise ja rahastamisega toetatud asutustes.

Üldises plaanis täheldas uuringu läbiviija toetust saanud organisatsioonide puhul suuri arenguerisusi, mis on ka osaliselt mõistetav, kuivõrd näiteks Tartu Ülikooli ja Tallinna Tehnikaülikooli kogemused antud vallas on märkimisväärselt pikaajalisemad ja ulatuslikumad kui teistel. Samas oli täheldatav toetuse saajate omavaheline puudulik kogemuste- ja infovahetuse praktika, mis oleks ehk aidanud arenguerisusi leevendada ning võimaldanud hilisematel liitujatel pikema kogemusega asutustelt õppida.

Eelpooltoodust tulenevalt järeldati, et SPINNO programm on oma eesmärgid vähemalt osaliselt täitnud ning jõuliselt panustanud T&A asutuste ja ettevõtete vahelisse koostöövalmidusse. Programmi peamine eesmärk on seisnenud eelkõige organisatsioonide teadlikkuse ja oskuste kasvatamises ettevõtetega koostöö tegemises ning sellest saadava tulu jagunemise osas selgete mängureeglite kehtestamises. Osaliselt tänu SPINNO programmile kasvas märkimisväärselt T&A asutuste ja ettevõtete valmisolek koostööks erinevate riiklike toetusprogrammide raames (T&A tegevuse projektide, Tehnoloogia Arenduskeskuste ja T&A asutuste infrastruktuuri investeeringute programm).

Soovida jättis aga teadmiste- ja tehnoloogiasirde valdkonna üldiselt madal reputatsioon T&A asutuste juhtkondade silmis tervikuna ning sellest tulenevalt nõrk esindatus ka asutuste strateegiliste arenguprioriteetide hulgas.

Kokkuvõttes toetasid hindajad programmi jätkamist, kuid tõdesid sarnaselt 2003. a. hindamise tulemustega peamise väljakutsena valdava osa Eesti ettevõtete madalat teadmiste ja oskuste taset T&A asutustega koostööks, mis on omakorda tinginud T&A asutuste keskendumise peamiselt suuremahuliste ja tehnoloogiamahukate T&A koostööprojektide eelisarendamisele.

Hindajad tegid järgmised ettepanekud:

- luua võimalused teadmiste- ja tehnoloogiasirde meeskondade baasfinantseerimiseks, mis tugineks iga asutuse suurusele ja vajadusele ning tagaks üle Eesti ligi 20 kõrgeltkvalifitseeritud spetsialisti jätkamise (suuremates ülikoolides neli, väiksemates 2 täistöökohta)
- luua eraldi toetusvõimalused erinevates arengufaasis olevate institutsioonide väiksemamahuliste eriprojektide rahastamiseks, mille eelduseks on asutustevaheline koostöö ning projektide vastavus programmi eesmärkidele
- EAS-i juhtimisel luua võimalused toetatud asutuste poolt pakutavate teadmiste- ja tehnoloogiasirde teenuste efektiivsemaks turundamiseks ning teatud teenuste ühiseks sisseostmiseks ja kasutamiseks
- käivitada Eesti teadmiste- ja tehnoloogiasirde spetsialistide täiendkoolitusprogramm, mis ühtlasi võimaldaks nimetatud spetsialistidel paremini saadud teadmisi ja kogemusi vahetada
- alustada prototüübifaasi projektide toetamist – luua T&A asutuste vaheline ühisfond, mis tagaks üksnes parima turupotentsiaaliga rakenduslike T&A projektide rahastamise
- EAS-i koostöö toetuse saajatega peab muutuma tihedamaks ja sisulisemaks, et nõustada toetuse taotlejaid ja saajaid toetuse eesmärkide ja nende saavutamise osas

Executive Summary

Background to the study

This is the final report of a study of the impacts of the SPINNO programme. The aims of the study were to assess the efficiency, effectiveness and efficacy of SPINNO funding and to make recommendations for its future structure, funding and management. The study was commissioned by the Ministry of Economic Affairs and Communications for Estonia (Ministry) and undertaken by the UK consultancy SQW Limited. The report is based on: a review of background information and documents; consultations with universities and others during two one-week visits to Estonia; and a workshop attended by participants in the SPINNO programme.

The SPINNO programme

The programme is funded by the Ministry and managed by Enterprise Estonia (EAS) and provides funds to higher education institutes (HEI-s) to develop their knowledge transfer capabilities. Support was initially provided for three projects during the period 2001–2003; this was subsequently extended to seven projects during the second round of funding awarded in 2004. Funds were allocated through a competitive bidding process. SPINNO is an important component of the Estonian National Innovation System. It aims to develop the underlying capacities of the HEI-s to respond to enterprise needs. This is essential if other national programmes designed to stimulate innovation are to be effective.

Conclusions

Efficiency: management of the activities

Enterprise Estonia has maintained close relationships with the projects, both to keep itself informed of progress and also to provide advice and assistance where needed. Discussions with the projects indicated that EAS has discharged its management role effectively. Personal contacts are good and EAS has responded well to requests for information and guidance. It has also helped to develop networking between the different SPINNO projects.

The main programme management issues are:

- auditing expenditure which places an onerous burden on institutions
- monitoring of projects where we are not confident that EAS has the information it needs to assess progress

Based on available indicators, we believe that project management by institutions has been satisfactory in terms of achieving planned targets and activities although there are important differences between projects. However, the time taken to establish rules and regulations governing academic staff working with enterprises (“the legal framework”) has been excessive in some cases. In addition, several of the projects had difficulty in recruiting appropriate staff and some have also suffered from high turnover rates. This is one of the reasons why only slow progress on the legal framework was made. We recognise the difficulties in recruiting suitable staff, but we believe that better results would have been obtained if senior management in the universities had attached higher priority to the SPINNO programme.

We believe there is scope for more sharing of knowledge and experience between projects. We were able to identify specific instance of this but it does not appear to be systematic. This is perhaps disappointing given that many of the projects were dealing with similar issues and those which had received SPINNO 1 funding already had significant and relevant experience.

The level of institutional contribution to SPINNO projects is currently set at 35%. HEI-s generally considered the 65% grant a sufficient incentive to participate and most would reduce their levels of knowledge transfer support in the absence of SPINNO funding. As such we believe the grant has been set at an appropriate rate.

Effectiveness: Performance against targets

We would judge results in aggregate to be at least satisfactory and indicative that SPINNO is achieving its targets. There has been a growth in business R&D sponsorship and consultancy and training which is particularly

encouraging since these activities typically represent real transfers of knowledge and may also be the basis for continuing relationships between the HEI-s and businesses. However, it is important to note that even where targets have been exceeded, many of the outputs are low in an absolute sense.

SPINNO outputs are not, however, restricted to hard income and associated data and the report draws attention to its intended role in developing capacities and capabilities to engage effectively with enterprises. Our consultations have given us some confidence that SPINNO has had two important impacts on all institutions. First, it has raised the profile of knowledge transfer amongst staff within the institutions. Second it has supported the development of regulations and procedures for staff to engage in knowledge transfer. The approaches adopted vary between institutions, but most have now developed procedures in areas such as costing and pricing work with business, the division of financial returns from such work and the handling of intellectual property (IP).

Efficacy: relevance to policy goals

Outputs, such as spin-outs and research collaborations are directly aligned with strategies articulated in Knowledge-based Estonia¹ and elsewhere. The programme as a whole has met several key targets and there has been encouraging growth in some activities during the SPINNO 2 period. However we consider SPINNO's role in developing an underlying capability, and enthusiasm, for working with enterprises as important and over the longer term perhaps its most important output. Our consultations suggest it has also made real progress in this respect.

Recommendations

SPINNO should continue; it has helped develop the 'infrastructure' for knowledge transfer, in the sense of underlying capabilities and enthusiasms to transfer knowledge as well as relationships with enterprises. This is important and needs to be built on in the future but it is unlikely to be sustained by institutions without continuing financial support.

There is little, if any, justification for continuing to support the development of the 'legal framework' for knowledge transfer within institutions. There have been unforeseen difficulties in specific cases, but most have made real progress and further time and funding is unlikely to be the solution.

The institutions are at different levels of development and have different opportunities and needs in relation to knowledge transfer. This needs to be recognised by future programme(s). The allocation of funds must be open and transparent but should not attempt to support the same activities in all institutions.

The higher education and research sector in Estonia is small and institutions need to collaborate where possible to ensure that resources are used as effectively as possible. A related issue is the shortage of knowledge transfer professionals and the programme needs to address this issue.

We recommend that future SPINNO programmes should have four components and also support the introduction of two new schemes which were under consideration at the time the study was undertaken.

Core funding for KT staff

We recommend that funding is provided for knowledge transfer staff in every institution. If SPINNO is to be supported from the structural funds in the future then competitive bids will be required. We would recommend that each eligible institution submits a single bid for staff covering the length of the next SPINNO programme. These bids would specify:

- numbers of staff
- university contribution
- responsibilities and objectives
- how the staff will build on achievements during the current SPINNO round.

¹ Estonian Research and Development Strategy for the years 2002–2006

Funding for specific projects

This component of funding is intended to cater for the different needs and opportunities facing different institutions. It would be allocated through a competitive bidding process. We see no reason at this stage to restrict eligible activities, provided they meet the general aims of SPINNO, but criteria for selection might include:

- fit with sector priorities as these emerge
- collaboration with other institutions. This could include other higher education institutions, but also organisations delivering innovation services such as technology/science parks and incubators. The aim would be to maximise the effectiveness of spend and to spread the benefits. However, we are conscious of the danger that collaborative bids may be submitted simply to enhance the chances of selection with no real synergies between partners. The overall quality of bids, and their potential impacts, must be the primary consideration. The benefits of collaboration would need to be clearly identified and the extra costs of collaboration justified.

Creating a network to promote KT services to businesses and other organisations

We envisage this component being established by EAS, in partnership with the institutions, rather than funds being allocated to the institutions individually. It would encompass

- joint promotional and marketing materials
- creation of a single access point for businesses wishing to access knowledge and expertise
- sharing resources between institutions, especially in relation to specialist expertise. There is a delicate balance here, there must be some internal capability within each institution in order to engage staff from that institution, lobby senior management and promote its services. But they should be able to draw on external expertise, for example in IP law or international collaborative arrangements, which they could not fully utilise as individual institutions. We recommend that the institutions explore with EAS the scope for such sharing of resources.

We would emphasise that these recommendations are not designed to substitute for individual institutions' marketing and promotional activities. The aim is to complement and enhance individual activities.

KT staff development

We envisage two related activities here, both of which would be funded centrally by EAS, and which could be a component of the network described above:

- a formal programme of seminars and workshops to enable institutions to share experiences of KT activities
- the procurement and provision of training services

New funding schemes

- Proof of concept funding
Most countries have recognised a funding gap at the very early stage of technology development which is often referred to as 'proof of concept'. We believe there is a need for such resources in Estonia and that SPINNO provides such funds. We strongly believe this should be a centrally managed fund to which universities submit proposals rather than pre allocating funds to individual institutions for proof of concept purposes.
- Mobility schemes
The Ministry is also considering the introduction of a mobility scheme and a feasibility study is currently underway. Our experience from elsewhere suggests that it could be an important component of the national innovation system and would complement SPINNO very well.

Implications for programme management and Enterprise Estonia

This section draws together the various implications for EAS. In some cases we have not been able to investigate possibilities in any depth, but we would urge that EAS gives these issue further consideration:

- EAS should engage in a closer dialogue with institutions at proposal stage; to agree targets; and to monitor project progress
- the current reporting and associate audit requirements are widely perceived as too onerous and of limited value. We recommend that EAS explores with both the Ministry of Finance and the European Commission whether less onerous procedures could be introduced

- we do not recommend any change to the 65% level of grant funding. However, we understand that institutions are also able to claim a 10% contribution to overheads but that this leads to further reporting requirements for very small sums of money. It may be possible to reduce the information requirements here but if not, we recommend that consideration is given to making the overhead contribution ineligible perhaps in exchange for a small increase in the overall grant rate
- the metrics so far collected by Enterprise Estonia can be useful but they present a short-term and partial picture of activities and we recommend they are revised in various ways

These and other recommendations will imply new tasks for EAS staff and while we have not analysed work loads within the organisation, but our strong impression, from the consultations, is that there is no capacity to take on additional tasks at present. Some recommendations could release staff time, for example, changes in reporting requirements but we doubt whether this is likely to create sufficient capacity. We therefore recommend that EAS considers whether staffing levels for managing SPINNO are appropriate taking into consideration any changes to the programme.

1 | Introduction

1.1 | Background to the study

This is the final report of a study of the impacts of the SPINNO programme. The study was commissioned by the Ministry of Economic Affairs and Communications for Estonia (Ministry) and undertaken by the UK consultancy SQW Limited. The study has two main purposes:

- to assess the efficiency (the management of the activities), effectiveness (how far the objectives have been met based on established performance indicators) and efficacy (how relevant it is to the broad policy goals to which it was designed to contribute) of SPINNO funding. This includes impacts on recipients of SPINNO funds and relevance of the impacts to programme goals, but also the effectiveness of programme management by EAS
- based on this evaluation evidence, to make recommendations for the future structure, funding and management of the programme. This is an especially important aspect of the study since there is a need to feed into various national strategies which are currently in preparation and which will determine the allocation of EU structural funds in 2007–2013.

The immediate objectives, as stated in the terms of reference, were:

- To provide an evaluation of the adequacy of the strategic concept of the programme in the Estonian (national SPD and R&D strategy, draft of the new RD&I strategy) and European context;
- To provide an evaluation of the programme's synergetic and structural results in terms of its contribution to the development and structural adjustment of the organisations participating in the programme;
- To establish whether the services and infrastructure, including organisational models, which have been designed and implemented at the institutions participating in the programme are corresponding to the needs of their strategic goals and the needs of their target groups and whether those are being used by the latter actively and in purpose;
- To identify which further developments and improvements in the design and implementation of the programme are needed in future in terms of better satisfying the needs of the participating institutions and their target groups, and the national innovation system at large;
- To provide an evaluation of the level and type of synergy with other public support programmes within the national innovation support system, to compare the experience derived from the programme with the lessons learnt from other national programmes if possible and to validate the information obtained;
- To establish whether the second call of the programme has been implemented in correspondence to the suggestions presented in the first mid-term review of the programme in 2003 (levels and principles of public co-financing);
- To provide an evaluation of Enterprise Estonia as the implementing agency of the programme.

This report is based, in the main, on two one week visits to Estonia by the study team in July and August 2006. During these visits we consulted with all the institutions which have received SPINNO funding and held discussions with: the project manager; a senior institutional manager; and, in most cases, one or two members of the academic staff who are actively involved in knowledge transfer (KT). We also consulted with three companies. In an evaluation of knowledge transfer activities we would, ideally, wish to consult with more businesses. However, this is problematic with respect to SPINNO. The programme is designed to enhance the basic infrastructure for KT rather than improve relationships with specific companies (or specific collaborative projects). It is, therefore, difficult to identify individual companies which would be able to make meaningful judgements on SPINNO impacts. We also consulted with the Ministry and EAS.

An interim report setting out initial findings and recommendations for the future of SPINNO was prepared in September. The report was presented at a workshop held on 17th October in Tallinn. Knowledge transfer staff and senior management from the institutions in receipt of SPINNO funds attended the workshop. Two knowledge transfer experts from outside Estonia also participated. These were Dr Paul van Dunn (General Manager K.U.Leuven Research & Development, Belgium) and Dr Anders Hugnell (Director Engineering Institute, KTH Sweden). The workshop was facilitated by members of the SQW study team. Its purpose was to review the study team's initial findings and recommendations and provide feedback for consideration in the final report. We are very grateful for the comments we received and also for the time participants had previously given the study team for discussion of the SPINNO projects.

A draft final report was submitted in November 2006. This final report incorporates feedback on the draft report from the Ministry, EAS and those SPINNO projects which chose to make comments.

1.2 | The SPINNO programme

An important element of Estonian national R&D strategy 'Knowledge Based Estonia' for the years 2000–2006 was the promotion of a knowledge-based society and economy in Estonia. The universities and research institutes have a key role in this strategy, both in providing highly skilled graduates and generating new knowledge but also in the transfer of knowledge, whether generated in Estonia or elsewhere, to businesses and other organisations. In recognition of this role and potential, and also the need to develop capacities, the SPINNO programme was launched in 2001. The programme is funded by the Ministry and managed by EAS. Support was initially (in 2001–2003) provided for three projects:

- Tallinn University of Technology (TUT)
- Tartu University (TU) which was the project leader and the main participant. Tartu Science Park and Estonian University of Life Sciences² were partners in this project,
- BIOSPINNO was a sector wide project. This was concerned with biotechnology and involved TUT, TU, Estonian Biocentre and a number of research institutes. Some companies were also closely involved although they did not receive funding from SPINNO.

A mid-term review was undertaken in 2003 and one of its recommendations was that the programme should be opened to other higher education institutions as well as universities. This was accepted and bids were invited from all institutions in 2004. Seven institutions submitted bids and all were awarded funds. A grant of 65% of eligible costs (labour, overheads, purchased services, office equipment, training, travel) was provided.

The seven current projects are:

- BIOSPINNO – involving Estonian Biocentre, TU, TUT, Estonian University of Life Sciences, the National Institute of Chemical Physics and Biophysics, Estonian Genome Foundation, Tartu Biotechnology Park, Estonian Biotechnology Association. There is a substantial overlap in membership with the consortium funded under the first round of SPINNO funding
- Estonian Maritime Academy (EMA)
- Estonian Academy of Arts (EAA)
- Tallinn University of Technology (TUT)
- Tallinn University³ (TLU)
- Tallinn College of Engineering (TCE)
- Tartu University (TU) – involving Tartu Science Park and the Estonian University of the Life Sciences as project partners

Financing levels are shown in Table 1.1

Table 1.1 SPINNO funding

Project	Other Participants	SPINNO Funds
First round		
Tallinn University of Technology		14 290 500 EEK
Tartu University	Estonian Agricultural University Tartu Science Park	9 000 000 EEK
BioSPINNO	Estonian BioCentre (Leader) Institute of Chemical and Biological Physics (Co-or) Tartu Biotechnology Park and Estonian Gene Centre (Co-or) TUT, Biotechnology and Gene Technology Tartu University, Institute for Molecular Cell Biology TUT, Institute of Gene Technology Tartu University, Institute of Technology TUT Centre for Biotechnology and Gene Technology	6 336 873 EEK
Total first round		29 627 373 EEK

² Formerly Estonian Agricultural University

³ Formerly Tallinn Pedagogical University

Project	Other Participants	SPINNO Funds
Second round		
Tallinn University of Technology		12 204 000 EEK
Tallinn University		8 345 800 EEK
Tartu University	Estonian University of Life Sciences Tartu Science Park	13 515 170 EEK
Estonian Biocentre	Tartu University Estonian University of Life Sciences National Institute of Chemical Physics and Biophysics Estonian Genome Foundation Tartu Biotechnology Park Estonian Biotechnology Association	13 443 300 EEK
Estonian Academy of Arts		7 008 812 EEK
Estonian Maritime Academy		2 600 000 EEK
Tallinn College of Engineering		3 250 000 EEK
Total second round		60 367 082 EEK

Funds were allocated through a competitive bidding process. Institutions were required to submit plans under five 'activity fields' but they were not required to address all fields in the bid if there was sufficient existing capacity in any of the five areas. The activity fields were:

- 1) to create a favourable environment for knowledge transfer and the commercialisation of the results of research and development activities at R&D institutions and universities
- 2) to raise the awareness of university staff members, development of knowledge and skills in commercialisation of R&D based ideas and the cooperation possibilities with companies
- 3) to offer support services for university staff members for commercialisation of specific knowledge-based business ideas
- 4) to introduce actively the competences, services, cooperation possibilities and intellectual property of R&D institutions and universities
- 5) to cooperate and exchange experiences with local and international partners regarding the knowledge and technology transfer.

In practice, there were significant overlaps between these activity fields in the proposals, and also some lack of clarity as to how institutions intended to address them. Nevertheless, grant recipients provide detailed 6+6-month activity plans and report activities against these activity fields. We have used them to structure our findings in relation to individual institutions.

The mid-term review also made a number of other recommendations:

- consideration of a reduction in funding from the (round 1) at 75% of their costs
- as mentioned above, widening eligibility to other institutions and a separate fund to support specific initiatives in such organisations. The rationale is that it may not be appropriate for such organisations to be awarded funding for the full range of activities but they may need support to launch specific initiatives, for example to develop a training course which could then be rolled out to a number of firms in a specific sector
- introduction of a *proforma* application form requiring applicants to address specific issues
- SPINNO would commit to funding successful projects for a three year period. Before awarding funding, however, there would be a dialogue between EAS and the bidder over the targets against which the project would be monitored
- progress against targets would be reviewed annually, again involving a dialogue between EAS and the project. Failure to meet targets need not necessarily result in reduced funding.
- formal progress reviews are held for each project on (say) a quarterly basis and that these are attended by an EAS representative
- consideration be given to SPINNO supporting students to undertake projects for and in industry
- EAS should consider whether it might provide support services to HEI-s.

1.3 | Report structure

Following this introduction, the next chapter discusses the potential role of SPINNO in the Estonian system of innovation. The next seven chapters report findings for each of the projects and these are followed by conclusions and recommendations in chapter 10.

2 | SPINNO and the Estonian Innovation System

2.1 | Introduction

National innovation systems (NIS) are difficult to describe, and more difficult to evaluate, but the term refers to the complex set of formal and informal relationships between the various actors with roles in supporting and implementing innovative activities. This study has not been concerned with a review of the Estonian NIS, but the SPINNO programme does not operate in isolation either from other programmes or factors impacting on the NIS. These relationships are discussed in this chapter. The general conclusion is that SPINNO's aims have a major contribution to make to the current, and planned, R&D and innovation strategies in Estonia.

2.2 | Current strategies

The key document informing current Estonian research, development and innovation (RD&I) policy is *Knowledge-Based Estonia*⁴ (KBE 1) which covers the period 2002–2006, and which was adopted in late 2001. It sets out the strategic objectives for Estonian RD&I as:

- updating the pool of knowledge, where the main focus is on raising the quality and level of scientific research
- increasing the competitiveness of enterprises. KBE 1 states that “*The precondition for achieving a greater competitiveness in enterprises on the basis of updated knowledge is the development of an integration mechanism between the research and business sectors, which will enhance the application of research results in enterprises and in society as a whole.*”

Table 2.1 Current innovation-related programmes

Target	Programme	Description
Primarily targeted at enterprises	Innovation Audit	Consultancy support for SME-s
	Enterprise Incubation	Support for incubator development and provision of incubation services of SME-s, finance for feasibility studies and providing services
	R&D Financing Programme	Grants for: <ul style="list-style-type: none"> ■ applied research and product development projects in enterprises ■ R&D institutions applied research projects ■ feasibility studies of applied research and product development projects
	InnoAwareness	Awareness raising programme
SPINNO		
Primarily targeted at universities and R&D institutions	Centres of Excellence	Infrastructure grants aimed at repatriating Estonian researchers and encouraging inward movement
	Technology Competence Centres	Co-finance for centres, which are founded and managed by (at least) 3 enterprises and 1 research centre
	R&D Institutions' Infrastructure Development	To increase the capability of R&D and innovation in through developing an internationally competitive R&D infrastructure system providing comprehensive support to higher education

Based on information provided in *European Trend Chart on Innovation Estonia 2004–05* and *Enterprise Estonia Web site*

Several programmes, including SPINNO, have been launched or extended during the period 2001–2006. They have been funded by the Phare programme and Structural Funds as well as the Estonian Government. Table 2.1 provides a summary description of the main programmes targeted at innovative SME-s and/or R&D institutions⁵.

⁴ *Knowledge-based Estonia, Estonian Research and development Strategy for the years 2002–2006. Prepared by a working group with participation from the Ministry of Education, Ministry of Economic Affairs and the Estonian Academy of Sciences.*

⁵ *Estonia has also launched a number of other programmes and initiatives which are related to innovation, for example “Tiger Leap”, a national target programme launched by the Ministry of Education, with the objective to modernize the educational system in the country by introducing information and communication technology.*

They have been divided into two groups: those where enterprises are the direct target and beneficiary; and those where higher education institutes and research centres are the main beneficiary.

Table 2.1 suggests two important points. First, and most obviously, there are a range of programmes which are seeking to act on: the innovation supply side (e.g. R&D institutions' infrastructure development programme); the demand side (e.g. R&D financing programme); both demand and supply side (e.g. Technology Competence Centres); and some targeted at more general awareness raising. The programmes between them cover the normal range of innovation activities in Member States with two notable exceptions.⁶ These exceptions are:

- providing early stage financing specifically for innovative or high technology commercial ideas. There is a wide spread recognition that uncertainty and information asymmetries⁷ (between inventors/researchers and investors) can lead to market failure and, as a result, publicly supported early stage financing schemes have become increasingly common in recent years
- there are no explicit schemes to support mobility between the research and higher education (HE) sectors and enterprises. Again these are relatively common within the EU, especially the movement of graduates to SME-s.

We have not explored the potential for such schemes in Estonia⁸ but we think it likely that there is scope for their introduction. In both cases there are reasons to believe that market failure will lead to underinvestment in such activities. In addition, they would directly complement SPINNO supported activities by promoting the commercialisation of IP and pulling through knowledge transfer (via people movement) into businesses and other organisations. Such schemes are being actively considered and plans are discussed further below.

The second point is the importance of the HE and research sector to the operation of these programmes. This is true in the sense that the programmes targeted at the sector account for a substantial share of the 'innovation budget' and some research institutions and HEI-s are also heavily involved in undertaking feasibility studies and applied research funded through the R&D financing programme. As such, they have an important role in the direct delivery of the programmes. But they also have an underpinning role and this is why SPINNO is potentially a major component of the NIS. This point is explained in the rest of this section.

Much of the activity within the SPINNO projects so far has been aimed at developing the underlying capacities of the HEI-s to respond to enterprise needs and to proactively engage in knowledge transfer. As is discussed elsewhere in this report, activities include:

- developing rules and regulations governing the handling of IP and engagement with enterprises
- marketing knowledge transfer capabilities
- training academic staff, and sometimes also students, to engage with enterprise and providing direct support and assistance in many cases
- establishing 'technology transfer offices' which can act as focal points both for external organisations, but also academic staff.

It is essential that the universities develop these capabilities if the NIS is to function effectively. Most directly, those programmes which are targeted at stimulating enterprise demand and access to new technologies require a responsive HE sector. This is especially true in the Estonian context where research and technology expertise are concentrated in the HE sector. Thus, for example, finance for enterprises could not function properly unless university researchers were willing to engage with sponsors and undertake applied research on their behalf and similar statements could be made in relation to the Technology Competence Centres. SPINNO type support is required to develop these capabilities because the incentive structure for individual academics, and research funding, encourages traditional academic research leading to publications rather than applications. Also, economic conditions are currently such that companies do not need to get engaged in collaborative or innovative research to be competitive. They are, at present, able to compete on cost but national strategy has identified innovation as the key to future prosperity.

The role of HEI-s in the NIS has been recognised by countries which are generally thought to be successful innovators. The nature of public support of course varies; in particular:

- it depends on the existence and roles of other actors. In, Sweden, Finland and Germany for example, a substantial proportion of R&D, and especially, applied R&D is performed outside the HE sector and the role of HEI-s is relatively less important

⁶ We have not reviewed current programmes (apart from SPINNO) and cannot comment on their effectiveness.

⁷ The potential investor will have limited information on the technical and therefore commercial potential of research compared with the inventor. It can be difficult and costly to gather this information especially if the inventor is only prepared to divulge limited information because of a fear of losing intellectual property.

⁸ A recent report, however, recommends improvements to venture financing: *Access of Enterprises to Venture Financing in Estonia, Feasibility Study of Government Support Scheme Zernike Group 2004*

- history is also important and the period over which there has been active interventions tends to influence the nature of these interventions; that is to say as lessons have been learnt, and capabilities developed, interventions have tended to become more selective and targeted on specific institutions and activities.

Nevertheless, many countries have recognised the importance of infrastructural support for universities and the need to change cultures if HEI-s potential is to be realised. According to the European Innovation Scoreboard, Finland, Sweden, Denmark, Switzerland and Germany are rated consistently highly for their success in innovation (see References on p 58). All continue to support the KT infrastructure in the their HEI-s in various ways including:

- In Finland, financial support for promoting innovation services at universities to exploit research outputs
- Denmark funds “Innovation accelerating research platforms” have been recently introduced. The aim is to ensure that research leads to innovation and is undertaken with both the international perspective and business development needs in mind
- In Germany there is financial support for: creating a professional patenting and commercialisation infrastructure; promoting the use of patents; and developing networks of commercialisation units
- In Switzerland there is public funding for regionally focused consortia which assist companies to identify needs and potential support from the HE sector (and other research organisations). SME-s are a priority
- Sweden initially provided support for ‘industrial liaison officers’ in the universities in the 1980s. Infrastructure support schemes have developed since then and now include the Competence Centres, which are well known in Estonia.

These are examples of the ways in which successful countries are supporting the underlying infrastructure for KT in their universities. As mentioned above they reflect the specific circumstances of these countries and are not models for action in Estonia. They also tend to embody a number of other characteristics which may not be appropriate in the Estonian case:

- the schemes are sometimes open to other types of organisation, for example applied research institutes. This can stimulate competition for funds and enhance the quality of activities. However, this obviously depends on the possibility of meaningful competition
- in some cases industry also contributes to the financial support available. This helps to ensure user-engagement and the relevance of activities, but would be difficult to secure given the current strategies of Estonian businesses and the resources available to them
- related to the last point, state level support as well as federal funding may be required, helping to ensure a focus on regional issues. This is not generally feasible, or necessarily desirable, in Estonia given the size of the country
- and finally, the management of programmes may involve non-governmental organisations, but this tends to reflect public administrative structures and governance norms rather than suggesting underlying lessons.

We would also note that these countries, and many others, also provide support on a project by project basis which helps to stimulate the demand for services with the infrastructure funding is supporting. There are a diverse range of schemes but they tend to fit into the following broad categories:

- collaborative (HEI-business) research
- mobility schemes, especially from the HE sector to business
- support and advice to (typically small) businesses to help them identify innovation related needs
- support for high level training schemes for businesses.

SPINNO’s potential role in the NIS, however, goes beyond developing a capability to respond to demands generated by other programmes and four other factors also need to be considered. First, knowledge transfer brings academic as well as potential commercial benefits. These arise because working with enterprises:

- helps academic researchers to identify challenging industrial problems which can inform the research agenda they pursue independently of any enterprise involvement. This may be self evident in the case of engineering subjects, but is also true of the natural sciences, where industrial problems may demand developments in basic science⁹, and the social sciences. In addition, industry may be at the leading edge of developments in some subject areas and academics need to relate to these enterprises in the same way they relate to the academic research community

⁹ This is the basis for innovation paradigms which emerged in the 1980-s. These rejected a linear model of basic research leading to applied research and then commercialisation with one characterised by multiple feedbacks from commercialisation to research. An early example is the “chain-link” model. See Kline, S.J. and Rosenberg, N., 1986, *An overview of innovation, in The Positive Sum Strategy: Harnessing Technology for Economic Growth*, R. Landau and N. Rosenberg (ed.), National Academic Press: Washington D.C

- helps to ensure the relevance of undergraduate and post graduate teaching programmes. There may be direct benefits through, for example, the development of case-study material but it is through contact with enterprises that academics can learn about enterprises' needs in relation to graduate skills and shape curricula accordingly. This is, we understand, especially important in the Estonian context where a shortage of appropriately trained science and engineering graduates is a real problem.

Second, all countries need to establish global research and technology development links but this is especially important to Estonia given its size. Academic researchers, particularly those at the leading edge, typically have excellent global networks with both other researchers and technologically advanced businesses. These networks are potentially an important resource for keeping abreast of global developments, accessing foreign technologies and, in specific cases, facilitating foreign inward investment. They require, however, leading researchers to engage with industry development issues.

Third, an active knowledge transfer portfolio may help to retain staff in universities and attract new entrants. Public sector salaries have lagged behind those parts of the private sector which have grown fastest. There are many other factors which make an academic career attractive, but salary is an important consideration for some. Working with enterprises does provide some potential to supplement salaries, notably through consultancy work. The research challenges may also be an added attraction.

The final point is slightly more speculative. Universities, around the world, have received a good deal of attention as a result of spinning out high technology companies. Our own view is that the spin-out role of universities is sometimes given too much emphasis. There are undoubtedly examples of spin-outs which have grown to become substantial companies and it is essential for universities to have policies to develop and support spin-outs when appropriate. However, the importance of universities has been overestimated; large firms are in fact generally a much more important source than the science base and a good deal of effort has been devoted to university spin-outs that never develop into real companies. Despite this caution, it may be the case that Estonian universities have a more important role in relation to spin-outs than in many other countries because the industrial structure is relatively less conducive to producing new ventures. If so, this is another factor pointing to the importance of SPINNO in the NIS.

2.3 | Planned developments

A draft of the second version of Knowledge-based Estonia (KBE II) has been produced¹⁰. The strategy sets out three main objectives:

- the competitive quality and increase in volume of research and development
- innovative entrepreneurship creating new value within the global economy
- an innovation-friendly society aimed at long-term development.

Limited cooperation between enterprises and universities/R&D institutes is identified as one of the main challenges to business competitiveness and this is attributed to:

- insufficient applied research within universities and research institutes
- more important, limited capabilities within the business sector to absorb and fund RD&I. Increasing business demand is, therefore, seen as a strategic need.

KBE II envisages that the broad strategic thrust of KBE I will continue and, for the reasons explained above, this will require universities to engage further with the business sector and underlines the important role of the SPINNO programme. There are also intentions to introduce two new innovation support programmes. Both will need an effective response from the universities for success which SPINNO can help to deliver.

First, KBE II specifies that *"Flexible opportunities will be created for financing the prototype phase in programmes and/or the incubators of research and technology centres. Early-stage own capital investments will be made in order to alleviate the lack of capital of research and technology intensive companies in start-up or development phase."* As is discussed further in chapter 10, we believe that universities should be eligible to bid for this type of funds. To do so effectively they will need to identify suitable 'projects' within their institutions and provide commercial guidance and advice to academic staff who win funding. Our experience of similar schemes elsewhere indicates that success is unlikely to be high in the absence of such support. Academic staff may, and should, draw on other sources of business support where appropriate but those components of the commercialisation process which depend on detailed knowledge of capabilities, encouraging staff to engage

¹⁰ Knowledge-based Estonia for the years 2007–2013 (KE II) Estonia's RD&I strategy. Working version 30 May 2006

in knowledge transfer and balancing academic and knowledge transfer responsibilities can be delivered most cost-effectively from within the institution.

Second, the Ministry is currently considering whether, and if so how, to introduce a new programme to promote staff mobility (in both directions) between the HE/research sector and enterprises. A study is currently underway but the expectation is that there is real potential for such a scheme. Success will again require a positive and informed response from the universities:

- there will be practical logistical issue of identifying suitable academic staff
- academic staff will need to be able to contribute effectively to enterprises
- similar schemes elsewhere often involve students and/or graduates. There is a need to ensure that the student learning experience is useful valid and this requires effective supervision by the academic (and enterprise) partner which is informed by an understanding of enterprise requirements.

3 | Tallinn University of Technology

3.1 | Context

Tallinn University of Technology (TUT) has received funding under the SPINNO programme since 2001. From 2001 until 2004 there were three different project managers; although disruptive, the legal bases for contract and collaborative work with industry were established during this period, and significant progress was made in increasing income from commercial partners. The current project manager has been in post since 2004; he feels that this prior period of turbulence actually made his job easier as people were more receptive to new ideas. However, some staff still have a negative opinion of SPINNO because of the early high staff turnover, although this is being mitigated through now having a distinct SPINNO office (the Technology and Innovation Centre, TIC) with its own staff (it was previously located within the R&D department and did not have a clear identity). Half of the staff of the TIC have their first degree in a business-relevant qualification.

The overarching aim of the project within TUT is to grow an entrepreneurial culture. At present the university earns 50% of its total income (from tuition fees and research and contract work), and has a target to increase income by three times over the next six years.

3.2 | Activities under each Activity Field

1. Creation of favourable environment for knowledge transfer and commercialising the results of research and development activities

Given the initial disruption, changes to the support system have only been in place for about twelve months. TUT allocates a significant proportion of the money generated through such activities to those responsible for bringing it in to the university (the proportion depends upon the type of activity). In 2002 the university fixed low overheads for contract research (the university centrally attaches 10%, and the relevant faculty can attach an additional 10% at the discretion of the Dean (prior to 2002, no overhead was charged). This low overhead motivated staff to get involved, and as it is retained by the relevant faculty and not given to the centre, staff have seen a direct impact on the faculty in which they work. In addition, a policy was implemented whereby 33% of any resulting IP belongs to the universities, 33% to the academic, and 33% to the funder.

During the first year of this phase of SPINNO funding, the IP database was updated and began to be actively managed, along with a register of research projects; both of these activities were continued during year two. The TIC was established during the second year (December 2005), along with a competition to identify the best piece of applied research work undertaken at TUT. Faculties mapped their industry-relevant activity, and two seminars were held to discuss creation of a TUT marketing strategy. Five sector development plans have also been created.

SPINNO funding was used to recruit a lawyer with a background in technology transfer and IP, and who had undertaken their graduate studies in the US, and can therefore also bring an international perspective to activities.

2. Raising awareness about the commercialisation of the ideas based on research and development, and about co-operation with enterprises

Managerial staff at TUT believe that all academics are now aware of TIC and its activities, although, as is the case in most institutions, some staff are much more receptive than others; this generally depends on the commercial potential of their subject area. A designated individual is being appointed in each Faculty to take forwards TIC activities; three faculties already have such staff in post, one is about to start, and one further post is currently being advertised. TIC found that academics needed such hands-on support because of the paperwork involved in writing joint project applications, lack of financial forecasting skills within the academic body etc.

Various events have been organised, including:

- 'From Tallinn University of Technology to Entrepreneurs' conference, to publicise commercialisation activities
- two design seminars in 2004–2005 and 2005–2006, in collaboration with EAA and the Swedish Embassy

- two IP conferences in 2004–2005 and 2005–2006, the second in collaboration with Tallinn Technology Park Tehnopol
- academic training, including on project management and copyright.

People who are actively working with companies have generated significant additional income for themselves; doubling their salaries in some cases. This has had a direct impact on the receptiveness of other staff to getting involved in such activities.

3: Providing support services to staff members for commercialisation of knowledge-based business ideas and 4: Commercialisation of competencies, services, cooperation possibilities and intellectual property

TIC staff started marketing its services internally during 2005. It has since moved from a broad marketing approach (general publicity) to spending time with individual academics, taking time to develop personal contacts. Specific training has been provided in business negotiation (46 consultation sessions in 2005–2006); because of a lack of experience, many academics had previously negotiated unfavourable terms and conditions. Training in IP protection has also been provided, and 60 consultation sessions on compiling project applications were given in 2005–2006. Due to limited resources, the SPINNO team chooses to deliver this training to those academics most connected with technology transfer, and also those who are acting in a supporting capacity (faculty administrative staff etc.) as this is more likely to generate sustainability of activities. Every year the TIC runs an event for new university staff, showcasing its activities and the events that it runs, to try and reach all new recruits.

All project applications between private companies or EAS and members of TUT staff must now be registered with TIC, who can help with the application. In particular, TIC staff has been providing assistance with financial projections, patent research, equality and environmental statements, and business consulting.

TIC also offers support for spin-outs in the pre-formation stage. TIC staff consults with the relevant scientist, help with business planning, and identify appropriate sources of finance. However, once a spin-out is registered, little active support is available. There is regular contact between TIC and the Tehnopol, but TIC staff stated that the Tehnopol has yet to demonstrate a positive impact on any spin-out companies placed there.

Nine European trade fairs were attended in 2004–2005, and two in 2005–2006, to publicise TUT opportunities for cooperation. A webpage for science at TUT¹¹ has been set up, to publicise the research and commercialisation activities of the university.

5: Cooperation in the field of knowledge and technology transfer and exchange of experiences with local and international partners

Approximately 30 'agreements in principle' have been established with large enterprises (including Estonian Energy, and transport companies). There have been discussions with these companies as to how TUT can potentially meet their business needs. These agreements are not based around specific pieces of work, but indicate a willingness to partner on both sides.

TUT has started running 'technology fairs' every two years, mainly funded through SPINNO. The most recent, with the theme of 'demand and innovation', was held in spring 2006, and had more than 2000 delegates, including TUT staff, staff from other Estonian universities, technology competence centres, spin-offs, and overseas companies. TUT also organised the BALTECH conference in Tallinn in 2005¹². These fairs have proved a very effective way of telling the outside world about the current research within TUT, and a number of potential partners have come forwards as a result.

A range of marketing activities have been undertaken, including meetings and seminars. Outcome data is currently being collected, and TIC hopes to have this available by autumn 2007. The TIC website is being developed as an R&D marketing site for the university. Marketing materials (primarily CDs) are also now being produced, setting out the R&D opportunities within the university. The Faculty of Chemical and Materials Technology has produced a 'Yearbook of Science and Technology: from science to industry', written with the support of the SPINNO team, which has been sent out to businesses.

¹¹ www.teadus.ttu.ee

¹² www.baltech.info

The amount of industrial income retained by the university is used to fund infrastructure and equipment; university income from industrial activities has increased threefold in recent years, and the reinvestment from this has had a direct impact on the range of services it can offer to companies.

3.3 | Achievements

Summary data on targets and outputs is shown in Table 3.1. The project manager reported that the gap between planned and actual activities was less than 10% in both 2004–2005 and 2005–2006. Income from R&D contracts with businesses was slightly below target in 2005 and 2006, although the actual figure for 2006 represents the position after 10.5 months rather than the full twelve that the target is based on. Income has grown steadily since 2002 and now represents a substantial increase over the 2001 figure when SPINNO funding was first made available to TUT. Patent and licensing activity is also below target, although income from realisation of IP has increased substantially in the last project year; indeed, given that the actual figure only represents six months of activity, the figure at the end of the year is likely to be higher again. The absolute value is, however, low for a University of TUT's size.

2006 actual income from consultation and training services also only represents six months of activity, and even at that stage has exceeded the annual target. Income from analysis and testing services is just under 50% of target, but again this only represents six months of activity. Nine spin-offs have been in existence for three or more years, compared to a target of 18, but the rate of foundation of spin-offs is close to target.

Several large companies have provided funding for embedded laboratories within TUT, including Akzo Nobel and Ericsson. Such potential partners are identified through networks (including industrial associations), web-based databases, and the personal contacts of TIC staff and academic staff. Given the small internal market in Estonia, the most valuable of these is felt to be personal contacts. The SPINNO project offered support at three levels which facilitated partnership activities; staff training, marketing support, and funding to write project bids. SPINNO activities have been further supported by the appointment of a new Rector in 2005, who is very encouraging of commercialisation activity.

Table 3.1 Tallinn University of Technology

	Actual outputs pre-SPINNO 2 (from preliminary application)				Outputs SPINNO 2		
	2001	2002	2003	2004*	2005	2006**	
R&D contracts concluded with businesses	69	99	88	100	90 331	95 131	Target Actual
Income from R&D contracts ('000 EEK)	14,300	27,000	23,100	30,000	29,000 27,479	32,000 28,832	Target Actual
Patents granted	2	5	7	5	5 1	8 1	Target Actual
Licenses granted	n/A	n/A	2	2	2 0	3 1	Target Actual
Income from realisation of IP ('000 EEK)	n/A	n/A	30	35	30 20	50 342	Target Actual
Income from consultation and training services ('000 EEK)	3,800	5,500	7,700	10,000	11,000 5,700	13,000 13,708	Target Actual
Income from analysis and testing services ('000 EEK)	1,936	2,500	4,500	5,000	6,000 5,400	7,000 2,890	Target Actual
Spin-off businesses established	n/A	n/A	9	3	2 2	2 1	Target Actual
Spin-offs existing for 3+ years	n/A	n/A	6	9	14 9	18 9	Target Actual

Source: Actual outputs pre-SPINNO 2 from preliminary application form, target outputs SPINNO 2 from full application, actual outputs SPINNO 2 from project manager.

* figures for 2004 are estimates provided in the initial bids

** figures for 2006 do not represent a full twelve months of activity in most cases – see text

3.4 | Limiting factors

As reported by other institutions, there is still a general lack of understanding on the part of the Estonian business base as to the services that universities can offer, and that services are complex and high-technology based. Many small companies see no need to innovate. This makes it difficult to sell the services and capabilities of TUT to industry.

It was initially very difficult to find good and appropriately skilled staff for the SPINNO team, but the team is now complete.

3.5 | Future plans

The university's development plans (which cover the next seven years) stress the importance of TUT marketing its services to Estonian companies to try to drive up business awareness of the services that universities can offer, and the value of these. This should help create increased demand for knowledge transfer activities and industrial research projects.

ICT, gene technology and biotechnology and materials science are all areas where there has been a significant volume of commercial projects. For the future, there is as-yet unrealised potential in mechanical engineering and chemistry. There has been limited activity in the humanities and economics faculties, and these will be targeted in the future.

The current range of funded activities still meets the university's and scientists' needs in this area. If SPINNO funding stopped, TUT would support some of the activities from internal funds, but solely on a self-financing basis; for example, the technology transfer position within the information technology department has recently become self-sustaining, although attempts to do this in the faculty of mathematics and natural sciences have so far been unsuccessful. The next areas of activity that should become self-financing are project management and some support services; TIC hopes to reach this position in the next round of SPINNO funding. Without further funding, much of the benefits from past expenditure could be lost. The university would not cover the salaries of all the expert technology transfer staff, since this would exceed expected income, and they would leave, taking their knowledge and expertise with them.

4 | Tartu University

4.1 | Context

This project is a partnership between TU, Estonian University of Life Sciences, and Tartu Science Park.

TU is the largest partner and wishes to maintain and consolidate its position as a research-based university but it recognises the importance of practical and applied research. As such, working with industry is a priority for TU and a component of its development plan. A key element of TU's strategy for working with industry is TU Institute of Technology (TUIT) and this has been the main vehicle for implementation of the SPINNO project, which in TUIT has dedicated staff and facilities for undertaking research with and on behalf of businesses. It is also able to draw on administrative and other resources from within TU (see below). The original intention was that TUIT would focus exclusively on research for businesses, but it has subsequently moved into the provision of PhD training; the first 10 PhD students have started at TUIT this academic year (there are 1070 PhD students across the university as a whole.)

4.2 | Activities under each Activity Field

1: Creation of favourable environment for knowledge transfer and commercialising the results of research and development activities

TU claims most of the necessary regulations have been put in place (and it is now advising colleagues, e.g., in Hungary on the basis of this). It has also established licensing and disclosure forms. In 2004–2005, a commitment was made to continuously update the university database of licensing agreements and contracts, and an expert committee has been established to evaluate new ideas and assess potential effectiveness of activities targeted at companies. There are still, however, some areas to address even though TU has received SPINNO funding since 2001. A concrete definition of a spin-out has only just been adopted by the university¹³, and the relationship between the University and any spin-outs remains to be defined. There were proposals to create a holding company for investments in spin-outs but they have not, so far, been implemented, because of the delay in resolving the underlying definitional conflict.

TUIT partners with the TU Faculty of Economics, particularly the Centre for Entrepreneurship within this. The Centre gives courses in writing business plans to students, and also to engineering and scientific staff. It is also developing a Masters programme in Entrepreneurship and Technology Management.

At the University of Life Science (or EAU as it was during the funding period), an analysis of academic and R&D activities has been carried out (in 2004–2005). As a result, various fields of responsibility have been approved.

2: Raising awareness about the commercialisation of the ideas based on research and development, and about co-operation with enterprises and 3: Providing support services to staff members for commercialisation of knowledge-based business ideas

TU has changed its approach since the Warwick University technology transfer training course in February 2006 which was organised by the Ministry and EAS. Previously the aim was to engage with a wide variety of staff but the focus has been now switched to specific projects which are judged to have good potential to generate commercialisable outputs. These are defined as those projects with larger industrial partners, and those in the fields of ICT, materials technology, environmental technology and biomedicine. TUIT has identified more than 200 scientists and is assembling information on IP for FAQ-s, disclosure forms etc. It is also switching from seminars to a personalised and more direct approach (and encouraging regular co-operation). These scientists are also marketed to businesses – TUIT experience has been that better results are achieved when dealing with smaller numbers of (the most relevant) individuals.

¹³ 'a university spin out company is a knowledge and technology intensive company grown out from the University, the owners of which include the university and/or its staff members and the activity of which uses intellectual property developed in the university on the basis of a collaboration contract between the university and the company'

Since 2004, a 'standard package of awareness' relating to commercialisation has been developed, and promoted to the university membership; six seminars were held in 2004–2005. A database of applied research groups at both TU and the Estonian University of Life Sciences has been set up and maintained¹⁴, and SPINNO team staff has received training both abroad, and in Estonia (using experts from Canada, the UK and the US). In addition, a competition for the best invention and the best spin-out company has been set up.

Outside TUIT, and for historic reasons, some academics are continuing to work with industry on a private basis, and not through the university (for some, 40% of their income comes from such work). People have been unwilling to admit to how much of this goes on, although they are becoming more accepting of operating through the university with time. Many faculties have seen sharp growth in contract research, in terms of both number and size of contracts.

4: Commercialisation of competencies, services, cooperation possibilities and intellectual property

The main focus over the last 2–3 years has been to build up research projects in applied areas. The early portfolio was thin, but there are now seven projects and up to twenty expected in the near future. SPINNO money has also been used to provide advice on patents from specialists outside of Estonia, which has impacted on the likely success of applications. 10–15 applications for feasibility grants (patent searches etc.) have been written using SPINNO funds to support the application process.

General marketing materials for both universities have been compiled and circulated to identified entrepreneurs and potential entrepreneurs, along with the 'Novaator' (Innovator) magazine. A competition has been held to identify the 'innovative cooperation partner' and training has been offered to academic scientists at Zernicke Group (Netherlands).

Tartu Science Park felt that it was very useful for TU to have one designated and obvious centre (TUIT) for companies who need consultancy or other R&D support. However, they were concerned about the lack of interest on the part of the University in working with companies on very small projects, and reported a lack of awareness within TU about the financial constraints that businesses operate under. The hope is that this will change as more students and staff starts to work across industry and academia.

Funding for prototype development (which TU believes cannot currently be funded under SPINNO) is considered a problem. TU is seeking around 100–150K per annum and is discussing a deal with a commercialisation company at the moment, about payment in return for disclosure rights. The payment would then be used to support prototype development. TU is, however, cautious about signing away the rights to any IP that comes out of TU research, and the related management of this. The University needs to balance the benefits of obtaining early stage funding against the risks of undervaluing the IP it generates.

5: Cooperation in the field of knowledge and technology transfer and exchange of experiences with local and international partners

There is a strong connection between the university and Tartu Science Park, where a new incubator is now being built (TU is one of the founders of TSP). There are also links with Tartu Biotechnology Park (TBP); the manager of TBP is involved in the new university-led 'drug development centre' (see below). Joint seminars have been organised between TU and the University of Life Sciences in areas where both universities have competencies (e.g. in wood) and approaches to businesses are being coordinated. Both institutions are keen to see these connections strengthen, and the relevant partners around Tartu co-operate as part of a real network.

The core facilities of TUIT are available for use to other universities and to companies, and the institute currently has 51 contracts with industry. The head of Tartu Science Park has a strong industrial background, and TU can tap into his contacts to access many entrepreneurs and businesses within the region. A number of conferences and exchanges on R&D and innovation have been attended (28 in 2004–2005), and the University has become a member of the BEPART project (Baltic Entrepreneurship Partners)¹⁵.

A central objective for TU is to break through and build a reputation of research excellence internationally. Senior staff feels that the key to achieving this is to recruit someone who has experience of industry and technology transfer outside of Estonia, and who is credible in these areas. This person could share their expertise across all the institutions in the Tartu region, the Tartu Science Park etc. and not solely work for TU.

¹⁴ www.tuit.ut.ee/ug

¹⁵ www.bepart.info

4.3 | Achievements

Developing TUIT has been a key part of TU's strategy, and without SPINNO funding, this would have been very hard to launch (SPINNO resources were instrumental in financing the bid preparation). The first phase of SPINNO funding brought TUIT to the 'virtual institution' stage; it has become a concrete institution within the last three years. It was initially founded to solely work with companies, but has since moved to encompass some research and PhD teaching because of examples from elsewhere in Europe showing that up to 60% of research income could be provided by industry-funded research projects.

Working with companies is obviously a priority for TU, and, more widely, is an important part of the university development plan. Activity has increased considerably in the last two to three years, particularly as TUIT has developed a physical presence. As Table 4.1 shows, total income from R&D contracts with businesses was EEK 25.5 million in the last academic year, up from EEK 3.8 million in 2001 when TU first received SPINNO funding. It is also worth noting that the target R&D income for the last academic year was EEK 19.1 million; this has been out-performed by more than 25%.

The university is also building a portfolio of IP arising from its own research. Income from realisation of IP was EEK 1.3 million in 2006, up from EEK 20,000 in 2001, and more than five times more than the total for 2005. There are currently seventeen spin-out companies from TU which have been in existence for three or more years, and a further seven were established in 2006. Licensing activity has increased from one license granted in 2001, to 12 granted in the last academic year (which is three times more than forecast). In addition, four patents were granted last year; however, this is significantly below target (20). Whilst income from consultation and training (EEK 1.8 million) and from analysis and testing services (EEK 1.9 million) has increased steadily since 2001, it is still at very low levels and there should be considerable further potential in this area given the institution's commitment to working with the business community.

SPINNO resources have also provided a means for TU to employ staff who don't solely want to do teaching and research; in the past the university would have had to let these people go, even if they were talented academics, and they would have been lost to the HE sector within Estonia.

Table 4.1 Tartu University

	Actual outputs pre-SPINNO 2 (from preliminary application)				Outputs SPINNO 2		Target
	2001	2002	2003	2004*	2005	2006	
Income from R&D contracts ('000 EEK)	3,828	6,145	7,373	11,000	15,000 25,460	19,100 25,514	Actual
Patents granted	1	1	0	2	2 1	20 4	Actual
Licenses granted	1	1	2	7	3 6	4 12	Actual
Income from realisation of IP ('000 EEK)	20	28	132	250	400 250	750 1300	Actual
Income from consultation and training services ('000 EEK)	300	570	906	1,100	1,960 1,680	2,235 1,770	Actual
Income from analysis and testing services ('000 EEK)	737	914	1,354	1,200	2,000 2,000	2,300 1,918	Actual
Spin-off businesses established	1	2	2	2	3 3	5 7	Actual
Spin-offs existing for 3+ years	6	10	11	12	13 14	15 17	Actual

Source: Actual outputs pre-SPINNO 2 from preliminary application form, target outputs SPINNO 2 from full application, actual outputs SPINNO 2 from project manager.

* figures for 2004 are estimates provided in the initial bids

4.4 | Limiting factors

The specific limitations TU has identified are:

- international expertise as mentioned in paragraph 4.14. The person would provide mentoring, support for writing business plans, marketing training, and links to international contacts. As a result, business plans would be ready to go international from the start, rather than having to rely on a limited home market
- better support for writing business plans, particularly for senior academics rather than students (students can access the 'how to write a business plan' course at the TU Centre for Entrepreneurship)
- the quality of the services that academics provide to businesses also needs to be improved, for example, ensuring academics have more understanding of how industry works and the deadlines it faces. Someone with international experience could also provide training in this area.

The need for international expertise reflects TU's strategy to increase its links with foreign as well as Estonian organisations. We have not assessed current capabilities in this respect but such expertise is necessary if TU is to further internationalise its KT activities. It is clearly not sufficient and the university will also need to demonstrate the required levels of quality and relevance. The last two points are, we believe, important. Senior academics are often unable and unwilling to engage with business planning and expert support in this area can encourage them to become involved as well as leading to better quality projects.

High quality delivery will become more important as the University seeks to broaden the range of companies it works with. We feel that international expertise is less important in relation to this factor. The key requirement is an understanding of Estonian organisations, both their needs and potential opportunities. However, there are obvious advantages if these skills are combined with international experience.

4.5 | Future plans

TU is currently planning to develop a new Faculty of Life Sciences and Technology, to incorporate existing biological and physical sciences faculties and institutes, with TUIT providing commercialisation support. In addition, TU, the University of Life Sciences and the Estonian Biocentre have signed a 'protocol of common interest' for an Estonian Drug Development Centre. Tartu University Clinical has joined the consortium, and an invitation has also been extended to TUT. The plans for the Centre include putting in place infrastructure that is currently lacking at the moment within Estonian, becoming internationally visible, and having a joint centre for R&D development. TUIT will support the Centre in this area.

Currently, although some responsibilities for development of technology transfer have devolved to TUIT, the central administration of TU holds all the records, and the IP and project management portfolios. With the planned future developments at TU, it has yet to be decided whether the new faculties will have their own technology transfer offices or whether one central unit or department of innovation should be formed to take responsibility for technology transfer. This would probably be headed up by a new post of Vice Rector for Innovation. The rationale behind having a separate central unit is that it could take responsibility for the project portfolios and associated IP in various fields (e.g. biomedicine) across the Tartu region.

For the next year, TUIT SPINNO resources will be used to help develop the technology transfer office and associated infrastructure for the proposed new campus of science and technology (which will include new buildings for both chemistry and genetics in the first instance). The SPINNO team will support senior management to push this forwards.

Although TU recognises that its students are very active in working with companies, there is currently no university record of this activity. This information could be collected in the future.

5 | BIOSPINNO

5.1 | Context

The Estonian bio sector has 30–40 companies (including a small number trading equipment to the other firms). Companies employ an average of three or four staff, and total employment in the sector is 170. In addition, there is 300 relevant academic staff across the country, not including in closely related sectors such as IT and agriculture. Although most of the academic staff are located in the institutions around Tartu, most of the more established companies are located in and around Tallinn. Contacts between the companies and the academic sector are strong, not least because many company employees also teach in the universities. In the last few years, universities and research institutions in Estonia have filed 11 new patents; such institutions are much more likely to hold patents than companies, given the relatively small number of companies and their average size, and the early stage of development of the sector in Estonia.

Conversely, although many international scientific firms have offices in Estonia, these tend to bring their own science with them (either through established R&D offices elsewhere, or links with other university research groups). They will therefore not automatically approach Estonian academics; academics need to develop the reputation and strengths to be able to approach the companies.

BIOSPINNO is a sector-facing organisation. It has nine partner organisations and a board of eight, including two business people. One of the partner organisations is a private company (Tartu Biotechnology Park) and other businesses are represented through the biotechnology organisation (essentially a trade association for the sector). It was initially awarded SPINNO funding in 2001; this is the second phase of funding for the organisation. The research budget of BIOSPINNO partners (not businesses) is about EEK 250 million per annum, with EEK 27.5 million of this allocated for technology transfer.

BIOSPINNO is very different from the other projects, specifically:

- it is focused on one sector and links across several research institutes, universities, intermediary organisations and businesses
- it seeks to complement other SPINNO activities, and technology transfer more generally, at TU, TUT and Estonian University of Life Sciences
- its activities have tended to involve businesses to a much higher degree than the other projects, because of the direct representation of businesses on the board.

5.2 | Activities under each Activity Field

1: Creation of favourable environment for knowledge transfer and commercialising the results of research and development activities

In the first year of this phase of funding, activities have included a mapping of the need for biotechnology databases, forwarding international cooperation proposals to more than 30 institutions, and organisation of a small number of biotechnology roundtables for the sector (on a six monthly basis). The sector has become much more tightly networked through the creation of BIOSPINNO, and the BIOSPINNO website.

As with the other projects, the project manager reported that the culture change that has been facilitated through SPINNO has been one of the most valuable activities. It was noted by one consultee that this can take considerable time, because even if an academic becomes interested, it takes them time to finish off their then current research projects to enable them to move into new, more industry-relevant, areas. BIOSPINNO recently undertook a survey of its members which revealed that most now think that generating IP is an important activity. Part of the activity at partner institutions has been focused on developing trust between scientists and the relevant commercialisation units, through operating successful support services.

2: Raising awareness about the commercialisation of the ideas based on research and development, and about co-operation with enterprises

A range of seminars and workshops have been delivered. These include training in development activities delivered to 100 coordinators, mainly through a single large-scale seminar using UK and US consultants. Weekly overviews of biotechnology are now compiled for the sector.

3: Providing support services to staff members for commercialisation of knowledge-based business ideas

Consultancy support has been delivered to more than twenty employees of the Estonian Biocentre in 2004–2005; in the same year, the Institute of Molecular and Cell Biology at Tartu University delivered 400 h of consultancy time, and TUT held three cooperation meetings with Estonian hospitals in the first six months of 2005. Two market research projects for business ideas in agro-biotechnology were also carried out. BIOSPINNO has also supported participation by Estonian enterprises in international fairs and produces the *Estonian Biotech magazine* which provides information on biotech enterprises. Twelve new business ideas have been evaluated by the summer 2006.

4: Commercialisation of competencies, services, cooperation possibilities and intellectual property

The National Institute of Chemical Physics and Biophysics (NICPB) held three seminars for entrepreneurs in 2005, and the University of Life Sciences held seven workshops on cooperation between scientists and companies.

5: Cooperation in the field of knowledge and technology transfer and exchange of experiences with local and international partners

The Estonian Biocentre participated in three cooperation networks in 2005, whilst the TU developed links with technology transfer organisations in the UK, including a two-month internship for one of its staff in the East of England Innovation Relay Centre in Cambridge. The post of external cooperation manager has been created and filled at TUIT. A cooperation agreement was signed in 2005 between Estonian and Canadian biotechnologists for participation in the P3G network. Significant effort has been put into developing international collaborations, through attendance at international meetings and events, study visits to international organisations and technology transfer offices, and the organisation of the International Gene Forum¹⁶, the biggest annual biotechnology event in the Baltic States.

Tartu Biotechnology Park (one of the project partners) runs a project trying to introduce biotechnology to the food and wood sectors in Estonia. The head of the biggest food company in Estonia is involved, and many businesses are interested, although the funds that they have to invest are limited.

It was reported to us that there is a history of competition rather than collaboration between the main institutions in Estonia, particularly TU and TUT. However, the partnership nature of the BIOSPINNO project has facilitated cooperation to evolve between the different partner institutions and organisations. Some examples of this include:

- stimulating mobility of experts to move between institutions within Estonia
- emphasising the importance of developing a common approach and services
- involving more than one BIOSPINNO member in any project
- organising joint seminars and conferences to discuss new ideas and co-operation (e.g. the annual seminar in Jämeda)
- encouraging academics to give guest lectures at other member institutions
- creating a common Drug Development Centre, involving Tartu University, the Estonian Biocentre, and the University of Life Sciences.

5.3 | Achievements

We are unable to present data on targets and actual outputs for BIOSPINNO in the same way as for other projects. The problem arises because it appears that in the bid for SPINNO 2 funds TUT and TU included in their targets all SPINNO related project outputs rather than just those relating to BIOSPINNO. The same was also true of past outputs. The actual outputs for 2005 and 2006, however, were submitted by the BIOSPINNO project manager and relate only to BIOSPINNO activities. This means we cannot compare actual BIOSPINNO outputs with targets since there is no meaningful information on the former.¹⁷ Actual outputs are shown in Table 5.1. Because of the problems associated with the data it is difficult to interpret and know what weight to place on it, but concrete outputs while relative small do show some strong growth between 2005 and 2006.

¹⁶ www.geneforum.ee

¹⁷ We are not clear as to why this problem has arisen, but the actual outputs are many times smaller than the targets as they appear in the original bid..

Table 5.1 BIOSPINNO actual outputs

	2005	2006
Income from R&D contracts ('000 EEK)	3,000	7,423
Patents granted	1	5
Licenses granted	0	1
Income from realisation of IP ('000 EEK)	330	Not Disclosed
Income from consultation and training services ('000 EEK)	880	1,195
Income from analysis and testing services ('000 EEK)	400	1,062
Spin-off businesses established	4	5
Spin-offs existing for 3+ years	9	25

Given the fact that BIOSPINNO is additional and complementary to the Universities own SPINNO programmes it may be difficult to track impacts through concrete commercial impacts. The programme has, however, provided a vehicle for all components of the sector to act together, and for production of group promotional material. Prior to start of the BIOSPINNO project, none of the members (with the exception of Tartu Biotechnology Park) provided specific services to biotechnology enterprises, nor had they specific plans to do so.

More specifically it has enhanced the following:

- Visibility outside and inside Estonia: many relevant Estonian companies and organisations have been able to participate in a range of exhibitions, conferences and seminars, which are felt to have been essential in generating new contacts, creating an international profile, and in prompting members to develop their own marketing plans. The sector in Estonia would not have had access to international events without funding from BIOSPINNO
- Increasing visibility has also helped raise awareness amongst prospective young Estonian entrepreneurs. The Estonian Genome Foundation project now details every week on its webpage what is new in the sector in Estonia, and has an e-mail list of 500. Journalists use extracts from this in the general press, and the biggest Estonian newspaper now has a health slot every couple of weeks with news about the sector, which can also serve to bring potential investors to light. This type of networking project or hub makes it very easy to share information amongst members, and also avoids people sending similar applications to the same funding pots
- Development of international collaborations: there has been a need to collaborate in order to make the sector internationally competitive. BIOSPINNO funds are being used for international awareness raising; one indication of success is the increasingly technical nature of questions coming back from the various international networks that BIOSPINNO is involved in, and which include EuropaBio and ScanBalt
- Development of internal collaborations: scientists at different universities within Estonia are now working together on biotechnology projects, some of which also include staff at Centres of Excellence. Participants are also starting to share R&D equipment with other BIOSPINNO partners, increasing the facilities available tot the group as a whole.

One of the goals of BIOSPINNO is the production of an Estonian Biotechnology Strategy, which the Estonian Biotechnology Association (one of the BIOSPINNO partners) is leading on; there is also representation from entrepreneurs and the public sector. Development started in late 2005, with the document due to be finished by spring 2007. Its main goals are to:

- define the priorities of the sector
- identify institutions responsible for different objectives
- identify relevant financial opportunities for further development of the sector
- officially become part of the Estonian National RD&I Strategy.

Further information on the development of the strategy can be found on the BIOSPINNO website¹⁸.

The project manager considers that it is currently too early to detect real tangible outputs even after five years. But in the last year (2005–2006) there have been 6 biotechnology spin-outs, so activity is ramping up. In addition, the higher education system is now starting to turn out motivated and ambitious young graduates who want to start companies and work for themselves because they have seen success stories both within Estonian and from overseas.

¹⁸ www.biospinno.ee/?a=page&page=443df02b26373212e4540

For small partners, such as the University of Life Sciences, SPINNO funding has enabled them to participate in activities that these partners would not be able to fund themselves, because of very constrained budgets and the otherwise low potential to generate external income.

5.4 | Future plans

BIOSPINNO held a development seminar in May 2006 to discuss the situation post 2007. The outcome was that the network will continue to function, whatever the funding position (there is already a good intranet for the group which facilitates this). The risks of reduced funding are divided between the partner institutions, and these have 1–2 staff each that are likely to be retained because of accumulated knowledge in technology transfer. Delivery of seminars and training could be taken over by the Estonian Genome Foundation and Tartu Biotechnology Park if funding was severely cut. The activities that are likely to suffer the most are visibility and awareness raising. There will be less need for management and co-ordination in the future because of the strong foundations that have been laid.

6 | Tallinn University

6.1 | Context

Tallinn University (TLU) has received SPINNO funding since 2004. Prior to this there was very little knowledge transfer activity in the university. However, a significant minority of staff was (and still are) undertaking independent consultancy work; formalising this through the university has been difficult because of the need for the university to take a cut of any income generated.

The SPINNO team is currently eight people. An initial high staff turnover seriously slowed the rate of progress, and as a result, the university is hoping for an extension to their activity period to December 2007 to enable it to spend the allocated funds.

At the outset it was decided to pilot activities during this funding period in five departments where there was obvious potential for knowledge transfer and commercialisation. These were the Departments of Advertising and Media, Environment, Information Sciences, Management Training, and Recreation and Health Sciences.

6.2 | Activities under each Activity Field

1: Creation of favourable environment for knowledge transfer and commercialising the results of research and development activities

Developing new legislation took twelve months. One member of the SPINNO team researched the regulations in place in other institutions, and from this the university created its own tailored legislation. This has been in place for about a year. The team has tried to limit the amount of bureaucracy involved, to make things as straightforward as possible for the academics.

Because of the prior history of academics working independently with businesses, the university has had to make it as profitable as possible to academics to operate through the university. The financial arrangements now in place are such that the relevant academic retains 80% of the profit, their research unit gets 10% and the university gets 10%. The numbers on the university register of staff active in knowledge transfer have increased since the new legislation was introduced, but this has taken significant effort. The team has tried to promote the credibility benefit to the academics from having their consultancy or testing work 'badged' by the university.

2: Raising awareness about the commercialisation of the ideas based on research and development, and about co-operation with enterprises

The SPINNO team provides advice and information to staff when requested, and also through approaching staff direct; when this happens, staff are asked to join the knowledge transfer register. The team also tries to work through the Deans and Heads of Department as well (although some are more supportive than others). University funds for overseas research trips have been used to motivate staff; six staff have been supported in this way during the last academic year (2005–2006) and there are a number of applications pending.

There have been a number of courses and seminars relating to commercialisation for academic staff, including 'R&D motivation, new ways of funding', and 'R&D effective implementation, self-education and support services'. However, getting attendance at these has been difficult, primarily because of other pressures on academic's time. The 'Tallinn University knowledge and technology transfer strategy' was developed during the first year of funding (2004–2005), along with an internal publication, 'R&D development motivation, R&D efficiency'.

3: Providing support services to staff members for commercialisation of knowledge-based business ideas

The SPINNO team provides support to any academic that approaches them. The team can help put together project teams (which may include other universities, businesses etc.) and can assist with writing applications for funding. The team's main activity so far has been this provision of staff advice and consultancy, on the back of a demand map for support services developed in 2004–2005. Most demand has come from the fields of recreational studies and health sciences, information studies, advertising and media, and e-learning and mobile programming.

4: Commercialisation of competencies, services, cooperation possibilities and intellectual property

The team has dealt with 53 ideas in the last 12 months, some that have been service-related and some possible spin-offs. One spin-off has resulted, and another idea went on to be funded by EAS as a research project. Facilitated by the SPINNO team, several staff are currently in negotiation with businesses about joint projects, including one with the three largest Estonian mobile phone companies to create software for mobile phones that will support the development of the linguistic skills of mobile users. Current active projects include:

- with the Baltic Film and Media School to establish a spin-off company
- with East-Tallinn Central Hospital to initiate an imago profile research project (Department of Advertising and Media)
- with E-School (a private company) to develop programmes (Faculty of Mathematics and Natural Sciences).

5: Cooperation in the field of knowledge and technology transfer and exchange of experiences with local and international partners

Most of the activities so far under this Activity Field relate to raising awareness about what the University can offer to its potential partners. SPINNO staff have visited businesses to explore their needs, and to identify how the university offer currently aligns with these. A marketing portal¹⁹ is being set up to act as a business gateway, but this currently has limited content as a marketing specialist has only recently been recruited to the SPINNO team (18 months was spent in the recruitment process).

One issue of a new marketing bulletin has been produced for each of the five pilot areas, setting out what these can offer to businesses and other relevant organisations. The SPINNO team organised for the Head of the Recreation Department to have a weekly slot for 10 weeks on Estonian radio to speak about recreation and his department, and they recently organised a conference on recreation for companies, which was a first for Estonia. Active networking started in 2004–2005, with 16 visits to relevant organisations and the signing of four cooperation memoranda. In 2005–2006, the university became a member of two European networks (Technology Information and Innovation, and Proton), and it has since used these networks to generate potential partners.

6.3 | Achievements

The first year of activity was focused on changing university regulations and administrative structures. In the second year the SPINNO team has moved on to providing support and advice to academics, and starting to look at developing joint projects with businesses. Table 6.1 shows that income from R&D contracts in 2006 was EEK 2.9 million, which although substantially below target, is significantly more than the EEK 0.3 million earned in this way in the previous year, and the EEK 0.6 million estimated for 2004. There has been a significant growth in income from consultation and training services; this was in excess of EEK 13 million in both 2005 and 2006, up from an average of EEK 83,000 in the three years before SPINNO funding was granted. Income from analysis and testing services, although comparatively a much smaller amount (EEK 0.75 million in 2006), has also increased since 2001. In addition to the obvious increase in revenue, there has also been an increase in the volume of marketing activity to businesses.

Income from realisation of IP in 2006 was EEK 1.4 million, more than twice the target. This increased from EEK 0.5 million the previous year; in 2001 the university received no income from IP at all. However, no new patents or licenses were granted in either 2005 or 2006, a decrease in activity over the four previous years in both cases. There are currently two spin-offs from the University that have been in existence for three or more years, and a further spin-off was founded in 2006.

The most important achievement so far, as reported by senior staff, has been the change of academic minds that has occurred, with staff starting to realise that they cannot operate independently from society. The required changes to university regulations have all been made, and some activities have also become integrated into the mainstream (a number of faculties now have staff within them pushing activities forwards). However, at present activities are only operating within five departments: the Advertising and Media; Environment; Information Sciences, Management Training; and Recreation and Health Sciences.

¹⁹ <http://www.tlu.ee/?CatID=1345&LangID=2>

Table 6.1 Tallinn University

	Actual outputs pre-SPINNO 2 (from preliminary application)				Outputs SPINNO 2		
	2001	2002	2003	2004*	2005	2006	
Income from R&D contracts ('000 EEK)	609	1,124	579	600	1,400 314	4,600 2,945	Target Actual
Patents granted	2	2	2	2	0 0	2 0	Target Actual
Licenses granted	2	3	3	1	0 0	2 0	Target Actual
Income from realisation of IP ('000 EEK)	0	0	300	300	400 472	600 1,393	Target Actual
Income from consultation and training services ('000 EEK)	0	80	85	85	400 13,658	550 13,782	Target Actual
Income from analysis and testing services ('000 EEK)	100	100	210	400	300 780	350 751	Target Actual
Spin-off businesses established	4	4	4	1	1 0	2 1	Target Actual
Spin-offs existing for 3+ years	1	2	2	3	4 2	4 2	Target Actual

Source: Actual outputs pre-SPINNO 2 from preliminary application form, target outputs SPINNO 2 from full application, actual outputs SPINNO 2 from project manager.

* figures for 2004 are estimates provided in the initial bids

There has also been some activity focused on students, including the development of an entrepreneurship course (which is run from January to May). Students have also been involved in contract research projects as team members, with academic staff acting as supervisors.

6.4 | Limiting factors

Spreading information within the institution has been difficult; until relatively recently there was no staff e-mail list and there is no intranet. As a result, some staff are probably still completely unaware of SPINNO activities. Around 50% of staff currently undertake no knowledge transfer activity at all, and have displayed limited interest in doing so.

It is difficult to market research projects to companies because of a perceived financial risk on the part of the company. Generating contacts has proved difficult, particularly because the university and the team had limited experience in this area. In terms of providing training to companies, the SPINNO team at the university perceives that the marketplace in Estonia is quite crowded, and their understanding is that Estonian-based businesses often source training from outside of Estonia.

Finding the right staff for the SPINNO team has also been difficult.

6.5 | Future plans

The team is currently examining how successful activities have been in each of the five pilot departments before decisions are made about how to proceed. Over the next 12 months they hope to continue adding to the register, to offer more support services to academics to initiate new collaborative projects, and to increase the numbers of contacts with businesses. The initiation of discussion groups including both academics and businesses has been suggested. The university also hopes to set up an alumni co-operation policy, as their alumni are a potential but currently untapped source of links to companies in a range of sectors.

Tallinn University has just finalised its development plan for 2006–2010, which includes a set of indicators closely based on the SPINNO indicators, which are now central to the university's strategic goals. One target in the new university development plan is to raise commercial income across the university by three times by 2010, and SPINNO projects should be a key mechanism in meeting this. The main policy statement of the university now includes a 'responsibility' for the university to act according to the needs of society, and it will be helped in this respect through SPINNO projects.

The university doesn't expect SPINNO activities to become self-financing for at least five years. If there was no further SPINNO funding, the university would probably continue to cover the salaries of those SPINNO staff that are embedded within departments. But there would be reprioritisation away from projects that contain knowledge transfer, back to pure research. It would also be difficult to continue trying to generate contacts with the business community.

7 | Estonian Academy of Arts

7.1 | Context

Prior to receiving SPINNO funding, the Estonian Academy of Arts (EAA) was planning to set up a Centre to support innovation within the Design Department: the Design Innovation Centre (DIC). A Director was recruited, which coincided with the 2004 call for SPINNO funding applications from Enterprise Estonia. A successful bid enabled the DIC to recruit additional staff, and start to develop activities.

The team spent some time initially mapping existing activity within EAA. Staff visited all 34 departments over 3–4 months, and held meetings with Heads of Department. These visits and meetings generated a list of ideas, needs and wishes which were used to develop an action plan for DIC activities.

7.2 | Activities under each Activity Field

1: Creation of favourable environment for knowledge transfer and commercialising the results of research and development activities

A lawyer was hired to the DIC team in 2005 to review the IP and supporting regulations then in place in EAA, and compare these with the position in other universities (within and outside Estonia). From this exercise, new university regulations were worked up, and new staff and student contracts developed. The lawyer is also accessible to staff and students to deal with any queries they have around knowledge transfer and commercialisation.

An online helpdesk for entrepreneurial activities was developed from the first year of funding and went live in 2006. 1000 brochures on intellectual property were produced, and distributed across the Academy.

2: Raising awareness about the commercialisation of ideas based on research and development, and about co-operation possibilities with enterprises

A mapping exercise identified that a significant number of staff were already working with companies, but on a private basis outside of EAA. As such, efforts have been put into demonstrating the benefits to the partners in such projects of working formally through EAA, rather than outside of it. One member of the SPINNO team has identified how the different partners within a project can benefit one another, and this has been used to raise awareness amongst staff, students, and companies.

Entrepreneurship days have been organised within individual departments, where EAA graduates in relevant fields, who are either successful in their own business or within a company, or who have experience of failure, are invited to attend and share their experiences. Twice a year the DIC runs seminars that are open to all staff and students. The lawyer on the team also runs courses for students; some departments (graphic design, product design) have made it compulsory for their students to attend these intellectual property courses, and the students get credit for attending. The fashion department has made an entrepreneurship course compulsory for its MA students, and the department funds provision of the course.

Increasing numbers of staff have become engaged with the work of the DIC as positive results have been generated.

3: Providing support services to staff members for commercialisation of knowledge-based business ideas

When the DIC was set up, the project manager found that many of the funding applications being written by EAA academics were of relatively poor quality, and were often not to the most appropriate sources. As a result, they instigated a programme of providing tailored one-to-one advice to staff on how to write research project funding applications, and where to apply to. From these discussions, an interest in undertaking larger scale projects was identified; four successful applications for structural funds have resulted, written by the SPINNO team:

- 'Design Year 2006–2007': EEK 1.4 million, executed by the DIC and others across EAA
- 'wearable technology': EEK 3.9 million, executed by the product and textile design departments
- 'animation curricula': EEK 4.2 million, executed by the media faculty
- 'life-long learning in arts': EEK 5.7 million, executed by the Open Academy.

A further two bids from structural funds are in preparation. The DIC is also executing two separate projects with funding from external sources:

- 'Nordic-Baltic innovation platform: EEK 400,000, funded by the Nordic Innovation Council
- 'e-Craft Idea Tutor', an e-learning portal for students applying manual skills: EEK 200,000, funded by the Leonardo da Vinci Programme.

4: Commercialisation of competencies, services, cooperation possibilities and intellectual property

In the first year of funding, the following were published and distributed to the business community:

- 2000 copies of a publication introducing the DIC and the commercialisation services it offers
- a publication on the Department of Glass and Metalwork
- a book '22+ young Estonian artists'
- the first edition of the EAA newsletter.

Last year (2005) for the first time a catalogue of graduates was produced, with information about their work and their contact details. Three thousand copies were printed, and half of these were sent to companies. Based on the catalogue, the SPINNO team is starting to systemise the information EAA holds on its graduates; a searchable database should be available for companies from October 2006.

5: Cooperation in the field of knowledge and technology transfer and exchange of experiences with local and international partners

There are a limited number of companies within Estonia that require the services of EAA staff and graduates, which is why the DIC has tended to focus until now on those companies that already have links with members of EAA staff. However, a number of activities have been run to increase awareness amongst the business community more broadly. For example, from October 2006 EAA, through the DIC, is running a year of design to publicise to Estonian companies why design is important, and to let them know there is a creative workforce in Estonia that can be tapped into.

The DIC has run a series of seminars ('Future Sense'), targeted at companies, to educate them about the creative workforce within Estonia. Feedback from the three seminars held so far has highlighted that Estonian companies are interested in more information on design and what designers can offer to companies. As a result, the DIC is working on a three hour seminar that it can offer to companies; this will be taken to each of the 14 regions of Estonia as part of the Year of Design

From the activities held, companies are starting to contact the DIC with ideas, looking for contact information for designers. At present the DIC is receiving one such enquiry a week. SPINNO funding has also enabled staff and students to attend international design fairs and make contacts with companies outside of Estonia.

There is some contact with the various Estonian business incubators, but to date EAA has only produced one incubator tenant (a jewellery artist). There have been discussions with Tehnopol, resulting in the joint creation of a workshop/seminar, ABC Design. Although there are good links with other Estonian universities, there have been no joint projects to date; EAA is currently in discussion with the robotics department in Tartu University over one possible joint project. Tallinn IT College is a partner in the EU structural funds project 'wearable technology' (see above).

7.3 | Achievements

Almost all proposed activities in the initial application have been accomplished; with a year of funding left the team is looking at taking on additional activities. There is a common approach, and a strong team in place to push things forwards. Table 7.1 shows targets and outputs achieved.

In terms of intellectual property, although income from IP was zero in 2005 and 2006 compared with EEK 3.5 million in both the previous two years, three new patents have been granted since SPINNO funding was made available. Income from consultation and training services rose substantially, from zero up until 2005, to EEK 0.9 million in 2006, and well above target. However, income from analysis and testing services, and income from R&D contracts has been zero in the last two years. The latter was only given a low target in plans reflecting the nature of the Academies activities.

Table 7.1 Estonian Academy of Arts

	Actual outputs pre-SPINNO 2 (from preliminary application)				Outputs SPINNO 2		
	2001	2002	2003	2004*	2005	2006	
Income from R&D contracts ('000 EEK)	0	0	0	25	30 0	50 0	Target Actual
Patents granted	0	0	0	1	1 1	3 2	Target Actual
Licenses granted	0	0	0	0	1 0	2 0	Target Actual
Income from realisation of IP ('000 EEK)	2,759	2,667	3,853	3,568	5,000 0	5,500 0	Target Actual
Income from consultation and training services ('000 EEK)	0	0	0	0	20 0	30 899	Target Actual
Income from analysis and testing services ('000 EEK)	638	664	831	850	900 0	950 0	Target Actual
Spin-off businesses established	0	1	0	1	1 0	1 0	Target Actual
Spin-offs existing for 3+ years	0	0	0	0	1 1	1 1	Target Actual

Source: Actual outputs pre-SPINNO 2 from preliminary application form, target outputs SPINNO 2 from full application, actual outputs SPINNO 2 from project manager.

* figures for 2004 are estimates provided in the initial bids

Although quantifiable impacts have therefore been low to date, a significant impact has been reported on EAA students. A seminar on the benefits of contacts and networking has increased student mobility; students are now more aware of the benefits and the importance of being part of international networks. A programme has been developed to enable EAA students and new graduates to undertake internships of up to one year in companies across the EU; SPINNO funding was used as leverage to prepare the bid to structural funds for this, and there is currently another application pending for a similar programme with Estonian companies.

More generally, SPINNO has been very positive in raising awareness about the economics and process of running a business for both staff and students; before SPINNO students in particular didn't see the relevance of such things, even though most end up self-employed. Raising economic awareness amongst staff is even reported to have had a positive impact on the financial management of departments!

7.4 | Limiting factors

EAA employs large numbers of part-time staff, many of whom probably still know very little about the DIC and what it does.

Commercialisation and knowledge transfer may never become a major income source for the EAA, as the market for design rights within Estonia in particular is limited.

7.5 | Future plans

EAA is starting to have commercial credibility, but needs to maintain visible activity levels to sustain this.

DIC plans to broaden its activities to reach all the creative industries in Estonia, not just those connected with EAA. The team is currently preparing a paper for Enterprise Estonia with suggestions about the needs of businesses in the creative industries, and how EAA and others can provide solutions to these.

The Academy needs to ensure that its students and graduates are sufficiently trained to meet the rising expectations of the companies that are starting to approach the DIC. One stage in this will be taking forwards the internship projects. DIC is also setting up a helpdesk for students, to help with any business-related enquiries they might have.

8 | Estonian Maritime Academy

8.1 | Context

The Estonian Maritime Academy (EMA) is a small institution, whose aim is to apply maritime knowledge in practical settings. Graduates tend to go straight into jobs in the maritime industry, and as a result, a key focus is teaching and the provision of necessary practical skills. Until recently, EMA undertook no research, and there was no knowledge transfer or commercialisation infrastructure. SPINNO money received since 2004 has been used to develop this infrastructure, and to drive the necessary changes to staff thinking.

8.2 | Activities under each Activity Field

1: Creation of favourable environment for knowledge transfer and commercialising the results of research and development activities

Many of the required administrative and legislative changes have now been implemented. It took 12 months to push staff contract changes through the EMA Board: one third of staff time is now allocated to paid R&D work (with one third for teaching and the remaining third for administration). Following the adoption of the new contracts, the material payment system was reformulated, and contract negotiation and project management systems introduced, along with a price list for internal services. All of these were totally new to the institution. A PhD student employed by EMA (and jointly supervised by Tartu and Warwick universities) is looking at models of commercialisation within English and other universities, how legal structures facilitate technology transfer, and how such structures could be implemented in Estonia and in particular in EMA. A web portal for EMA has been set up, making information more accessible to staff, students and potential partners.

EMA is currently a government institute, and as such is unable to hold shares in any company. It has been promised that this status will be changed to allow it to take an equity stake in any spin-out it generates, which will be highly beneficial. Staff at EMA attributes this change primarily to the SPINNO programme.

2: Raising awareness about the commercialisation of ideas based on research and development, and about co-operation possibilities with enterprises

A number of seminars have been held to publicise the results of projects undertaken between EMA staff and industry, and the experiences gained from these, and staff training has been organised on R&D commercialisation and copyright. One joint seminar was undertaken in 2005 with the Tartu University, discussing how SPINNO activities were being carried out in both institutions; a further joint seminar on spin-off development was held in 2006 and involved the Tartu University and EAA.

Staff attitudes to commercialisation are changing, and SPINNO activities have been crucial in this. For example, having seen the potential benefits, staff in the Engineering Faculty now want to create a new academic centre for industrial research in heating and cooling.

3 & 4: Providing support services to staff members for commercialisation of knowledge-based business ideas, and Commercialisation of competencies, services, cooperation possibilities and intellectual property

EMA plans to develop spin-outs through its R&D Centre (see below) using the templates from the Warwick Ventures training course. One student/staff spin-out was launched last year, and was successful in attracting EEK 98,000 of start-up funding from Tallinn City Enterprise Board; their business plan was developed in conjunction with SPINNO staff. The statute, foundation agreement and budget for the Estonian Short Sea Shipping Promotion Centre were agreed in 2004–2005.

In 2004–2005, a study of the market know-how held within the Academy was carried out. This specified eleven fields of activity where Academy staff is well-placed to deliver services and provide consultancy and training to industry. As a result of this, three seminars were held in 2005 for maritime and other relevant companies to introduce the competencies of the Academy to them, eight bilateral meetings have been held with companies, and two publications have been produced. In 2005–2006 a seminar was held for logistics companies, twelve bilateral meetings have been held with companies, and two publications have been produced for industry.

5: Cooperation in the field of knowledge and technology transfer and exchange of experiences with local and international partners

The Academy now has a functioning R&D Centre, which acts as a gateway for companies requiring contract research. The Centre has two staff, which manages the contract process and put together a relevant research team. The staff also has responsibility for identifying potential commercial partners worldwide. The Estonian Ship Owners Association has recently located within the Centre, and it can feed information on industry direct to centre staff. EMA aims that the Centre will be financially sustainable within 3–5 years, and envisages that once fully operational, it could support up to 40–50 academic staff undertaking research projects in conjunction with industry. SPINNO activities are supporting the development of the Centre through raising the profile and reputation of EMA with industry, developing joint projects etc.

In Spring 2006 EMA ran a conference on 'Estonia as a sea state'. There were 120 participants from 72 maritime cluster companies. 12 enquiries about partnering with the academy were received subsequently. Partnerships are also being sought with Government departments and agencies; the Ministry of Defence has recently contracted EMA to educate military navigators on its behalf.

EMA is currently developing a new campus on the sea (scheduled for completion in 2009), adjacent to a working shipyard. Negotiations have already started with the owners of the shipyard on the potential for joint projects where EMA can provide R&D. EMA has also had enquiries from Finland about the new facilities; few maritime research facilities are located so close to the shore.

The SPINNO team is concluding an investigation into cluster development in the Estonian maritime sector, which will identify potential partners and avenues for action. This will require industry support to take forwards, but other SPINNO activities will make it more likely that this happens as they demonstrate EMA is a credible industrial partner. A framework agreement on cooperation has been signed between EMA and TUT, and there are now good links with TUT Marine Systems Institute, and TU Marine Institute. Outside of Estonia, visits have been undertaken to the Centre of Marine Education at the University of Turku and the Latvian Maritime Academy, and contacts established with the University of Newcastle. EMA has also participated in the creation of the technology platform in the EU WATERBORNE project.

8.3 | Achievements

EMA now has a coherent vision for commercialisation activities. Increasing numbers of contacts have been made with companies and other organisations are currently four projects and one contract running enterprise involvement. Table 8.1 shows that income from R&D contracts and analysis and testing services reached EEK 280,000 in 2005 and EEK 140,000 in 2006; however, this is a reduction in the amount generated in each of the two years pre-SPINNO funds. SPINNO is reported to have come along at the right time for EMA; staff had realised the necessity of developing this type of activity if the institution itself was to develop.

As yet there has been no income from the realisation of intellectual property, although one license has been granted. Given that EMA has no history in this area, it will undoubtedly take time for activity to be generated, and revenue earned as a result. However, income from consultation and training services has increased from zero in 2004 to EEK 2.9 million in 2006.

Some of the activities undertaken have provided a 'window to Europe' which was previously lacking, but which is immensely valuable in keeping up with research and development trends within the sector. Activities have also had an impact on teaching. Partnerships developed through SPINNO are having a positive effect, through providing access to up-to-date information about technology developments and 'where the world is going'. One valuable result of the seminars has been the bringing together of staff and students who are interested in working with industry to engage in joint discussion.

At the start of 2006 EMA was awarded accreditation to provide its first Masters-level course (with the first intake scheduled for Sept 2006). This was indirectly facilitated by SPINNO as the driver for research activities within the institution, which increased the numbers of research-active staff to the numbers required to run such programmes. EMA now hopes to develop a PhD programme, initially in conjunction with other Estonian universities. It is hoped that SPINNO activities will also enable the Academy to increase its number of research specialists.

Table 8.1 Estonian Maritime Academy

	Actual outputs pre-SPINNO 2 (from preliminary application)				Outputs SPINNO 2		
	2001	2002	2003	2004*	2005	2006	
Income from R&D contracts ('000 EEK)**	267	255	300	800	200 280	400 140	Target Actual
Patents granted	0	0	0	0	0 0	0 0	Target Actual
Licenses granted	0	0	0	0	0 0	1 1	Target Actual
Income from realisation of IP ('000 EEK)	0	0	0	0	0 0	0 0	Target Actual
Income from consultation and training services ('000 EEK)	0	12	0	0	500 1,227	1,000 2,909	Target Actual
Spin-off businesses established	0	0	0	0	0 0	0 1	Target Actual
Spin-offs existing for 3+ years	0	0	0	0	0 0	0 0	Target Actual

Source: Actual outputs pre-SPINNO 2 from preliminary application form, target outputs SPINNO 2 from full application, actual outputs SPINNO 2 from project manager.

* figures for 2004 are estimates provided in the initial bids

** includes .Income from analysis and testing services rendered to businesses

8.4 | Limiting factors

Due to senior level resistance, the project has not proceeded as quickly as staff had hoped. However, a change in leadership in early 2006 has significantly improved progress.

8.5 | Future plans

The priority for the foreseeable future is to continue to develop existing activities; these still require time and resources given the low starting point and the relatively short amount of time that the changes have been in place for. EMA also now needs to work to develop partnerships, and to generate income from these. It is important to look for partners beyond the maritime sector; to this end, first negotiations have been held with Skype about how their technology could be used within the maritime sector.

EMA is hoping that some of the upcoming commercial projects can provide practical examples of the types of benefits that these partnerships can produce. These can then be used as marketing material, increasing the credibility of EMA as a partner.

In parallel to activities funded under SPINNO, and in order to support its new research agenda, the Academy is starting to develop a cadre of new research staff. This should increase receptiveness and demand for SPINNO-type activities amongst the staff.

If funding were to stop in 2007, EMA has no resources of its own to fund such activities, and the likelihood is that they would stop.

9 | Tallinn College of Engineering

9.1 | Context

Although TCE was founded in the 1940's, it has only provided higher education since 1992. Until relatively recently, staff were primarily involved in teaching and did not undertake research. Some student projects involved an industrial partner, but such activities were peripheral, and not seen as being of great importance for the College. More recently, the importance of both research and industrial-related activity has been recognised within the College, but it is difficult to promote such activities because the College does not receive Government funding for research, and resources are therefore very limited; in order to be eligible for co-funding under the R&D Financing Programme, an institution needs to be in the official register of R&D performing institutions (run by the Ministry of Education and Research), which Tallinn College of Engineering is not.

SPINNO funding, awarded since 2004, has been instrumental in developing research and industry-related activity within the College. However, there have been significant problems. Since inception there have been three project managers; the current project manager took up the post in January 2006 and had to start from scratch as limited progress had been made by the previous post-holders. As a result, activities have only really started within the last six months.

9.2 | Activities under each Activity Field

1: Creation of favourable environment for knowledge transfer and commercialising the results of research and development activities

The main initial priority has been to put in place supportive administrative regulations. There is now financial motivation for staff to get involved in such activity; staff now receives 64% of the income generated from any IP, or 10% of the contract value in the case of an R&D contract with an industrial partner. Prior to SPINNO, staff were not financially rewarded for working with companies.

The next step is an appropriate quality control system, which will be in place by the end of 2006. This will ensure the quality of research collaborations and applications for joint projects with industry, and will be overseen by the technology transfer staff. Also, staff currently does not have dedicated time within their contracts to undertake research; however, under the TCE Development Plan 2006–2010, staff will have an allowance for research within their contracts, which will be increased year-on-year over the four year period (from 2007).

In the first year of funding a questionnaire was sent to 34 companies to assess industry interest in innovation, but only four responded. However, as a result of the survey, TCE signed a cooperation agreement with Tallinn Environmental Board.

2: Raising awareness about the commercialisation of ideas based on research and development, and about co-operation possibilities with enterprises

This has been difficult given the low starting point; only six staff was involved in commercial research activities prior to the start of SPINNO. There are now thirteen. However, most members of staff still only want to teach. Changing minds and attitudes has been very difficult, having to be gone through with each member of staff. Each faculty now has a designated 'faculty representative' who work to raise awareness within their faculty, and who have responsibility for developing company contacts and industrial projects within that faculty. The SPINNO team has also run a small number of staff seminars; in 2004–2005 there were nine seminars on business planning, three on intellectual property, and five on opportunities in environmental technology.

3: Providing support services to staff members for commercialisation of knowledge-based business ideas and 4: Commercialisation of competencies, services, cooperation possibilities and intellectual property

Activities under these fields have been limited given the lack of research activity within the college at the start of the project. However, as a result of SPINNO, there has been a successful funding bid by staff for a joint research project between the College, the Ministry of Economic Affairs, the Architectural Union, Tallinn University of Technology and a construction company, looking at environmentally sustainable renovation. The hope is that this will serve as a flagship project for the College, and will lead to follow-on work in this area.

Thirty-two hours of consultancy relating to intellectual property was provided to staff in 2004–2005 (in 19 separate sessions).

5: Cooperation in the field of knowledge and technology transfer and exchange of experiences with local and international partners

SPINNO staff has visited a number of Estonian counties to meet with the industrial base there, and to introduce the skills and services that the College can offer. A newsletter is also sent out twice a year to the College's business partners, and other companies based on the content of the articles. This outlines the College's services and the resources available.

These and other activities are starting to raise company awareness and understanding; small companies are beginning to see the benefits of contracting out research and not trying to do everything in house. Two companies have approached the College to help them with expansion plans (factory design, plant installation etc.), understanding that this is the College's area of expertise.

A number of academic staff have attended international conferences elsewhere in Europe, including from the faculties of construction (innovation conference in Helsinki), transport (logistics fair in Munich), mechanics (technology transfer conference in Helsinki), and architecture (field study visit to Latvia).

9.3 | Achievements

Progress so far is reported as being significant from an internal perspective, even if there are limited tangible impacts. (Table 9.1). There has been a real shift in mindset amongst the teaching staff, with staff now aware of the benefits, both financial and otherwise, that come from engaging with industry. There have also been a small but growing number of projects with companies (currently six), particularly within the Construction Faculty, and facilitated by the current economic conditions in Estonia. The Faculty of Environmental Engineering is also starting to show positive results; academics from this faculty are currently working on a water system project in Mexico with a German company. The Mechanics Faculty is increasing its research activity, and starting to set out how it can meet identified industry requirements. Although most of the commercial projects to date have been for consultancy-type activities; the College is using this first step to try to introduce other potential areas for joint working. More generally, experience of working with companies is growing amongst College staff.

There has also been a positive impact upon teaching at the College; undertaking commercial projects has enabled those staff to use practical examples in their lectures, which makes the content more relevant for the students, and enthuses them as they are not just being taught from a textbook. As more staff undertakes these types of projects, the impact on teaching will be increased.

9.4 | Limiting factors

Companies in relevant sectors have limited budgets to undertake projects with the College. Sometimes, even if a company approaches the College with a potential project, the institution itself is unable to help because of its limited history in undertaking R&D. There is an associated shortage of top-level researchers and equipment within the College which limits the number of projects that can be undertaken. This is one of the reasons why consultation and training targets have been met but there has been underachievement on R&D contracts during the current year. Our view, based on experience of similar institutions elsewhere in the EU, is that TCE's comparative advantage is in the provision of training, analysis and testing and probably consultancy services rather than R&D where other HEI-s in Estonia have long established capabilities and indeed some track record. This is supported by the output data which shows that consultancy and training targets have been comfortably exceeded (although there is a significant shortfall on analysis and testing).

9.5 | Future plans

Estonian companies are having to find new ways to increase competitiveness and productivity, and are starting to realise that one way to do this is through using technology. This should drive an increase in the number of companies willing to work with the College on joint projects. A dedicated College webpage that businesses can use to find out about the services on offer is being planned. The College hopes to establish a dedicated technology transfer centre by June 2007, which will employ two staff initially (including the SPINNO project manager). This is projected to be profitable within five years of establishment, although this will depend upon a significant increase in the number of commercial contracts taken on by the College (perhaps by as much as four times), and will only really be possible if the College looks to international as well as national companies for partnering.

The College currently provides testing services for industry (there are mechanical, environmental, transport and construction testing facilities); in addition to R&D projects, it hopes to increase this type of work, and start to offer company training courses.

Each faculty directly controls its own budget, so the staff should directly see the benefits of any commercialisation activity undertaken within their faculty. This has already happened within the Construction Faculty where there has been most activity; this is starting to raise interest from staff in the other faculties.

As the numbers of industrial projects increases, the hope is to get students involved. This will give them direct practical experience of working with companies, and lead to better skilled and higher quality graduates.

Senior staff within the College is aware of the potential for SPINNO-type activities to generate significant returns, and are committed to taking these forwards. However, without further funding, existing activities would stop: they are not sufficiently embedded within the College at present, and are not yet generating significant returns. The faculty representatives were recruited from amongst the full-time lecturing staff, and would revert to these posts.

Table 9.1 Tallinn College of Engineering

	Actual outputs pre-SPINNO 2 (from preliminary application)				Outputs SPINNO 2		
	2001	2002	2003	2004*	2005	2006	
Income from R&D contracts ('000 EEK)	100	150	150	580	550 575	750 300	Target Actual
Patents granted	0	0	0	0	0 0	0 1	Target Actual
Licenses granted	0	0	0	0	0 0	1 0	Target Actual
Income from realisation of IP ('000 EEK)	0	0	0	0	0 135	500 150	Target Actual
Income from consultation and training services ('000 EEK)	0	0	40	85	1,200 2,400	1,700 2,600	Target Actual
Income from analysis and testing services ('000 EEK)	40	50	450	500	600 0	700 100	Target Actual
Spin-off businesses established	0	0	0	0	0 0	0 1	Target Actual
Spin-offs existing for 3+ years	0	0	0	0	0 0	0 0	Target Actual

Source: Actual outputs pre-SPINNO 2 from preliminary application form, target outputs SPINNO 2 from full application, actual outputs SPINNO 2 from project manager.

* figures for 2004 are estimates provided in the initial bids

10 | Conclusions and recommendations

10.1 | Conclusions

10.1.1 | Efficiency: management of the activities

This section first considers programme management by EAS and then project management by the individual institutions. It concludes with some specific comments on BIOSPINNO.

Enterprise Estonia

EAS has maintained close relationships with the projects, both to keep itself informed of progress and also to provide advice and assistance where needed. In February 2006 EAS organised, with the Ministry (which provided most of the funding) a 5-day technology transfer training course for SPINNO staff delivered by Warwick University which was widely thought to be valuable. Discussions with the projects indicated that EAS has discharged its management role effectively. Personal contacts are good and EAS has responded well to requests for information and guidance. It has also helped to develop networking between the different SPINNO projects. EAS has fulfilled these management responsibilities with few staff resources and these resources are currently devoting substantial time to collecting and collating administrative information on the projects in order to meet perceived requirements of the Ministry of Finance and EU structural funds.

There are, however, some issues which need to be addressed in relation to programme management. The first concerns reporting requirements for institutions which have received funds. There is almost universal dissatisfaction with reporting arrangements at present. The main issue concerns auditing expenditure. All projects recognise the need to account for the use of public funds but the process seems to entail three 'audits' of the same activities: an internal audit by the HEI or RI; an external audit; and a further check by EAS. The last two stages require detailed evidence of expenditures to be produced, which itself places an onerous burden on institutions. We have not explored the reasons for these procedures in any detail but we understand they arise from the need to account for the use of EU structural funds and the (related) rules imposed by the Ministry of Finance. It is, however, unclear whether EAS needs to interpret these rules in the way it does at present with the resulting burden that this imposes on the projects.

The second issue concerns the monitoring of projects. SPINNO activities are, by their nature, complex. Institutions cannot be expected to predict outputs in advance with any certainty and they need flexibility to adjust activities in the light of experience and emerging opportunities to transfer knowledge to enterprises. This means that project plans may not be followed exactly for good reasons. There are two broad responses to this: institutions can be provided with grants and left to use these as they deem most appropriate, provided they are spent on eligible SPINNO activities; alternatively the projects can be monitored regularly to check that activities and outputs are in line with expectations and commensurate with funding. If Structural Funds are to be used to support SPINNO then there is effectively a need for continuous monitoring (and end of programme evaluation) since this is an EU requirement. At present this is achieved through annual reporting by projects largely in terms of activities and performance against targets set at the beginning of the project. This is a necessary process but we are not confident that it is sufficient to provide EAS with the information it needs to judge progress. Our view is that this requires a closer dialogue between EAS and the institutions than at present, so that EAS staff is able to make well-informed judgements on progress and achievements. The knowledge transfer process is too complex for metrics to substitute for dialogue and individual understanding. This is not intended as a criticism of SPINNO management staff who, in our judgment, have real insights into some aspects of the projects. They do not at present, however, have sufficient time to engage with the projects in the way we think necessary given the resources available and the administrative tasks they are required to fulfil.

This issue is also related to the way in which proposals were submitted and assessed. EAS did engage with the bidders prior to submission but our understanding is that this was mainly to ensure aims, objectives and eligibility criteria were properly understood. This was essential, but given the small number of projects there was scope to discuss in some detail what the project was trying to achieve and by what means and from such a discussion it would have been possible to develop more meaningful monitoring criteria and metrics. In the event, all projects are reporting against the same indicators even though their strategies and starting points differ. We recognise that EAS's scope to adapt its approach was limited since the decision on funding proposals was limited to rejection or fully fund as submitted; i.e. there was no possibility to suggest changes in activities, funding levels or targets.

Related to the last point, institutions were required to submit proposals under five “activity fields” and report progress against these fields²⁰. In practice there is substantial overlap in aims and activities between the fields and this gave rise to some difficulties at proposal appraisal stage and have also created reporting difficulties, in particular for the larger projects.

Institutional management

This section presents conclusions on overall programme performance. So far as we are able to judge from the indicators available this has been satisfactory in terms of achieving planned targets and activities although there are important differences between projects. However, we would make some specific comments about institutional management.

First, much effort has been devoted to establishing rules and regulations governing academic staff working with enterprises (“the legal framework”). Much has been achieved in this respect but we do consider that the time taken has been excessive in some cases, especially for those institutions which have received SPINNO funding since 2001. The issues are complex and the governance structure of some HEI-s makes it difficult to achieve change when there is resistance from influential parts of the academic body. However, the legal framework is fundamental to successful knowledge transfer, and some SPINNO participants are also small institutions and we consider that senior management should have attached a higher priority to ensuring changes were introduced sooner.

The second point concerns recruitment and retention of knowledge transfer staff. As the previous chapters revealed, several of the projects had difficulty in recruiting appropriate staff and some have also suffered from high turnover rates. This is one of the reasons why only slow progress on the legal framework was made. Again we recognise the difficulties of finding appropriate recruits. They are in short supply and the universities are in competition with the private sector for the skills such staff has. Nevertheless, we believe that better results would have been obtained if senior management had attached higher priority to the SPINNO programme, either through offering more competitive salaries or by assigning more existing managers to SPINNO, and providing them with the support they would require. The numbers of individuals working in the ‘technology transfer’ office may be indicative of the problems faced. It is very difficult to make comparisons because institutions differ in other respects and we do not have any detailed information on individual responsibilities. However, our impression is that the number of technology transfer staff supported by the SPINNO programme is significantly higher than we would expect to find in institutions of a similar scale in many other members states.

Programme management also has a responsibility in this respect. The preliminary applications submitted in mid 2004 indicated that institutions were planning to expand significantly the number of knowledge transfer staff and it was recognised that projects were likely to face recruitment problems. It might therefore have been cost-effective to organise training for staff in 2004, and on a larger scale, rather than (or as well as) the Warwick University course in 2006. Individual institutions, of course, have staff development obligations, but in this instance central organisation and provision may have benefited from economies of scale.

The third point on management concerns the extent to which SPINNO funds have been used for the purposes they were designed? We cannot answer this question on the basis of the discussions we have undertaken but one point does need some discussion. In most projects SPINNO supported staff is also involved in assisting academic staff make applications for research grants which are not specifically concerned with knowledge transfer. Our view is that this is a natural development which should not be restricted, even if it is in some sense outside SPINNO activities strictly defined. Our reasoning is as follows:

- knowledge transfer staff need to establish good working relationships with researchers if they are to engage them in knowledge transfer activities
- they also need to be aware of research within the institution and to ensure that IP issues are properly addressed and research activities properly costed
- in practice, the distinction between knowledge transfer related research and ‘other’ is not clear cut, for example the EU Framework Programme or EAS’s finance for enterprises.

²⁰ As was mentioned in chapter 1, institutions were not required to bid for all fields of activity previous developments meant there was an appropriate level of capability in place. However, all bids did in fact cover all five fields.

Fourth, we believe there is scope for more sharing of knowledge and experience between projects. We were able to identify specific instance of this but it does not appear to be systematic. This is perhaps disappointing given that many of the projects were dealing with similar issues and those which had received SPINNO 1 funding already had significant and relevant experience. The ‘legal framework’ developments are a good illustration; several projects had undertaken some kind of surveys of existing practice outside Estonia but there appears to have been limited sharing of this knowledge. There may be scope for some central coordination of information sharing, at least at the current stage of development, but it is difficult to identify which organisation might have played this role, given the constraints on EE’s resources.

The final point concerns the level of institutional contribution to SPINNO projects which is currently set at 35%. This is to some extent arbitrary; a higher contribution would reduce activity and a lower one encourages more, but the precise trade off is uncertain. However, it is worth noting that all the major HEI-s considered the 65% grant a sufficient incentive to participate and most would reduce their levels of knowledge transfer support in the absence of SPINNO funding. As such we believe the grant has been set at an appropriate rate.

This section has tended to focus on the difficulties encountered, but there are also examples successful activities in the projects and good practice for others to consider. These are noted in the previous chapters and summaries in the box below.

Examples of good practice

Tallinn University of Technology

TUT has successfully used financial incentives to drive up academic participation in knowledge transfer activities. These incentives are targeted both at the individual academic, and at their department.

The SPINNO team has a strong skills base on which to draw: various team members have industrial experience, and a lawyer with a background in technology transfer and IP has also been recruited.

Attempts are being made to embed knowledge transfer across the institution: a designated individual is being appointed within each Faculty to take forwards activities (one of which has since become self-funding), and all new recruits to the university now attend a seminar run by the SPINNO team.

A number of key areas have been identified as a future target for knowledge transfer activities; these are areas where there has previously been a significant volume of commercial projects and therefore there is an existing track record of working with industry.

Tartu University

Attempts are being made to maximise outputs, with priority given to projects with the highest potential to generate commercialisable outputs (those in key areas, and/or with significant industrial partners).

A standard knowledge transfer training package is in place for all university staff.

Students are a key part of knowledge transfer activity at TU, with the Institute of Technology providing courses in writing business plans to students, alongside engineering and scientific staff. A Masters programme is also being developed in Entrepreneurship and Technology Management.

Links have been developed with other relevant organisations within the local area, including Tartu Science Park, Tartu Biotechnology Park, and the University of the Life Sciences, enabling staff to tap into a wide range of experience and networks.

BIOSPINNO

A number of activities have focused on developing a more coherent, tightly networked, and visible life sciences sector in Estonia. Links have been developed with companies, public sector organisations, and Estonian hospitals.

The partners have shared the sectoral development activities, enabling BIOSPINNO to capitalise on the different expertise within each one.

Collaborations have been facilitated between scientists within different Estonian institutions, strengthening the reputation of the academic base.

Partnership working through BIOSPINNO has enabled knowledge transfer activity to proceed in some smaller organisations who would not have been able to fund such activity on their own.

Tallinn University

Financial incentives have been used to drive up academic participation in knowledge transfer, offering a return both to the academic and to their research unit.

Priority has been given to making knowledge transfer procedures within the university as straightforward as possible, so that academics have a positive experience.

The SPINNO team is investing in understanding their ‘customers’: members of the team have visited relevant businesses to find out what their needs might be and how the university can meet these.

Attempts are being made to generate activity at all levels within the institution through student training in entrepreneurship and student involvement in contract research projects.

Estonian Academy of Arts

The SPINNO team is developing strong links with EAA alumni, using these to share their experiences of success or failure with current staff and students.

The SPINNO team has been involved in professionalising the academic approach to writing funding applications. Four successful applications for structural funds have resulted.

Initial approaches to companies were made to those that had an obvious requirement for the skills of EAA staff and/or students. From this first wave of 'warm' contacts, activities of more general relevance to the business community are being developed.

EAA is starting to explore how working with other Estonian institutions can strengthen the product it has to offer to businesses.

Estonian Maritime Academy

EMA staff has dedicated time for paid R&D activities specified within their contracts, which encourages staff to get involved in knowledge transfer.

The Academy has capitalised on knowledge transfer expertise held within the other institutions in Estonian, through holding joint staff seminars.

An obvious entry point has been set up within the Academy for companies requiring contract research, the 'R&D Centre'.

EMA is at the centre of attempts to raise the profile of maritime research in Estonia, through developing links with other relevant institutions both within Estonia and overseas.

Tallinn College of Engineering

TCE is currently putting in place a quality control system to ensure the quality of research collaborations and applications for projects with industry. This will strengthen the professional reputation of the College with industry partners.

Attempts have been made to assess the needs of the customer base, through sending a questionnaire to relevant companies to assess their interest in innovation, and a programme of visits to the relevant industry base in a number of Estonian counties.

In an effort to overcome staff reluctance to participate in research, each faculty now has a designated 'faculty representative', who works to raise awareness amongst the staff, and who has responsibility for developing company contacts and industrial projects within that faculty.

The College is trying to develop activities by using consultancy projects as a springboard for contract research and collaborative working.

Specific issues relating to BIOSPINNO

As was mentioned above, BIOSPINNO is unique in that it relates to a sector rather than an individual institution. The nature of the sector in Estonia is also important:

- it is mainly comprised of very small firms
- while some are undertaking R&D, the nature of the market is such that regular trading activities are important, for example the sale of laboratory equipment to other sectors
- many companies have been established by former or current academics and employ university graduates. This is an important point, because it means that personal contacts and networks between the business sector and research and higher education institutes are good and certainly better developed than in other sectors
- related to the last point, representatives of the business sector are closely involved in the setting strategic directions and priorities for BIOSPINNO.

The factors mean that BIOSPINNO has operated in a very different way to the other projects. It has undertaken similar activities in terms of staff development and awareness raising by working alongside the other SPINNO projects²¹ and in the case of the University of the Life Sciences, BIOSPINNO is a major source of SPINNO support. But, more important, it has worked more as an initiative to promote the commercial development of the sector rather than the transfer of knowledge from the HEI-s and RI-s. Given the nature of the sector, there is an important knowledge and technical component to its activities but there has been a focus on establishing

²¹ We would note that in both the initial proposal for funding and subsequent monitoring data, it is very difficult to separate BIOSPINNO impacts from those of the other projects.

contacts between Estonian companies and others inside and outside the country. BIOSPINNO has also become involved in developing the national strategy for the sector.

We believe that BIOSPINNO is fulfilling a useful function in promoting and developing the sector. There are also benefits in a single organisation fulfilling this role rather than individual organisations having to bid into several sources of funds. Our only question mark is whether this sort of activity would be more appropriately funded from some other sources rather than the SPINNO programme.

10.1.2 | Effectiveness: Performance against targets

Table 10.1 shows aggregated targets and outputs for all the SPINNO projects. It is based on the tables in the previous chapters, but some years are incomplete because projects did not disclose data for that year. Actual outputs for 2004 have not been included because the data we have were estimates prepared in the middle of that year and the indications are that many of these were optimistic. Most important, we have excluded BIOSPINNO from the table. As was mentioned in Chapter 5, there appear to be differences between the basis on which targets were set out in the original bid and the basis on which outputs have been reported such that the comparisons are meaningless²².

Table 10.1 indicates:

- targets for industry R&D contracts for 2005 and 2006 combined have been exceeded by a small amount. This is, however, accounted for by Tallinn University of Technology and Tartu University. The former has come close to meeting targets and the latter exceeded targets by a significant margin and the two universities together are responsible for the vast majority of industry sponsored R&D. It should be noted, however, that sponsored R&D is substantially greater than in 2003 before SPINNO 2 funding was allocated and has increased by more than three times since 2001.
- patents are substantially below target for 2006, reflecting an increase in the target rather than reduced performance, and licences are close to target. Neither has increased significantly in absolute terms during the period of SPINNO support. However, these are relatively poor measures of impacts; in particular the number of patents indicates nothing about their commercial value and they are relatively easy to obtain (if there is genuine novelty). Income from commercialisation of IP is a better measure and this has been disappointing both in relation to targets and pre 2005 levels.
- consulting and training services have grown very substantially and targets have been exceeded by a substantial margin. Almost all the projects have recorded strong growth in this area, including those institutions which participated in SPINNO for the first time in 2004; some of which have generated very significant growth.
- results for analysis and testing are less impressive. Targets have not been met and there has been little or no growth since 2003
- the number of spin offs established in the last two years is close to target but the target actually represented a reduction on 2003 levels. As with patents and licenses, the number of spin-outs is a poor guide to economic impact and the number existing for at least three years is a better, albeit still partial, measure of impact. Outputs are still below target but the number of longer surviving spin-outs is more than double the 2002 figure. Improved survival rates are a necessary condition for impact but there is no data on employment or investment in these companies which could be used to assess their real impact.

We would judge these results in aggregate to be at least satisfactory and indicative that SPINNO is achieving its targets. The growth in business R&D sponsorship and consultancy and training are particularly encouraging since these activities typically represent real transfers of knowledge and may also be the basis for continuing relationships between the HEI-s and businesses. As was discussed above, achievement of targets has been variable, but some important ones have been met or exceeded. In addition, the targets were set in 2004 and it is very difficult to predict performance on several of these indicators over any length of time. Our general conclusion is that the programme has performed reasonably well against targets and this is the main factor against which the performance of institutions, in aggregate should be judged.

²² It is important in any future funding rounds that such issues are resolved at the beginning of projects otherwise the monitoring process has little relevance.

Table 10.1 Aggregated performance and target s for all (Excluding BIOSPINNO) projects

	Actual outputs pre-SPINNO 2 (from preliminary application)			Outputs SPINNO 2		
	2001	2002	2003	2005	2006	
Income from R&D contracts with businesses ('000 EEK)	19,104	34,674	37,581	46,180 54,108	56,900 57,731	Target Actual
Patents granted	5	8	9	9 3	34 8	Target Actual
Licenses granted	3	4	7	6 6	12 13	Target Actual
Income from realisation of IP ('000 EEK)	2,779	2,695	4,315	6,330 877	8,400 3,185	Target Actual
Income from consultation and training services ('000 EEK)	4,100	6,162	8,731	14,580 24,665	17,515 35,668	Target Actual
Income from analysis and testing services ('000 EEK)	3,451	4,228	7,345	9,800 8,180	11,300 5,659	Target Actual
Spin-off businesses established	5	7	15	7 5	10 10	Target Actual
Spin-offs existing for 3+ years	7	12	19	32 26	38 29	Target Actual

However, it is important to note that even where targets have been exceeded, many of the outputs are low in an absolute sense. Table 10.2 presents data from a 2006 survey of ASTP²³ members. We would stress that this is not intended as a benchmark for SPINNO projects, much less levels they should have achieved. The differences between institutions are too great for meaningful comparisons. In particular, the average total R&D expenditure of ASTP member universities is around 17 times greater than SPINNO participants. In addition, the industrial structure within which most ASTP members operate is very different from Estonia at present and there is generally greater demand from enterprises²⁴. Despite these qualifications, the table does indicate significantly lower levels of knowledge transfer outputs in Estonia than amongst ASTP members. It is also interesting to note that the average number of technology transfer support staff is indicated to be significantly higher in Estonia, although we have doubts as to whether these comparisons are meaningful.

Table 10.2 Comparison of SPINNO outputs and ASTP survey results (both 2005)

	Six ²⁵ SPINNO projects		ASTP
	Total	Average per project	Average per university
Personnel supporting knowledge and technology transfer	75	13	7
R&D budget (mEEK)	547	91	1550
% of research funded by industry	10%	10%	16%
Patents granted (number)	8	1.3	3.6
Licence agreements (number)	13	2.2	10
License income (mEEK)	3.2	0.5	22.8
Start-ups (number)	10	1.7	3.5

SPINNO outputs are not, however, restricted to hard income and associated data and this report has drawn attention to its intended role in developing capacities and capabilities to engage effectively with enterprises. There is virtually no data on which to assess outputs in this respect, although we have had access to summaries of one year's reports which indicate that most projects are at least close to their targets for delivering staff development programmes.

²³ Association of European Science and Technology Transfer Professionals

²⁴ There is also an important technical point in that the data sets were collected in different ways and for different purposes.

²⁵ Excluding BioSPINNO

Our consultations, however, have given us some confidence that SPINNO has had two important impacts on all institutions. First, it has raised the profile of knowledge transfer amongst staff within the institutions. In part, because the programme itself has a fairly high profile especially since it has brought additional financial resources to the institutions, but the activities of staff supported by SPINNO funds have also been important in this respect. Typically, these staff have:

- run seminars and one-to-one consultations with academic staff designed to raise awareness
- provided training sessions on how to relate to business clients
- helped to locate sources of funding
- assisted with contract administration, both in relation to businesses but also other funding sources.

This is not to suggest that all staff is enthusiastic and willing to engage in knowledge transfer; this is definitely not the case and some institutions we visited identified the need to spread knowledge transfer more widely within their institutions as an important aim for the near future. However, we believe that SPINNO has put knowledge transfer firmly on the agenda and that staff are now much more aware of the possibilities of using their knowledge and expertise in new ways, even if many are not yet doing so. In this respect, we believe SPINNO 2 to have been more successful than SPINNO 1, although there is no hard data to substantiate this.

The second impact is the development of regulations and procedures for staff to engage in knowledge transfer. The approaches adopted vary between institutions, but most have now developed procedures in areas such as costing and pricing work with business, the division of financial returns from such work and the handling of intellectual property (IP). Although, as mentioned above, progress has been slow in several cases. We do not have detailed information on rules and regulations in many cases, but it is evident that these vary between institutions in terms of important factors, particularly:

- the extent to which staff are able to undertake external work on their own account, i.e. independently of their employing institutions, and if so what charges are levied by the institution for the use of its resources
- what share (if any) of income or surplus from working with industry is retained by individual academics
- how are IP rights assigned between the individual and the employing institution and what share of revenue from the exploitation of IP is retained by the individual.

In an ideal world, we would recommend harmonisation of these regulations between institutions, if only to avoid any confusion which the different rules might engender within enterprises. However, we believe that any movement towards harmonisation needs to be treated with caution:

- there is a practical issue, which we have not explored in any depth, because the SPINNO institutions have differing legal status and therefore different contracts of employment. The rules governing external work need to be consistent with these employment contracts and that alone may inhibit harmonisation
- the priority must be to encourage engagement with enterprises. The institutions have different aspirations, traditions and cultures and the incentive (and control) structures need to reflect this. What works well in one institution may inhibit activity in another. We would note that in most cases we understand there are still significant numbers of staff who are working with enterprise outside SPINNO structures. The aim should be to encourage these staff to work with SPINNO, both to ensure proper quality control but also because the HEI-s may be able to exploit these linkages in other ways.

In most institutions, SPINNO support has also enhanced the marketing effort significantly. There are, of course, variations between institutions but the following kinds of activities are illustrative:

- promotional materials, including web site development
- seminars/workshops with businesses
- studies to identify industry needs
- attendance at trade fairs/exhibitions.

10.1.3 | Efficacy: relevance to policy goals

The previous section discussed SPINNO achievements in terms of tangible and less tangible outputs. Outputs, such as spin-outs and research collaborations are, of course, directly aligned with strategies articulated in Knowledge-based Estonia and elsewhere. The programme as a whole has met several key targets and there has been encouraging growth in some activities during the SPINNO 2 period. However, it will be clear from the discussion in chapter 2 that we consider SPINNO's role in developing an underlying capability, and enthusiasm, for working with enterprises as important and over the longer term perhaps its most important output. Our consultations suggest it has also made real progress in this respect although there is little data we can produce as an evidence base.

It is, however, important to note the constraints within which the SPINNO participants, and therefore the programme are working. The first of these is demand from Estonian businesses. The nature and scale of the Estonian economy does place a constraint on the demand for services from local businesses. We would not wish to minimise the importance of this but some of the SPINNO projects have sought to address this in various ways:

- demand for R&D related state support managed by EAS has increased rapidly in recent years. In part, this indicates increasing interest from the business sector, but also active promotion of these grants by HEI-s and RI-s
- the key interest by HEI-s is often in the relatively large research project with business. However, the initial step may require the provision of consultancy or training services with the relationship developing into something more substantial
- finding business partners outside Estonia

Second, the financial and traditional academic incentives for institutions to engage in knowledge transfer are limited. They all attach higher priority to knowledge transfer than previously, and several have it as an explicit component of strategic plans but:

- as mentioned above, demand from Estonian businesses is still limited and the financial returns are not attractive when compared to the costs of engaging in knowledge transfer
- 'mainstream' activities such as teaching and conventional research are better rewarded. In particular, we understand that the research funding system does not give explicit weight to applied research and knowledge transfer and favours conventional research outputs (publications in academic journals).

We would note that some of the projects have taken an explicit decision to focus their efforts on a limited number of staff who have expertise and enthusiasm to work with businesses. This strategy may pay dividends, not least because it can achieve high profile successes which can then serve as demonstrators to other staff and role models for individuals. It may also represent a cost-effective way of maximising outputs. In other cases, institutions have sought to follow a more inclusive approach. We do not consider there is a right or wrong way in this respect. Each institution needs to adopt the strategy which best suits its position and aims.

Third, there is a specific issue concerning the development of research ideas and new company formation. SPINNO funds cannot be used to support the major costs of development and fabrication of prototypes, and cannot be used to invest in companies (spin-outs or otherwise). In addition, the HEI-s themselves have little if any funds to invest in prototype development or spin-out companies. Venture capital is becoming available in Estonia, but supplies are limited and, we understand, funders are risk averse. There appears, therefore, to be a gap in funding at the early stage of developing research ideas into commercial outputs. However, an act establishing a public co-investment fund (the Estonian Development Fund) was adopted by the Parliament of Estonia on 1st December 2006. This will make equity investments into early stage knowledge-based Estonian companies, and is expected to commence business operations in late 2007.

We have little doubt that, taken together, these factors mean that without SPINNO funding the level of KT activity would drop significantly. More specifically, the universities and research institutes would reduce the number of staff promoting KT to levels which could be "self-funding"²⁶. There would be some legacy from past funding, notably the development of processes and rules for engaging with businesses but the institutions would, at best, focus on specific staff and sectors rather than seeking to extend activities. This would represent lost potential and we also think there is a real danger that momentum would be lost and the level of activity could revert to pre-SPINNO levels.

²⁶ It is worth noting that this represents a change since the mid-term review (2003) when projects claimed there would be virtually no activity without SPINNO funding.

10.2 | Recommendations

Before presenting recommendations, we would make some general points which are relevant to any future SPINNO funding and also other related programmes:

- **Recruitment and retention of knowledge transfer staff is difficult.** There have been significant difficulties in staffing the SPINNO offices within institutions, in terms of both recruitment and staff turnover. This is partly as a result of salaries on offer (lower than the private sector therefore it is difficult to attract people with experience of working with industry), and partly because there are limited numbers of people with the appropriate skills within Estonia. There are two complementary ways of dealing with this in future programmes:
 - institutions should be encouraged to collaborate and share specialised commercialisation staff (which should enable a higher collective salary to be offered, and more institutions to benefit from the limited skills available)
 - Enterprise Estonia should expand upon the staff training opportunities it has offered for SPINNO office employees in the past, in an attempt to directly address the skills gap
- **Changing staff culture within academic institutions is not straightforward.** It has taken a significant amount of time and/or effort to raise the profile of knowledge transfer activities, and to get academic staff interested in becoming involved, although the underlying reasons for this vary between institutions (some have no history of such activities, in others academics previously undertook such activity independently from the university). However, although resource intensive, it is worth proceeding to fund awareness raising activity, as getting widespread academic participation across institutions is important for the sustainability of activities.
- **SPINNO in future should not aim to support the same activities across all institutions.** The institutions involved have historically had very different research capabilities, and are at different stages of strategic development. A single programme of activities with limited flexibility cannot therefore be expected to meet the needs of each of them to the same degree, and the timelines which they require to take forwards particular activities will also vary.
- **Estonian companies currently represent a limited marketplace for knowledge transfer from universities.** There is a limited history within Estonia of companies working with universities. In addition, the company base itself is quite small, is risk-averse and does not have a tradition of being innovative. Whilst this is expected to change through time, especially with the development of sectors such as biotechnology, it will take time to generate high levels of demand from the local company base for the services that the universities have been empowered through SPINNO to offer. Similarly, few international companies are located within Estonia, and those that are can afford to source R&D from all over the world.

10.2.1 | Premises

Our recommendations are based on the following premises:

- SPINNO should continue in some form. Institutions derive real benefits, academic and financial, from KT but some form of subsidy is necessary to generate appropriate levels of activities. All industrialised countries recognise this in some form or another. There is a key issue as to the balance between demand-side initiatives which subsidise the customer, and supply-side programmes such as SPINNO. This study is only concerned with the latter but the stage of development of Estonian businesses and institutional experience with KT suggests that supply-side support is especially important in the Estonian context
- related to the last point, in most cases, SPINNO has helped develop the 'infrastructure' for KT, in the sense of developing the underlying capabilities and enthusiasms to transfer knowledge as well as relationships with enterprises. This is important and needs to be built on in the future but it is unlikely to be sustained in its present form without continuing financial support
- there is little, if any, justification for continuing to support the development of the 'legal framework' for KT within institutions. There have been unforeseen difficulties in specific cases, but most have made real progress and further time and funding is unlikely to be the solution
- the institutions are at different levels of development and have different opportunities and needs in relation to KT. This needs to be recognised by future programme(s). The allocation of funds must be open and transparent but should not attempt to support the same activities in all institutions
- the higher education and research institute sector in Estonia is small and institutions need to collaborate where possible to ensure that resources are used as effectively as possible
- related to the last point, there is a real shortage of KT professionals and the programme needs to address this issue
- taken together these have various implications for programme management.

Based on these premises, we recommend that future SPINNO programmes should have four components:

- core funding for KT staff
- funding for specific projects
- creating a network to promote KT services to businesses and other organisations
- KT staff development

Comments are also made in relation to new funding schemes which are currently under consideration. Each is discussed below.

10.2.2 | Core funding for KT staff

For the reasons given above, we do not believe that institutions will maintain current levels of KT staff in the absence of SPINNO support. Some reductions may be appropriate given that progress has been made with developing the basic infrastructure for KT, but the interviews suggested that staff would be reduced to those which could become self-funding. This would imply a narrow range of activities with a focus on securing research contracts and protecting IP²⁷. The more general support to academic staff and marketing of KT services would be reduced and the full economic potential of research and higher education institutes would be under exploited. In addition, without a core KT capability, the remaining recommendations, and some of the demand side initiatives in Estonia, would not be effective.

We therefore recommend that funding is provided for KT staff in every institution. We would prefer that this element of funding be automatic rather than subject to competitive bids. The aim would be to provide greater certainty and stability of funding which may help institutions recruit suitable staff.²⁸ The funding could be based on some appropriately defined measure of scale, such as turnover, but there may need to be adjustments to ensure a minimum critical mass and differences in specialisations of different institutions. Although funding would be automatic we recommend that:

- funding is contingent on a commitment by institutions to support additional staff; SPINNO funds should not be used to support staff currently paid for from University funds
- reports on (SPINNO-funded) staff activities would be submitted to EAS on an annual basis.

However, since SPINNO will be supported from the structural funds, competitive bids are required. We would recommend that each eligible institution submits a single bid for staff covering the length of the next SPINNO programme. These bids would specify:

- numbers of staff
- university contribution
- responsibilities and objectives
- how the staff will build on achievements during the current SPINNO round²⁹.

If this recommendation is adopted the Ministry and EAS will need to decide on how many staff should be funded in total. Our view is the number should be significantly less than current staff levels. It is reasonable to expect institutions to make some contribution and, in addition, the number of KT staff is, in comparison with many other countries, large in relation to the number of academic staff and students. This may have been appropriate at the early stages of development but is not sustainable. Our view is that around 18 staff in total would be appropriate based on the following:

- the two largest HEI-s (Tartu University and Tallinn University of Technology) would be awarded funding for four full-time equivalent KT professional staff
- all other projects would be awarded funding for two staff.

This reflects a pragmatic approach; as was mentioned above the Universities should make some contribution to staffing and current numbers are high in comparison with most other member states. It, albeit crudely, reflects size differences but should ensure that a critical mass of staff is maintained. We estimate that the costs of such funding would amount to around 14.5m EEK over a two year period³⁰. This is around 25% of the current SPINNO project which leaves considerable flexibility for HEI-s to bid for specific projects (see the next section).

²⁷ We have some doubts as to whether these activities would in practice be self-funding so the reductions in staff could become more severe.

²⁸ The temporary nature of some current contracts has been a problem.

²⁹ This was a requirement for applications to SPINNO 2, but was not addressed satisfactorily by any of the applications.

³⁰ Based on annual staff costs (including taxes) of 400,000 EEK. This reflects cost estimates in the SPINNO 2 bids and 5% inflation.

10.2.3 | Funding for specific projects

This component of funding is intended to cater for the different needs and opportunities facing different institutions. It would be allocated through a competitive bidding process. We see no reason at this stage to restrict eligible activities, provided they meet the general aims of SPINNO, but criteria for selection might include:

- fit with sector priorities as these emerge
- collaboration with other institutions. This could include other HEI-s but also other organisations, such as science parks and technology incubators, which have a role in delivering innovation services. The aim would be to maximise the effectiveness of spend and to spread the benefits. Collaboration with other innovation related organisations could also facilitate access by businesses through the creation of a 'one-stop shop'. However, we are conscious of the danger that collaborative bids may be submitted simply to enhance the chances of selection with no real synergies between partners. The overall quality of bids, and their potential impacts, must be the primary consideration. The benefits of collaboration would need to be clearly identified and the extra costs of collaboration justified.

These projects would need to be monitored by EAS and evaluated at their end in order to ensure value for money and that lessons are identified and information disseminated to other institutions.

10.2.4 | Creating a network to promote KT services to businesses and other organisations

This component of the programme has two main aims:

- to facilitate access by businesses to HEI-s and RI-s
- to maximise the effective uses of scarce professional KT staff.

We envisage this component being established by EAS, in partnership with the institutions, rather than funds being allocated to the institutions individually. It would have three distinct, but related sub-components.

The first concerns joint promotional and marketing materials; the rationale being that there is scope to promote the availability of knowledge resources generally and economies of scale if this is done on behalf of all institutions.

The second is the creation of a single access point for businesses wishing to access knowledge and expertise. It would be primarily targeted at companies which do not have existing contacts in the knowledge base, or wish to establish contacts in new areas of technology. In particular, we envisage a web based facility for companies to register enquiries for assistance which would then be circulated to all members of the network. The network would need to be centrally managed but it would have no role in vetting enquiries and deciding in the most appropriate institute or team to respond. Central management would be largely restricted to promotion and ensuring that enquiries are responded to by some member of the network.

We would emphasise, that neither of these last two recommendations is designed to substitute for individual institutions' marketing and promotional activities. Rather, they are designed to complement these and facilitate access by companies with few or no prior contacts in the HE sector.

The third recommendation is potentially more far reaching. Many of the HEI-s and RI-s are small institutions and cannot justify a full complement of KT professionals on their own account. We believe there is scope for sharing resources between institutions, especially in relation to specialist expertise. There is a delicate balance here, there must be some internal capability within each institution in order to engage staff from that institution, lobby senior management and promote its services. But they should be able to draw on external expertise, for example in IP law or international collaborative arrangements, which they could not fully utilise as individual institutions. We recommend that the institutions explore with EAS the scope for such sharing of resources.

10.2.5 | KT staff development

We envisage two related activities here, both of which would be funded centrally by EAS, and which could be a component of the network described above:

- a formal programme of seminars and workshops to enable institutions to share experiences of KT activities. We understand that meetings have been arranged in the past but we think this could be more formalised
- the procurement and provision of training services. As was mentioned above, EAS and the Ministry have organised one such programme and this was valued highly by those attending.

This is not intended to substitute for other networks which several institutions are already members of. We do, however, believe there is scope for a programme of activities specifically focused around Estonian issues. Foreign experience can be highly relevant but there will always be a need to evolve solutions which address local requirements and there are likely to be economies of scale from central coordination. In addition, this kind of activity would reinforce networking to market the HEI-s expertise more effectively.

10.2.6 | Proof of concept funding

The final recommendation is concerned directly with the commercialisation of research outputs. Most countries have recognised a funding gap at the very early stage of technology development which is often referred to as 'proof of concept. Ideas emerge from the laboratory but cannot attract venture capital interest until researchers can demonstrate their potential. The sorts of activities involved could include prototype development but also further (applied) research and strengthening of the IP position. Some of those we consulted drew attention to the need for such funding and also that this sort of activity could not be supported by SPINNO funds.

We believe there is a need for such resources in Estonia at present. We have not undertaken a demand study during the current project, nor reviewed the supply of risk funding in Estonia. However, HEI-s and RI-s are likely to have an important role in generating technologies for licensing and to support spin-outs and such funding could be valuable.

At the time previous drafts of this report were prepared we believed that HEI-s might be eligible to bid for the proposed *Estonian Development Fund*. However, we understand that this fund is to be restricted to enterprises which have already been established and it can not therefore serve as a proof of concept fund. We therefore recommend that proof of concept funding is made available from SPINNO funds.

We recognise that some universities would wish to have funds allocated directly to them and they would then select projects from within their own institutions but we would recommend strongly that this does not happen and that instead a single centrally managed fund is established. The rationale is essentially to maximise competition for funds and therefore the quality of deal flow and commercial outcomes. If the funds are pre-allocated to a single institution there will inevitably be a temptation to use the funds irrespective of the quality of opportunities and it will also be difficult to ensure that they are restricted to proof of concept activities rather than research projects. There will be a need to establish 'an advisory board' with commercial and technical expertise' to evaluate proposals and this will introduce new management costs. However, a similar process would be required within each university and the central approach will benefit from economies of scale.

This general approach is the one followed in the UK and we understand elsewhere in Western Europe. Scottish Enterprise was the first public agency to introduce such a scheme³¹ and it adopted a central approach despite having a larger university sector than Estonia. Other schemes were subsequently introduced on a regional basis in the UK. There are some examples of groups of universities collaborating to deliver (publicly funded) proof of concept funds but these groups are also large in relation to the Estonian HE sector.

³¹ SQW undertook the initial evaluation of this scheme in 2003

10.2.7 | Mobility schemes

As was mentioned in chapter 2, the Ministry is considering the introduction of such a scheme and a feasibility study is currently underway to be completed in early 2007. We have not considered the potential in any depth but our experience from elsewhere suggests that it could be an important component of the NIS and would complement SPINNO very well. In particular, Successful innovation requires unexpected problems to be solved which calls for tacit rather than codified knowledge and ‘know-how’ as well as ‘know-what’. Bringing highly skilled individuals from HE/research institutes to work on innovation can therefore be expected to deliver tangible benefits in terms of business outputs. However mobility can also bring wider benefits. In the current context, schemes, especially where relatively low cost and risk to the business, can provide an excellent introduction to what HE/research institutes can offer. Experience demonstrates that, for example, student projects can be the first step in building relationships which may progress to collaborative research. They could therefore materially enhance access to business and the uptake of knowledge transfer services. In addition, there are many opportunities for less research intensive institutions to become involved in such programmes and the scheme could therefore have a wide take up and benefit the HE sector as a whole.

10.2.8 | Implications for programme management and Enterprise Estonia

This section draws together the various implications for EAS. In some cases we have not been able to investigate possibilities in any depth, but we would urge that EAS gives these issue further consideration:

- at various points we have recommended that EAS engages in a closer dialogue with institutions. It has a responsibility to ensure that public funds are spent appropriately but knowledge transfer is too complex to be properly reflected in a few metrics. We recommend the following; if the above recommendations are accepted then they will be relevant in relation to the competitive bidding process (paragraph 10.43) rather than the whole of SPINNO funding. It would involve:
 - discussion at proposal stage to ensure a full understanding of aims and objectives
 - joint agreement of targets in the light of this discussion
- regular dialogue over progress in addition to the preparation of annual reports by the project. We believe annual written reporting should be sufficient and will be less onerous for the project.
- the current reporting and associate audit requirements are widely perceived as too onerous and of limited value. We have not explored this in depth and in particular have not consulted with the Ministry of Finance. However, we have spoken to an organisation in the UK which distributes Structural Funds and while there is no doubt the EU has special requirements there was some surprise over the Estonian process. We would emphasis that this does not represent a proper examination of the issue and we recommend that EAS explores with both the Ministry of Finance and the European Commission whether less onerous procedures could be introduced
- we do not recommend any change to the 65% level of grant funding. However, we understand that institutions are also able to claim a 10% contribution to overheads but that this leads to further reporting requirements for very small sums of money. It may be possible to reduce the information requirements here (see the last point) but if not, we recommend that consideration is given to making the overhead contribution ineligible perhaps in exchange for a small increase in the overall grant rate.
- the metrics so far collected by EAS can be useful but they resent a short-term and partial picture of activities. We recommend that:
 - data is collated and presented in a format which enables progress against targets to be tracked more easily for both individual projects and the programme as a whole. This would apply to activity indicators (e.g. staff development) as well as output indicators (e.g. spin-outs)
 - EAS should begin collecting outcome as well as output data, for example, further information on the employment/turnover/export sales of spin outs, commercialisation of research outputs by enterprises. In many cases it will be difficult to devise appropriate metrics and EAS should consider case studies of specific activities
 - this information should be (selectively) featured on the EAS website. It can serve to publicise success stories and may encourage more contact between enterprises and the HE sector.

These and other recommendations will imply new tasks for EAS staff and while we have not analysed work loads within the organisation our strong impression from the consultations is that there is no capacity to take on additional tasks at present. Some recommendations could release staff time, for example, changes in reporting requirements but we doubt whether this is likely to create sufficient capacity. We therefore recommend that EAS considers whether staffing levels for managing SPINNO are appropriate taking into consideration any changes to the programme.

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