PRICEWATERHOUSECOOPERS

Scottish Enterprise

Edinburgh Stanford Link Evaluation

Final Report

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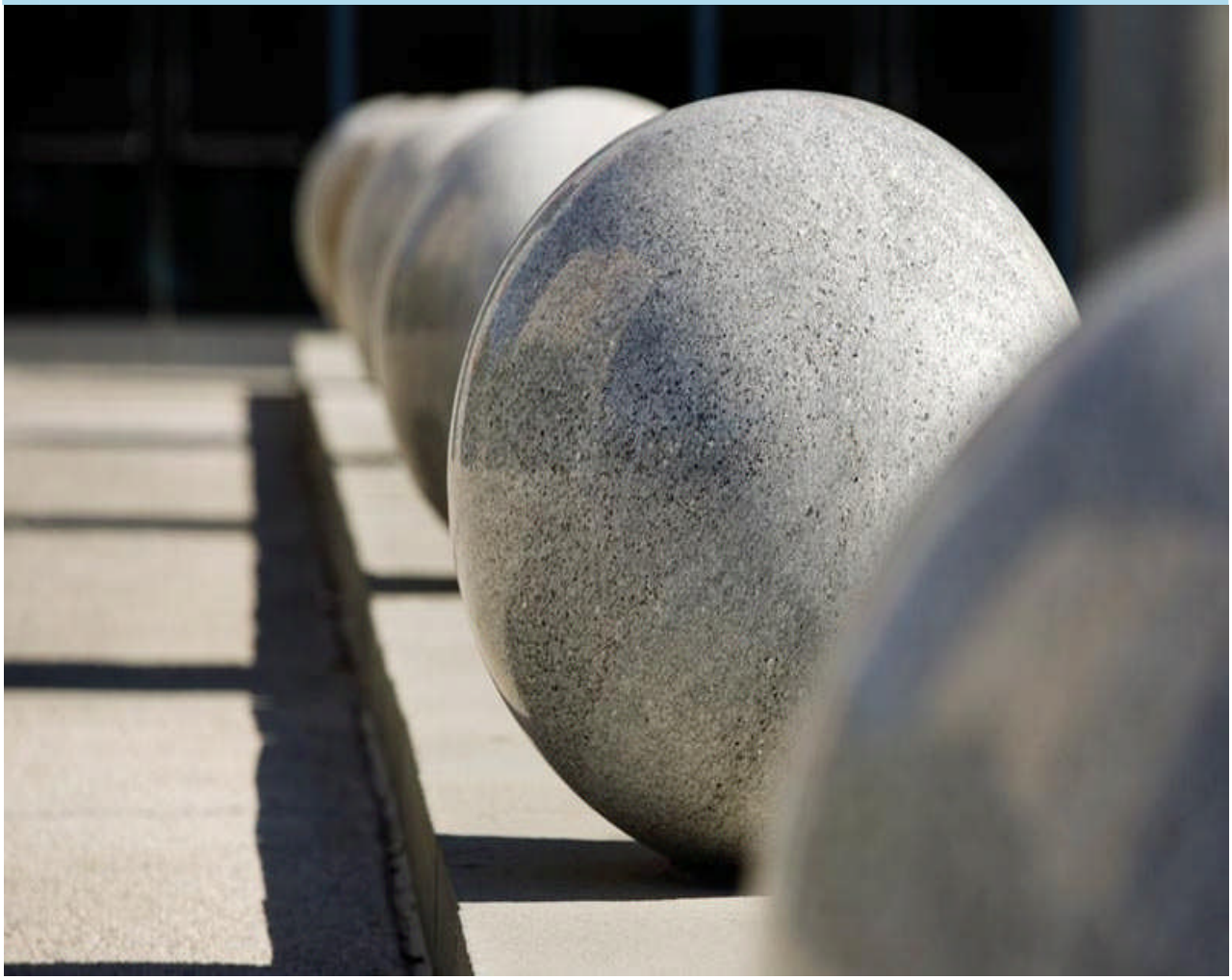


"The Link's aim is to nurture Scotland's capability in the research and application of speech and language technology, with the goal of creating a sustainable community that revolves around the University (of Edinburgh)".

ERDF Grant Application, Part 2, 2005.

Table of Contents

1 Introduction

1.1 Study Rationale

PricewaterhouseCoopers LLP were commissioned by Scottish Enterprise, in September 2007, to undertake an evaluation of the economic and wider impacts of the Edinburgh Stanford Link ("ESL" or "the Link").

In 2001 the Scottish Executive received a proposal from the Universities of Edinburgh and Stanford to develop a pilot collaborative research and commercialisation programme between the Human Commercialisation Research Centre (HCRC) at Edinburgh University and the Centre for the Study of Language and Information (CSLI) at Stanford University in California.

The proposal focussed upon developing strategic research in language technology by providing entrepreneurship training, technology transfer and commercialisation assistance to businesses with the aim of producing (from a Scottish perspective): *"a sustainable research pipeline in Language Technology, feeding from pure research through research prototypes to eventual commercial exploitation in Scotland …….to enhance Scotland's global reputation as a centre for research and development".*

At the application stage, in 2001, the objectives of the Link and the proposed partnership arrangements between the two Universities were focussed on a range of potential benefits and desired outcomes, namely to:

- *"Develop research synergy in areas of immediate and medium term technological potential between Edinburgh and Stanford Universities, in order to lever additional funding and thereby strengthen the international competitiveness of Scotland's research base in key emerging technologies;*
- *Develop and exploit links with high technology industries to fund research, particularly with those companies located both in Scotland and Stanford, in order to increase the R&D intensiveness of Scottish based businesses and exploit the technologies arising from collaborative work;*
- *Contribute to links between the two Universities from which both will benefit, thereby facilitating a range of activities, including academic exchanges, sabbaticals and scholarships; and,*
- *Develop networks between Scotland's business and academic communities and those in Stanford with the aim to encourage the development of greater dynamism and create an entrepreneurial culture inspired by Stanford's experience".*

While both innovative and original these objectives were also strongly aligned with the strategic priorities of: 'A Smart Successful Scotland' (the strategic document produced by the then Scottish Executive setting out its vision to guide overall economic strategy) not least in potentially addressing market failure.

Market failures are: *"imperfections in markets that prevent them from producing efficient outcomes"*[1]. In the context of commercialisation two types of failure were apparent:

- **Risk;** is manifest in private sector perceptions that the risks attached to R&D investment with Universities is unacceptably high (which in turn leads to a reduction in availability of both internal and external private sector funding support); and,
- **Imperfect Information**; in terms of both knowledge and understanding – by private sector companies, funders and others – of the opportunities available within Scottish Universities.

By addressing these failures the Smart Successful Scotland strategy anticipated a series of beneficial outcomes, namely:

- Increasing the level of commercialisation activities within Scottish academia;
- Addressing the relatively low levels of R&D activity within Scottish companies;
- Ensuring greater understanding and adoption of entrepreneurial skills and creativity (in both academia and industry); and,
- Enhancing linkages with the 'global' economy through appropriate partnership opportunities.

Consequently – and on a 'pilot project' basis – the Scottish Executive made around £6 million available to Scottish Enterprise to assist the two Universities develop and implement the Link. The involvement of Scottish Enterprise, at this stage, ensured that the Universities were not focused solely in developing collaborative research projects but rather that the market linkages of such projects were explicitly examined and developed as a key element in determining project implementation (and latterly funding support for new projects).

As a result since its inception, in July 2001, the Link has undertaken a range of activities which, while based on a core portfolio of research projects, have also encompassed project commercialisation, knowledge and skills transfer programmes, the promotion of company linkages at national and global

[1] "Assessing the Impacts of Spatial Interventions Regeneration, Renewal and Regional Development: The 3Rs guidance", ODPM, May 2004.

levels and the introduction of the first entrepreneurial module within a Scottish post graduate degree course.

1.2 Key Issues

Against this background, and to assist Scottish Enterprise in assessing the importance of these activities to the Scottish economy, the key issues we required to address in our work included:

- Identifying the direct (current and future) economic impacts of the Link to assess whether ESL objectives have been (or are likely to be) met in an effective and efficient manner and thus whether the funding support, provided by Scottish Enterprise, has generated 'value for money';
- Analysing how impacts have been achieved, in terms of the processes and activities involved in implementing and managing the Link, as well as examining the wider "spill over effects" and lessons learnt from the involvement of Scottish Enterprise, the Universities and other stakeholders in this initiative; and,
- Assessing, on the basis of both the above, the implications for the future of the Link and, more broadly, Scottish Enterprise's role in supporting knowledge transfer and commercialisation.

1.3 Our Approach

In addressing these study issues our approach has comprised:

- A detailed analysis of the documents, provided to us by Scottish Enterprise, in relation to the initiation, implementation, management and outputs of the Link;
- A comprehensive interview programme across a cross section of Link staff, the management team, Link advisors, Scottish Enterprise staff, University representatives and other stakeholders to test their views of the Link and its impact (now and in the future);
- An economic impact evaluation – based on the above and the stated outcomes of Link activities up to November 2007 – to identify the current and potential future effects of the Link in terms of net income, employment and gross value added;
- Examination – using the Scottish Enterprise Business Environment Mapping framework – of the wider spill over effects of the Link; and,

- Analysis of the implications of our findings to inform Scottish Enterprise, and other key stakeholders, in assessing and selecting how best to generate future benefits from the commercialisation of academic know how (through the Link or successor bodies and programmes).

1.4 Outputs

The findings from these stages of work are summarised in the rest of this first draft report for discussion in terms of:

- **Context *(Section 2)***; indicating the background to the development of the Link, market failures that the Link aimed to address and the profile of Link activities, related funding and outcomes and what, in our view, were the key evaluation issues in taking forward our work;

- **Sample Selection and Survey Programme *(Section 3)***; outlining the rationale for selecting representatives for interview and the process and frameworks we used to examine direct and wider impacts and 'lessons learnt';

- **Direct Impacts *(Section 4)***; providing a quantitative analysis of the outputs identified from the activities of the Link and the range of potential impacts that might arise in the future;

- **Wider or Spill Over Impacts *(Section 5)***; analysing, on a qualitative basis, the range of other effects – upon stakeholders – that have been generated by their involvement with the Link in terms of benefits (over and above any direct outcomes) and lessons learnt (that might inform future initiatives); and,

- **Conclusions and Recommendations, *(Section 6)***; outlining – in the context of all of our findings – the implications of our work and, in particular, the options that might be considered by Scottish Enterprise (and other stakeholders) in taking forward initiatives in this field.

Finally, by the nature of our work programme, we have captured a significant amount of data, information and related study material and thus 'evidence base' to support our overall findings and conclusions. We have provided this evidence in the form of appendices to this report (and cited these appendices at relevant sections) in terms of:

- **Background Material Summaries *(Appendix A)***; in the form of matrices highlighting the key findings of our review of the ESL documents provided to us by Scottish Enterprise;

- **Consultees *(Appendix B)***; listing the names and organisations of the representatives we interviewed during our work programme;

- **Interview Frameworks *(Appendix C)***; detailing the questions we asked consultees in relation to their understanding, involvement with and views of the Link; and,
- **Economic Impacts *(Appendix D);*** outlining the background analysis to support our findings in relation to direct Links impacts.

2 Context

2.1 Introduction

In this section we outline the initial rationale and objectives for the ESL, provide an overview of the main activities and outcomes to date and the implications – across all these factors - upon our approach to evaluating the potential impacts of the Link.

Our analysis is, in part, based on our review of around 120 documents relating to the Link that were provided to us, at the start of this study, by Scottish Enterprise. Our main review findings, in relation to this documentation, are detailed at Appendix A.

2.2 Initial Rationale for the Edinburgh Stanford Link

It is important, in our view, to recognise that the proposals put forward by Edinburgh and Stanford were developed in the context of strong long standing informal relationships between the two organisations (that included secondments, joint research and other links to share knowledge).

Recognition of the mutual benefits in maintaining and developing such linkages led to the Universities proposals for the ESL. Acceptance of these proposals – by the (then) Scottish Executive – and consequent rationale for funding support was, in part, due to a change in the policy landscape which, by the time of the proposals in 2001, had begun to focus upon the importance of academic and industrial partnerships.

In the late 1990s the Scottish Executive held the view that, despite the presence of good quality universities and research institutes, Scottish firm's had been unwilling or unable to exploit the research of these bodies (particularly in 'cutting edge' research fields such as artificial intelligence, opto electronics, e-commerce, language technology and bio-technology) into marketable products or industrial processes.

There were various reasons cited by the Scottish Executive for such unwillingness including – as evidenced previously – two key market failures, namely:

- Risk, in terms of the perception by companies and related funders that Research and Development ("R&D") and innovation activities are inherently risky and require significant levels of investment over long periods of time which are not (or cannot be) matched by internal and external funding availability; and,

- Imperfect information because of the lack of sufficiently strong or sustainable linkages between companies and universities and research institutes (to reduce the risks associated with R&D by developing collaborative, interdisciplinary, innovative solutions to meet current and future market needs).

With the increasing recognition of the value of intellectual knowledge and expertise resident in academic institutions that could be used to increase levels of technology transfer (and hence regional and national economic regeneration and development) public sector bodies in the UK were, in this period, seeking to develop new models of funding support for 'R&D'.

To address the market failures above – and the consequent outcome of Scottish companies and universities failing to maximise the benefits of knowledge transfer – the Scottish Executive identified the promotion of: *"university industry interaction"* as a major priority in its economic development policy.

Consequently, support by the Scottish Executive for developing and enhancing the 'informal' links between Edinburgh and Stanford was given on various grounds, namely the:

- Potential to address the broad policy agenda of enhancing knowledge transfer;
- Focus on specific market failures, particularly in regard to the lack of formal international linkages in such transfer activities; and,
- Innovative nature of the proposals and consequent potential of the ESL to act as a 'demonstrator' or pilot project for future international or 'globalisation' initiatives.

Such rationale was also evidenced in the subsequent ERDF application by the ESL, in 2005, which cited both: "A Smart Successful Scotland" and the: *"corresponding operational priorities"* of the Scottish Enterprise in terms of the Link addressing various key market failures, which might lead to in:

- Increased commercialisation of research and innovation;
- Higher levels of (Scottish) business R&D;
- Greater entrepreneurial dynamism and creativity; and,
- Global success in key sectors.

2.3 Link Objectives

As indicated previously – in the introductory section – the initial objectives of the Link were focussed on four key objectives that may be summarised in terms of:

- Enhancing joint research activities in those fields with immediate and medium term market potential;
- Securing interest and funding support for these activities from industry (both in Scotland and the United States);
- Supporting new linkages between the two institutes (in terms of academic exchanges, sabbaticals and joint course development); and,
- Developing networking activities (between Scottish businesses and academic communities and those in Stanford) to encourage a greater understanding and adoption of entrepreneurship.

Initially the focus of the two institutions was – not unsurprisingly - upon the first objective namely initiating joint research activities (as a baseline or starting point to developing linkages). The involvement of Scottish Enterprise, however, ensured that a (more) balanced view was taken of these objectives to ensure that, over time, ESL activities focused upon assessing how best to secure and maximise commercial take-up of the Link's R&D programme.

By adopting this view - and ensuring that advances in language technology (and related technologies) were developed, where possible, into innovative products - various benefits were anticipated (by Scottish Enterprise) to ESL stakeholders, not least:

- Access to cutting-edge technology;
- Assistance in innovation and R&D strategies;
- Access to world-class researchers and post graduates skilled in the latest technology; and,
- Access (for companies in Scotland and wider afield) to the latest R&D through collaboration with the Universities thereby enabling these companies to generate commercial benefit and competitive advantage.

Consequently the Scottish Enterprise Board approved the proposals for the Link in 2001 on the basis that the associated funding likely to be drawn down by the two institutions would be focussed on research that, **ultimately**, could offer commercial exploitation opportunities for Scottish based companies.

2.4 Overview of Activities

Initially – as indicated above - the main focus of the Link was to identify and approve specific research projects in the fields of speech and language processing. Growing awareness over time - by both ESL and Scottish Enterprise staff - led to the Link becoming more commercially focused. In this regard a commercialisation team was set up (including staff from both institutions) to identify projects which offered: *"academic research excellence"* and the potential for commercial exploitation. Where projects met such criteria the commercialisation team helped researchers in developing their proposals, identifying industrial contacts and presenting their case to an ESL Steering Group.

Moreover this growing focus on commercialisation led to the development of other activities - with Scottish Enterprise support - including:

- Graduate and undergraduate training in areas that would enhance commercialisation and entrepreneurship;
- Increased mobility and technology transfer between the institutes and relevant industrial sectors to:
  - Engender a 'culture of entrepreneurialism';
  - Offer 'first mover advantage' for commercial exploitation by Scottish companies; and,
- Adoption of 'best practice principles' between the two Universities technology transfer offices.

In supporting the above activities the Steering Group (including staff from the institutions and Scottish Enterprise as well as additional commercialisation staff following the successful ERDF bid in 2005) was responsible for:

- Taking decisions on issues relating to commercialisation (based on recommendations prepared in advance by the commercialisation team);
- Agreeing targets for commercialisation objectives;
- Monitoring progress with respect to these targets;
- "Unblocking" major issues that the commercialisation team could not resolve on its own; and,
- Receiving and taking into account reports, on proposed research projects and their potential market applications, from the Programme Directorate.

The Programme Directorate (again consisting of institutional and Scottish Enterprise staff) and the subsequent Proposal Review and Project Monitoring Panel (or "PRPMP") set up in 2003 had overall contractual responsibility for the ESL in relation to funding draw down and performance. Consequently, decisions taken by the Steering Group constituted: *"non-binding advice"* to the Directorate and PRPMP (ultimately projects might not be approved by the latter two groups or, overtime, stopped if performance was unlikely to meet projected outputs).

Overall, therefore, ESL project activities combined a 'bottom up' approach to research initiation and development (i.e. the commercialisation team) with 'top down' monitoring (Steering Group) and strategic oversight (Programme Directorate).

This support structure was also adopted in relation to other Link activities initiated by the commercialisation team and/or relevant academic departments including:

- Knowledge transfer between the institutions in the form of exchanges, seminars and presentations;
- The development of three new Entrepreneurship courses;
- Industry contacts and project funding and exploitation; and,
- Subject matter masterclasses, with leading industry experts, in both Scotland and Stanford.

2.5 Project Outcomes

Since its inception the Link has undertaken 18 major research projects over three: *"research rounds"*. The first of those rounds started in 2003, accounted for £2.4 million funding, involved over a dozen staff at Edinburgh and Stanford as: *"principal investigators"* and, in addition, utilised around 10 researchers. The nine research topics were:

- Alignment between humans and computers during dialogue and its implications;
- Collaborating using diagrams;
- Critical agent dialogue;
- Enhancing the ability of the biomedical literature to support biomedical discovery;
- Enriching dialogue system architectures with reactive planning;
- Machine learning of entity recognizers for modular retargetable language processing;

- Paraphrase analysis for improved generation;
- Robust semantic interpretation; and,
- Sounds of discourse: analysis of prosody for improved speech synthesis.

Four projects were funded in the second funding round in early-mid 2004. The project themes were:

- Automated speech recognition using innovative methods;
- Automating contact centres language-ready business process modelling;
- Combining shallow semantics and domain knowledge for improved information extraction ("EASIE"); and,
- Prosody for unit-selection speech synthesis.

Finally, five projects were funded in the third and final research round in late 2005, namely:

- EASIE project extension;
- Efficient model-level integration of novel methods into HMM speech recognition;
- Scaling up reinforcement learning of dialogue management for industrial applications;
- Synthesis: integrated models and tools for fine-grained prosody in discourse; and,
- Understanding and leveraging alignment in human-technology interaction.

In relation to these projects various outputs have already been generated (with anticipated longer term effects) including:

- Scottish Enterprise 'Proof of Concept' funding support being provided to four of the above projects (with the expectation that a least one of these projects will lead to a spin-out);
- Four patents (granted or applied for) one in the area of information personalisation, another in the area of on-line music delivery (arising from one of the Proof of Concept funded projects – 'Methodius' – above) and two related to work with Cognia[1] (who set up an EU office in Edinburgh and undertook joint research with the ESL and Scottish Enterprise's ITI Life Sciences Initiative);

[1] As detailed, in Appendix A, Cognia – a database specialist for the pharmaceutical and biotechnology industries – signed a commercial license agreement (in March 2005) with the ITI Life Sciences to develop in-licence text mining intellectual property with the School of Informatics at Edinburgh University.

- Additional funding support estimated to be in the region of £2.4 million (from various sources including the Proof of Concept and ITI programmes); and,

- Leverage of funding support via initial revenue support in relation to commercialisation activities of around £8.5 million (from such sources as 'PROSPEKT' via Scottish Enterprise Edinburgh and Lothian).

In addition – and as summarised in Table 2.1 overleaf – the Link has generated a range of other outputs from the activities undertaken to meet the ESL's wider objectives of exploiting links with industry, developing the undergraduate and graduate skills base and creating an entrepreneurial culture and spirit. These have included:

- Supporting the work and ambitions of 13 Edinburgh MSc students and 16 PhDs (and, thereby, increasing the skills base and pool of relevant expertise within Scotland);

- Developing information entrepreneurship modules at Edinburgh University which has involved, to date, around 250 student participants (these modules were developed in conjunction with Stanford staff and, in particular, Stanford Ventures);

- Holding 27 'masterclasses' with around 400 industry participants (as emphasised by the results our stakeholder interviews the success of such classes was in large part due to guest speakers – both at Edinburgh and Stanford events – being drawn from high profile "Silicon Valley" entrepreneurs and venture capitalists); and,

- Engaging with industry in terms of:

    - Active negotiations with 40 companies and other organisations, such as the BBC and NESTA Futurelab; and,

    - Working with approximately 12 of these companies (with consultancy contracts worth over £500k having been signed or likely to be signed soon).

Table 2.1 ESL Key Outputs (2007)	
Key Outputs	**Actual to Date (2007)**
Full-scale research projects currently underway or completed	18
Small projects, travel grants etc	19
Academic publications	100
Talks and presentations of research	97
Associated student projects	18
Funded MSc students	13
Funded PhD students	16
New entrepreneurship courses in two Schools	3
Completed or current entrepreneurship students	250
Companies actively engaged with	40
Companies involved in discussions	119
Masterclasses with over 400 attendees	27
Patents granted or applied for	4
Software licenses sold	7
Press articles on the Link since its inception	75

Source: ESL Progress Report, 2007.

2.6 Funding

In July 2001 the Scottish Enterprise Board approved funding support for the ESL of around £6.0 million over a five year period. As illustrated – in Table 2.2 overleaf – it was anticipated that Edinburgh University would receive around £2.3 million (or around 38% of the total funding of £6.0 million) Stanford University would receive around £3.0 million (50%) and the remaining £0.7 million (or 12%) would be used to develop a joint Scottish Enterprise Network/Edinburgh University Technology Transfer Initiative to exploit the outputs of the Link for the benefit of Scotland.

Table 2.2: ESL Projected Project Funding								
	Year 1 (£)	Year 2 (£)	Year 3 (£)	Year 4 (£)	Year 5 (£)	Year 6 (£)	Total (£)	Percentage
UoE	287,400	471,063	553,301	521,404	368,282	59,354	2,251,804	38%
Stanford	342,557	631,035	827,132	734,292	461,962	44,954	3,041,932	50%
Sub Total	**629,957**	**1,102,098**	**1,380,433**	**1,246,696**	**830,244**	**104,308**	**5,293,736**	88%
Tech Transfer	95,331	130,711	137,824	146,206	156,897	39,337	706,306	12%
Total	**725,288**	**1,232,809**	**1,518,257**	**1,392,902**	**987,141**	**143,645**	**6,000,042**	**100%**

Source: ESL Mid-Term Evaluation, Final Report, 2005.

Based on the recommendations of the mid-term evaluation of the Link the University of Edinburgh and Scotland Europa developed applications - to both East and West Scottish European Partnerships - to secure further funding for the commercialisation component of the ESL. The Partnerships approved a total of £400,000 ERDF support with drawdown levels (subject to match funding requirements) of £177,000 in 2006/2007 and £223,144 in 2007/2008.

A breakdown of actual expenditure by the ESL over 2001 to 2007 is provided in Table 2.3 overleaf. As illustrated, across a total expenditure level of £6.2 million, the main expenditure items have been salaries (31%), Stanford research projects (24%) and legal and professional fees (12%).

Table 2.3: Financial Analysis (2001-2007)									
Activity	**2001 (£)**	**2002 (£)**	**2003 (£)**	**2004 (£)**	**2005 (£)**	**2006 (£)**	**2007 (£)**	**Total (£)**	**Percentage**
Project Expenses	15,670	27,860	36,928	50,409	51,548	92,524	16,002	290,940	5%
Marketing	-	-	667	-	928	10,389	9,171	21,155	0%
Business Development	-	98	16,914	6,197	1,168	10,374	5,470	40,220	1%
Conferences	8,304	20,642	29,048	44,226	37,814	57,194	22,942	220,170	4%
Salaries	5,870	101,003	345,086	427,761	382,279	495,474	186,330	1,943,803	31%
Student Maintenance	15,795	46,426	59,421	88,777	91,815	135,938	56,779	494,951	8%
Student Fees	21,025	23,630	14,871	39,910	32,940	76,759	-	209,135	3%
Legal & Professional[1]	18,971	74,830	135,754	164,165	151,383	138,359	57,868	741,331	12%
Rent[1]	3,302	13,750	24,696	30,721	48,083	36,666	12,626	169,843	3%
Admin[1]	223	6,909	19,539	25,033	18,652	35,612	6,701	112,668	2%
Stanford CSLI Infrastructure	54,865	97,157	92,360	89,831	73,878	80,651	-	488,742	8%
Stanford research projects	-	218,547	284,819	410,652	230,108	241,414	94,649	1,480,189	24%
Depreciation	-	-	-	-	-	-	-	-	0%
Taxation	-	-	-	-	-	-	-	-	0%
TOTAL	**144,024**	**630,853**	**1,060,103**	**1,377,681**	**1,120,595**	**1,411,352**	**468,538**	**6,213,147**	**100%**

Source: ESL Financial Accounts, 2001-2007.

[1] The University of Edinburgh contributed to Legal, Rent and Admin costs (as Scottish Enterprise set a limit of £668,000 on any drawn down to support these activities).

2.7 Evaluation Issues

In the context of the preceding findings a number of issues needed to be recognised to inform our analysis of ESL impacts. First and foremost is the innovative, complex and interdependent nature of the activities undertaken by the Link: one of the key set of ESL activities related to “main stream” research project support and commercialisation, there were also range of other activities – such as masterclasses, business links, entrepreneurial modules and so forth – which were also undertaken.

The latter in our view were dependant on the former and vice versa in that support, from the perspective of Scottish Executive, would not have been forthcoming without these non project activities and engagement, by Stanford, in helping and advising on the progress of these activities which in turn would not have been likely without project research funding.

Such a conclusion, however, leads to the issue of attribution – is it possible to disaggregate funding and resources across activities and their impacts in any meaningful manner? Our view is that in:

- Principle it may be possible if only to inform future initiatives in terms of taking forward one or more elements of the ESL elsewhere (i.e. where an activity had demonstrable added value it may be possible to adopt the characteristics and related resources of this activity elsewhere); and,

- Practice it is not because of the specific pilot nature of ESL (i.e. given that many of the non project focused activities would not have emerged without the initial joint research programme being in place).

Consequently in engaging with stakeholders in relation to impacts our analysis focused on what individual activities – in principle - have worked well and what have not in order to inform future policy while also testing what - in practice - might have occurred had the total funding support for all these activities not been made available.

The other main evaluation issue relates to the timing of impacts. The process of evaluation is time bound – it involves assessing past activities to examine outcomes and impacts at a given point in time. It is apparent, particularly in the context of the currently recorded outcomes identified by the ESL (and detailed previously at Table 2.1) that some impacts are only likely to be realised in the future (including, for example, full exploitation of research outcomes, development of entrepreneurial activities and so forth).

In our view it is important, therefore, to distinguish between current and future outcomes and indicate ‘what has’ and ‘what might be’ the relationship between these outcomes and the ESL’s objectives and activities.

3 Sample Selection and Survey Programmes

3.1 Introduction

In this section we outline how, in the context of our analysis of the Link and implied evaluation issues, we selected stakeholders and interview themes and topics.

3.2 Stakeholders

The consultation exercise covered two main groups of interviewees:

- **Stakeholders**; i.e. representatives of organisations involved in key aspects of the Links funding, operation, management and outcomes; and,
- **Projects**; i.e. covering a sample of company representatives involved in a selection of the Link's projects and other programme activities.

Sample Selection: Stakeholders

In order to understand the rationale and objectives of the Link and its performance, stakeholders interviewed included representatives from various internal Scottish Enterprise teams that at the time of our interview programme were responsible for:

- Competitive Business;
- Growing Business;
- High Growth support;
- Knowledge Management (Strategy);
- SE industry teams;
- SE investment; and,
- Technology Collaboration.

A selection of representatives were was also drawn from the Universities of Edinburgh and Stanford including those directly involved in supporting the Link (whether in terms of strategic and operational direction, research activity and commercialisation) as well as the respective Research and Commercialisation Offices.

Sample Selection: Companies

Given the importance attached to understanding 'what works and why' it was agreed with Scottish Enterprise that we should interview representatives of 4 companies that had been involved with ESL programmes.

Outcomes

As illustrated – at Table 3.1 below and detailed at Appendix B - our consultation exercise covered a total of 18 interviews. The consultation exercise was conducted between October 2007 and November 2007 and all interviews were undertaken on a non-attributable basis.

Table 3.1: Consultation Interview Selection

Category	Interviews
Projects/Companies	4
Stakeholders	14
Total	18

3.3 Interview Framework

A framework of common themes and topics for discussion were devised for each set of interviewees. The detailed frameworks used for stakeholder and company representatives are attached in full at Appendix C.

In terms of the interviews with **stakeholders**, including the Link internal staff and Steering Group and related SE personnel, we focused on their views and comments on the strategic context and role of the Link, the project identification and assessment process and how this operates (particularly in addressing Link objectives), how commercialisation opportunities are assessed, the outcomes and results of the Link and the impacts it has had (or will have), particularly in terms of commercialisation and bringing products to market and their sustainability, lessons learnt, opportunities for adding greater value, future role and remit, wider perceptions of the Link and the role of other funding providers.

For company representatives we focussed on:

- **Background and rationale for involvement** – to determine the representatives understanding of the objectives of the Link, their involvement and rationale behind their commitment, outcomes if Link support had not been available, the ability of the Link to meet its original remit and the timeframe over which outcomes and benefits should be measured;

- **Experience of the Link** – to review perceptions regarding the Link's performance by ranking experience from very good to very poor in terms of programme management, marketing, relationship with HEIs and industry, and quality of advice and support.

- **Specific Impacts** – in terms of the outputs secured or expected from Link programmes (including Intellectual Property, licensing revenue and other income, employment, and other outcomes) plans for the future, any requirements for further input from the Link and any other effects; and,

- **Wider Benefits** – to identify the major lessons learnt from involvement with the Link, particularly in relation to knowledge transfer and industrial linkages, improvements to current arrangements, the development of new areas of activity, the future role of the Link, the securing of commercialisation benefits and making them sustainable.

4 Impacts

4.1 Introduction

Our analysis of the impacts of the Link is based on what is now known to have occurred as a result of Scottish Enterprise funding and what impacts might occur in the future.

In relation to 'known impacts' we have based our analysis upon two sources of evidence, namely the:

- Declared Link outcomes as of August 2007 (i.e. as defined previously at Table 2.1); and,
- Results of our consultations (with representatives from the Link and other stakeholders).

With regard to 'future impacts' we have drawn on our consultations as well as external data sources in relation to commercialisation outcomes across other Scottish and UK universities and institutes.

The detailed analysis (and supporting assumptions and data) - upon which our estimates of impacts are based - is provided at Appendix D. The remainder of this section provides a summary of our key findings.

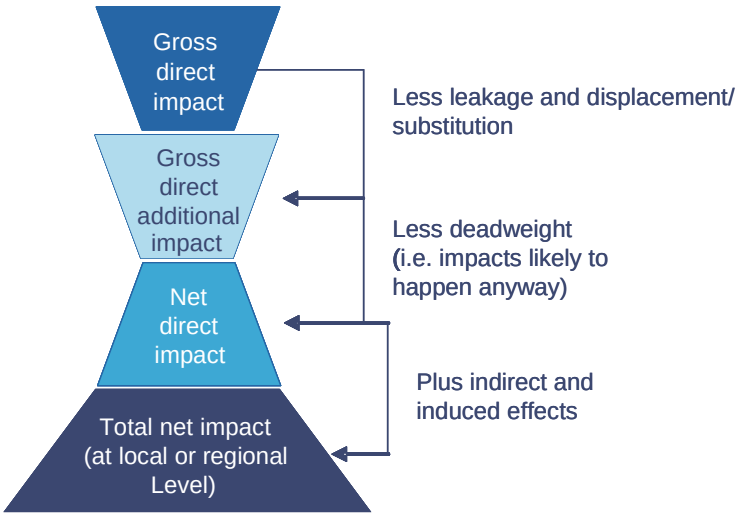
4.2 Impact Framework

The basis upon which we have measured impacts (across known and future effects) consists of two components, namely the:

- Level of benefits that are likely to have been supported **directly** by the Link as a result of Scottish Enterprise funding support; and,
- Range of impacts that are likely to be generated **indirectly** as a result of this 'initial injection' of funding.

In measuring these effects we have adopted Scottish Enterprise guidance in relation to net economic impacts. As illustrated, in Figure 4.1 overleaf, this guidance suggests that various effects require to be considered in deriving the net (as opposed to the gross) impacts of any given project or programme.

Figure 4.1: Net Economic Impact Framework



In the context of the ESL we have interpreted each of the effects above as:

- **Leakage**; representing the loss of income (and related employment and gva) to the Scottish economy as a result of:
    - Initial Scottish Enterprise funding to the Link being spent on materials, consumables and services supplied from non-Scottish sources; and,
    - Any future 'induced' funding support to Link projects (again) being spent on non Scottish service on product providers.
- **Substitution/Displacement**[1]; representing the activities that might not have occurred as a result of the Link's operation;
- **Deadweight**[2]; which endeavours to capture outcomes that may have occurred 'anyway' had the Link not been taken forward; and,
- **Indirect and Induced Effects**; in terms of the likely streams of income, employment and gva that, through appropriate multiplier analysis, are likely to have been (or will be) generated from the:
    - Expenditure by the Link on Scottish based providers; and,

[1] Or alternatively : "the proportion of the intervention's outputs/outcomes accounted for by reduced outputs/outcomes elsewhere", "Assessing the Impacts of Spatial Interventions Regeneration, Renewal and Regional Development: The 3Rs guidance", ODPM, May 2004

[2] Or: "the proportion of gross observed outputs/outcomes that occur under the reference case (in appraisal) or counterfactual (in evaluation)" (source as above in footnote one).

- Potential income that may be generated by the activities developed or supported by the Link.

4.3 Current Impacts

As illustrated, in Table 4.1 below and detailed at Appendix D, we have estimated that the current impacts of the Link to date are likely to have comprised around:

- £9.4 million of net income within the Scottish economy;
- 330.5 full time equivalent years of employment ("fteye"); and,
- £6.25 million net gva.

Table 4.1: Combined Direct and Wider Net Impacts of the ESL

Impacts	Direct	Indirect/Induced	Total
Income	£3.6 m	£5.8 m	£9.4 m
Fteye	98.5	232	330.5
GVA	£2.25 m	£4.0 m	£6.25 m

The key assumptions, on which these projections are based, are:

- **Direct Leakage;** effects are assumed to be around 100% for all Stanford related expenditure, 50% for direct and indirect project support activities, and 0% for Edinburgh based staff and students (based on our consultations with stakeholders);
- **Substitution/Displacement;** were likely to be minimal as only one of the projects and none of the related ESL activities would probably have occurred without the partnership between Edinburgh and Stanford;
- **Deadweight Effects;** we identified 27% of indirect support costs (primarily overheads) that probably would have occurred without the ESL and a level of up to 50% deadweight in relation to staff/student activities;
- **Indirect and Multiplier;** effects based on Scottish Executive data concerning type II multipliers and gva breakdowns; and,

- **Induced Effects;** in terms of a wide range of knock-on impacts (in terms, for example, additional research funding, consulting contracts, improvements in company productivity and licensing income).

4.4 Future Impacts

As detailed in Section Two of this report (in particular Table 2.1) - and examined in more detail at Appendix D - the ESL has involved a range of project and other activities that might, in the future, generate further commercialisation outcomes than already identified under the current impact analysis.

Under a 'worst case' scenario it may be assumed that no such outcomes are realised. Under a 'best case' scenario; however, we have assumed that:

- There are likely to be further licences and spin outs as a result of student projects (not least because of their engagement in entrepreneurship studies); and,
- Based on our interview programme, a proportion of the companies that ESL has engaged with directly or, indirectly, through the ESL Master Classes, are likely to experience increased sales and/or improvements in their net revenue position.

Consequently we suggest, as illustrated in Table 4.2 below, that the final impacts of the ESL might fall between a worst case net income level of around £9.4 million to a best case scenario of £28.51 million, net fteyes of around 330.5 to 480 and gva levels of between £6.25 million to £10.6 million.

Table 4.2: Potential Future Impacts				
Worst Case Scenario				
Impacts	**Current Impacts**	**Future Licences/ Spin-Outs**	**Future Sales/Net Revenue Gains**	**Total**
Income	£9.4 m	0	0	£9.44 m
fteye	330.5	0	0	330.5
GVA	£6.25 m	0	0	£6.25 m
Best Case Scenario[1]				
Impacts	**Current Impacts**	**Future Licences/ Spin-Outs**	**Future Sales/Net Revenue Gains**	**Total**
Income	£9.4 m	£4.11m	£15 m	£28.51 m
fteye	330.5	41.5	150	480
GVA	£6.25 m	£1.65 m	£2.7 m	£10.6m

[1] The detailed assumptions underpinning this scenario are provided in Appendix D.

4.5 Conclusions

In drawing conclusions concerning the 'value for money' of any given public sector initiative it is necessary to compare the level of resources committed to the initiative with the net effect or impacts secured.

Adopting this approach for the Link suggests - relative to the 'worst' and 'best' case scenarios considered above - that under the:

- Former, worst case scenario, the initial funding commitment of Scottish Enterprise of £6.0 million is likely to generate £9.4 million of net benefits (i.e. representing a ratio of 1:1.6); whereas,
- Latter, best case scenario, this commitment may generate up to £28.51 million of net benefits (i.e. representing a ratio of 1: 4.75).

As indicated – at Section Two – it is important to consider the issue of attribution to determine whether there may be differences in the impacts of component parts of ESL activities.

For example it is apparent from our analysis that the engagement with Scottish companies will potentially lead to the largest quantifiable net impact (of around £15 million income as outlined in Table 4.2). Similarly it might be tempting to conclude that, to date, the entrepreneurship modules have generated little or no identifiable impact. Such a conclusion ignores, however, the longer term benefits that might be captured by increasing the supply of young Scottish based graduates who may, in the future, be more likely to take forward commercial projects as a result of these modules.

Moreover the success of company engagement is, in our view, as much a result of the focus of the Link upon **a range of practical** connections between industry and academia. It is best to consider, therefore, the impacts identified as a result of a continuum from undergraduate and graduate engagement in entrepreneurship and company placements, to research with potential commercial applications to Master Classes with Scottish companies and global counterparts to specific market focused consultancy contracts with individual Scottish SMEs and other organisations.

The specific impacts we have captured are, therefore, a result of considering such a range of linkages and providing a basis upon which licensing, spin-outs, consultancy contracts, further funding and specific improvements and sales opportunities may emerge. The danger in attributing specific impacts to specific activities – in relation to ESL – is that, in our view, individual activities on their own or individually would not have generated the same levels of interest or commitment and, therefore, benefit.

In recognising these interdependencies, between ESL activities and impacts, we consequently explored with stakeholders their views on which ESL attributes any future initiative might offer – either individually or collectively – as the best basis to build upon the types of impacts identified. Such considerations have informed our analysis of both the wider or spillover effects (Section Five) of the Link and our recommendations for future initiatives (Section Six).

5 Wider or Spill Over Impacts

5.1 Introduction

In this section we review the wider non quantifiable benefits that are likely to have been generated by the Link by reviewing the:

- **Analytical Framework** adopted by Scottish Enterprise to capture such benefits;
- **Effects** identified through our consultation programme in relation to this framework; and,
- **Conclusions** that may be drawn concerning the Link in relation to the generation of such effects.

Analytical Framework

Over the last four years, economists within the public sector, have placed increasing importance upon assessing the wider impacts of projects and programmes. The drivers for this focus have been the:

- Recommendation, within the new HM Treasury 'Green Book', of reviewing and where possible quantifying the social and other effects of projects and programmes;
- Evidence, primarily from the appraisals of proposed major transport projects such as Cross Rail, that such effects may have a material impact on the selection of a preferred project option; and,
- Importance attached to 'cross cutting initiatives' and consequent recognition within recent appraisal and evaluation processes of the need to identify the interdependencies between different but related interventions and aggregate market conditions and impacts.

Against this background – and in order to complement the measurement of direct impacts – Scottish Enterprise has developed a: "Business Environment Mapping" ('BEM') framework to assess the interaction between companies and organisations that have received Scottish Enterprise support and their "external business environment".

As indicated in the BEM internal Scottish Enterprise paper: *"The environment in which businesses operate is a key driver of their ability to succeed"*. The paper proceeds, therefore, to provide a framework against which to classify this environment in terms of six key characteristics, namely:

- **Financial Capital;** in terms of the availability of appropriate funding support and the ease or otherwise of accessing such support;

- **Intellectual Capital;** covering the potential to access and leverage knowledge assets (both internally and externally);
- **Physical Capital**; in terms of access to appropriate equipment and facilities to allow development and growth (as well as the wider infrastructure networks to allow market accessibility and penetration);
- **Human Capital**; covering the availability of the: *"right skills at the right time"*;
- **Market Capital**; through networks across a given sector and the perceived value of this sector to existing and potential customers; and,
- **Social Capital**; that covers the internal and complementary support within a sector or groups of firms and organisations.

Adoption of these factors, in turn, provides the basis against which to assess whether such factors are prevalent in a certain sector (and if not, how they may be addressed through intervention) and to evaluate the influence of Scottish Enterprise on these factors once a project or programme has been initiated. It is in the latter context that we adopted this framework to identify the potential wider effects of the ESL.

Link in relation to BEM

It was agreed with Scottish Enterprise representatives at the outset of our study programme that consideration should be given, in our consultations with project representatives and other stakeholders, to the influence of the Link upon the factors identified across the BEM framework.

Given the nature of ESL objectives it was also agreed that, for the purposes of our evaluation, these factors should be more specifically defined in order to examine the influence of the Link (or otherwise) within the 'external environment', in which it operates. Consequently the issues which we agreed could (and should) be tested encompassed:

- **Financial Capital;** namely whether the ESL has effected the:
    - Perceptions (and ultimately) interest of private sector and other funders that, in the absence of the ESL, may not have considered supporting Scottish based commercialisation within the Higher Education and related research fields; and,
    - Ability of research project teams and companies involved with the Link to promote interest in and attract support for their projects which, again in the absence of the Link, they may not have been in a position to take forward;

- **Physical Capital;** to examine the extent to which any of the IT generated by the Link has attracted other users and benefits that would otherwise not have been (or taken longer to be) generated;
- **Human Capital;** to assess the influence of Link activities on students, staff and other stakeholders skills and capabilities;
- **Intellectual Capital**; namely whether the ESL has influenced stakeholders in regard to their strategic approach to and implementation of commercialisation and whether, in turn, the (brand) profile of the Link provided a basis for attracting (or retaining) skills that might otherwise not have been available;
- **Market Capital**; in relation to wider stakeholders' perceptions of the Link and the impact that this may have had upon commercialisation activities 'pre' and 'post' ESL involvement; and,
- **Social Capital**; whether involvement with ESL activities has led to any increased knowledge transfer and network opportunities or activities across projects and relevant organisations and, if so, the potential benefits that had been obtained.

(a) Financial Capital

On the basis of our consultations – with both ESL representatives and wider stakeholders – we suggest there is evidence to suggest that the Link has changed the perceptions or interest of the private sector towards supporting Scottish based "industry and academia" projects and related programmes.

We have drawn this conclusion on the basis that:

- There is evidence, to date, of recurring private sector investment in ESL related projects;
- The relatively high number of private sector company linkages which have been developed (and consequent potential for 'deal flow'); and,
- The emphasis, by the Link, to actively seek external interest and support (for project development, graduate placements and engagement with a range of entrepreneurial related activities) from private sources.

(b) Intellectual Capital

As outlined above we have interpreted this effect as capturing the influence (or otherwise) of the ESL upon the activities and actions of Edinburgh University in relation to commercialisation.

It is apparent, from our consultations, that the ESL has had a profoundly beneficial effect upon the Universities commercialisation activities in terms of:

- The approach to developing and supporting commercialisation activities as well as the internal management of the commercialisation office as a direct result of links with and knowledge share with Stanford counterparts; and,

- Initiating new activities – again with the help and support of Stanford and in particular the access they have provided to a range of Californian based entrepreneurs and industry representatives – in the areas of entrepreneurial studies, company networking and commercialisation..

It is also our understanding that such effects may be re-inforced in the future through the opportunity to develop more formalised links between the two organisations through exploitation of Scottish originated commercialisation projects involving funding partners (and serving markets) in the United States.

(c) Physical Capital

Given the significant proportion of ESL resources devoted to student/staff and support services we suggest that – aside from the software and IP related to Link projects – there is little evidence (or relevance) to this type of effect being generated.

(d) Human Capital

This effect relates to the impact of the ESL on staff, students and other stakeholders. It is apparent, from our consultations, that one of the key benefits of the Link has been the sharing of knowledge and experience across and between:

- Students and (primarily Scottish based SME) industry representatives;

- Edinburgh staff and counterparts in Stanford (at project and management levels : the latter, for example, also being reflected by the intellectual capital impacts identified above);

- Industry contacts and networking with the universities and counterparts in Scotland and the United States; and,

- Intelligence, the project characteristics required to meet such need and, consequently, how best to respond to commercial opportunities.

In particular, in the case of Link students, staff and other stakeholders these relationships and the “knowledge share” involved has been beneficial and led to the development of a range of new skills and expertise, not least in relation to:

- Commercialisation management capabilities (as per above);

- Understanding and awareness of market opportunities;

- Development of business cases and funding sources;
- Entrepreneurial skills and cultures; and,
- Targeting and engagement with industrial partners.

(e) Market Capital

In the context of ' market environments' it is important to consider the extent to which the Link has influenced the network of support, advice and other activities 'pre' and 'post' Link activities.

We suggest that there is significant evidence to suggest such effects have – at least to date – been generated given the:

- Relatively high levels of engagement by the Link with SMEs and other private sector companies; and,
- The innovative nature of the type of activities that these companies have been involved as a direct result of such engagement.

(f) Social Capital

This final effect focuses upon the influence of the Link in developing networks and knowledge transfer within and across the Universities and other stakeholder bodies.

As the core "raison d'être" of the initiative it is unsurprising – as reflected by the above effects - that there is significant evidence of this type of effect occurring. Consequently the Link in our view has:

- Encouraged interaction with all those involved to develop and explore linkages; and,
- As a result, developed a range of formal and informal mechanisms and networks that have led and are likely to lead to mutual benefits to all parties in taking forward research, development, and commercialisation and exploitation opportunities.

Conclusion

It is our view that the Link has generated a series of significant 'spill over effects' that are not captured by our economic impact analysis. In short the linkages between the Link and the external environment in which it operates have been strong or well developed. In the next and final section of this first draft report we consider the implications and 'lessons learnt' from this conclusion and our overall evaluation of Link activities.

6 Conclusions and Recommendations

6.1 Introduction

Our overall conclusions, based on our findings from the consultations we have undertaken and the analysis of impacts generated, are that:

- The ESL has generated (and is likely to generate further) high levels of economic and wider impacts (relative to the level of public sector funding provided); and,
- Consequently there is much to learn and benefit from ESL in developing and supporting future commercialisation initiatives.

In the rest of this section, therefore, consideration is given to the lessons that may be drawn from this evaluation, by Scottish Enterprise, in considering future initiatives of this nature.

6.2 Lessons Learnt

We suggest that in taking forward any future initiatives of this nature that initial consideration should be given not only to the nature of the market failure identified (i.e. the 'failure' to link industry to academia) but also the best means to respond to such failure in terms of addressing market needs.

In general terms we suggest, therefore, that the evidence provided by the Link suggests that for an economic development agency such as Scottish Enterprise to derive success it is necessary to combine three different types of approaches namely:

- Pro-active engagement with industry sectors to identify needs (and opportunities) that could be addressed by university know-how with an international institute;
- Pro-active engagement with University departments to identify needs (and opportunities) to roll out know-how to commercial parties (again at a global level through a partnership arrangement); and,
- Pro-active engagement with both industrial sectors and university departments to develop joint and potentially new opportunities for commercialisation (at an international level).

In combining the above we suggest also that there are three specific elements of the ESL that might be worthy of further and future consideration in replicating the types of benefits we have identified, namely:

- Introducing more entrepreneurial modules within accredited undergraduate and graduate courses to increase the supply of potential commercialisation projects (or “deal flow”) within Scotland (at the originating source of such projects) and thereby attract and retain students who are interested in adopting this approach to research and development;

- Identifying and developing more international linkages at departmental and or thematic level (through appropriate pooling) to secure the benefits of both knowledge share and commercialisation that have been demonstrated by ESL; and,

- Examining how best to attract international funding support to exploitation of commercialisation projects either through such links (as is potentially available to ESL through SRI) or as a separate but supporting initiative to developing links and promoting university and industrial partners in commercialisation.

Finally, by implication, we suggest that consideration might be given to formalising such initiatives within a management framework and potentially organisational structure that might include relevant Universities, SMEs and other industrial partners as well as funders from both the public and private sectors.

Such a structure could generate a range of potential benefits including the:

- Potential attraction of new UK and international funding sources (given sufficient volume and access to “project deal flow”);

- Economies of scale in terms of accessing and utilising business advice as well as IP and other transactions support; and,

- Potential “pooling” of expertise and projects to increase the likelihood of project outcomes.

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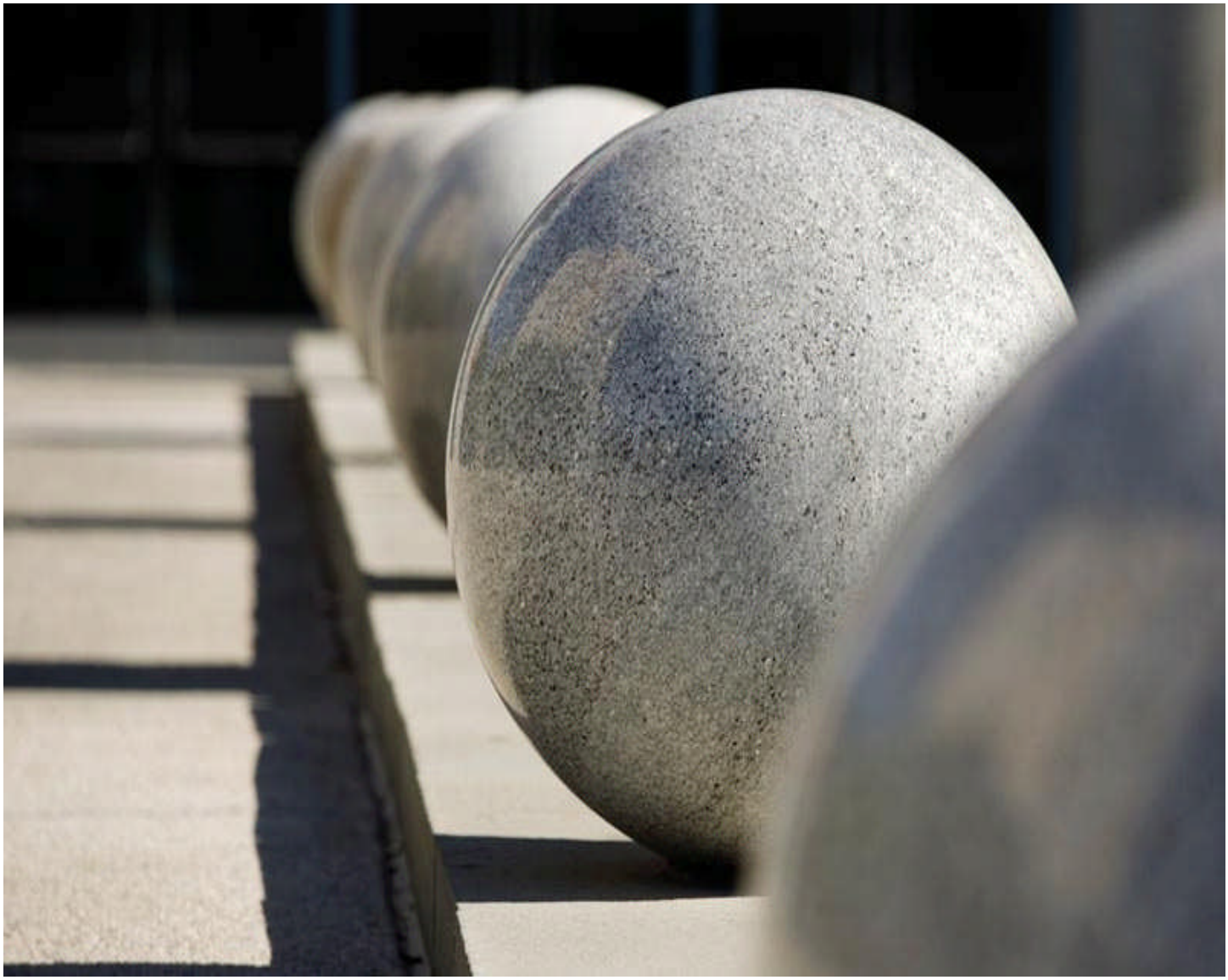
Edinburgh Stanford Link Evaluation

Final Report

Appendix A – Background Material Summary



Appendix A – Background Material Summary

Edinburgh-Stanford Link Material Review Matrix

Key Factor	Description and Comment	Sources
Monitoring/Evaluation	"As a condition of board approval, and in keeping with SE project monitoring procedures, Technology Collaboration commissioned an independent mid term evaluation of the ESL in 2005. One of the key findings was that the commercialisation component was under resourced and that the partners should explore ways of supporting these activities, thereby strengthening the commercialisation output of the project. The partners agreed to explore ERDF as a possible solution. Over the latter part of 2005, SE Knowledge Transfer, the University of Edinburgh and colleagues in Scotland Europa jointly developed and submitted applications to both East and West Scottish European Partnerships. The partnerships have since confirmed a total of £400,000 has been approved for the ESL project. Additional spend to cover resource accounting requirements for 2006/07 have recently been notified by Andy Downie of SEN Finance. " **Changes that have come about since the initiation of the Link** • As the economic environment changed, the targets for the Link were reviewed and revised to take account of the learning gained in the early stages of the Project. This has resulted in an annual target setting process that builds on the original targets set in the Board paper, but articulates some of these in more detail. In addition, there is now less emphasis on the creation of new spin-out companies. • Changes that have taken place within the Project over its life to date. The establishment of the Commercialisation Team, the Steering Group's role in advising the PRPMP and the appointment of the Commercialisation Manager have all helped to focus the Project on its economic development objectives. However, these changes were only realised in 2003 and are only now starting to filter down into outputs and impacts. **Evaluation** Experience of working with the Link: One of the main study components was to gather feedback from direct beneficiaries of the Link Project. These beneficiaries fall into two broad groups: • academic staff involved in Link funded research activities; and	ESL ERDF Approval Paper – Draft , last updated 12.12.06 Edinburgh Stanford Link Mid-Term Evaluation – Final Report – April 2005 p.57 p.54 Edinburgh Stanford Link Mid-Term Evaluation – Final Report – April 2005

- businesses that have engaged with the Link.

Face-to-face and telephone interviews were undertaken with representatives from each group.

p.27

TABLE 4.1: SURVEY OVERVIEW

Face-to-face	Telephone	Total	Number contacted but no interview arranged	Number not willing to take part or not appropriate
ACADEMICS				
8	3	11	2	0
Businesses				
6	9	15	9	0
TOTAL				
14	12	26	11	0

Survey of Academics – Experience of working with the Link

p.30

Respondents were asked to rate various elements of the Link Project on a five-point scale with 1 being very poor and 5 being very good. The results are presented below.

Rating Elements of the Link

	1	2	3	4	5	n/a
for Link funded research, clarity and ease of the application process	-	-	-	55 %	36 %	9 %
relationship with Stanford (Edinburgh)	-	-	27 %	18 %	55 %	-
marketing and promotion of the project to businesses	-	-	27 %	45 %	18 %	9 %
provision of commercialisation advice and support	-	-	9 %	55 %	9 %	27 %
level/extent of industry collaboration	-	27 %	-	27 %	18 %	27 %
quality of industry collaboration	-	27 %	18 %	27 %	9 %	28 %
management of the Project and its administration	-	-	-	55 %	36 %	9 %

Source: ES Link evaluation interviews, February 2005.

Survey of companies – Experience of working with the Link

p.40

Companies were asked to rate various elements of the Link Project on a five-point scale with 1 being very poor and 5 being very good. The results are presented in the table below.

Table 4.8: Rating Elements of the Link

	1	2	3	4	5	n/a
for Link funded research, clarity and ease of the application process	-	-	-	-	-	8
relationship with Stanford (Edinburgh)	-	-	-	1	1	6
marketing and promotion of the project to businesses	-	2	-	3	-	3
provision of commercialisation advice and support	-	-	-	-	-	8
level/extent of academic collaboration	-	-	-	-	4	4
quality of academic collaboration	-	-	1	2	1	4
management of the Project and its administration	-	-	1	2	1	4
license negotiation	-	-	-	2	-	6
Other (IP arrangements)	1	-	-	-	-	-

Source: ES Link evaluation interviews, February 2005.

CONLUDING FINDINGS

p.55

It was the view of Ekos Ltd and O'Herlihy & Co Ltd. that:

- the management structures overseeing the use of Link research money and the overall delivery of the Project are robust and appear to be functioning effectively. In large part this is due to the Steering Group and Commercialisation Team and their role in advising the PRPMP; and,
- the Link has made good progress in terms of establishing and testing a new model for commercialisation of research within key university

research departments. This is a valuable source of learning for all of the partners in the Project.

p.58

While the mid term evaluation highlighted the caveat that it was too early in the life of the Link to provide a clear account of its wider economic impacts, it identified a range of important benefits and impacts of the Project up until April 2005 and highlighted some issues for the future in this respect.

- The evaluation fieldwork found the impacts and benefits of the Project to be strong on the academic side and more mixed for businesses. This was unsurprising, given that the impacts for companies will be further down the line, while the impacts for academics will be more immediate.
- Amongst academics in particular, the Report highlighted that there was strong support for the collaborative relationship with Stanford and a feeling that this had brought academic and other benefits. This relationship has been created by the unique ability of Link funding to support transatlantic collaboration. There was clear recognition by academics that the funded research was creating new IP, although it was acknowledged that most of the research projects supported were still quite far from market
- Business feedback was more mixed, with some businesses reporting very positive impacts of their involvement with the Project and others expressing some disappointment. For most, the impacts of their involvement were not yet in view for a wide variety of reasons, although the general feeling was that commercial gains would be returned in the longer term. While some new IP had been developed through the company interactions, many of the projects were more focussed on generating business improvements and as such were not primarily concerned with IP creation.

p.59

In terms of wider impacts created by the Link project, the 2005 Report highlighted the fact that –

- the Project has assisted the development of a number of new companies (mainly through the entrepreneurship module)
- less formal interactions between the Link and businesses can yield important economic gains not easily captured through the measurement frameworks for the Project

p.60

- In addition, companies generally valued the quality of discussions with the academic staff, and welcomed the opportunity to develop a relationship with HCRC.
- In terms of attitudinal change, the overall view of the Report was that the ESL had made good progress in terms of creating a more entrepreneurial culture.
- Overall the Report concluded that while the impacts of the Link in quantitative terms was mixed, the Project was delivering value in many other ways, and at that stage in its life, there was sufficient evidence to give comfort that the Link was a worthwhile intervention.

p.57

Recommendations

The Mid Term Evaluation made the following recommendations – p.62

- FUNDING
  - The overall funding allocation for commercialisation activities was considered to be too small to meet the real needs of the Project. There was a view that this constrained the commercialisation activities undertaken in the Project and that more could have been done had more resources been available. Therefore, the report recommended that future projects take into account this learning from the current Project. p.63
- SUSTAINABILITY
  - That the partners consider in more detail the range of options for ensuring the sustainability of the realised and potential benefits of the Link, building on the findings of this mid-term evaluation.
- INDUSTRY INTERACTION
  - That the partners consider a more flexible model of IP ownership that incorporates a menu of different IP options for companies, reflecting their levels of input to the research work.
  - That the partners ensure that terms of the Commercialisation Agreement governing the commercialisation of research with companies within and beyond Scotland are fully understood by all participants in the Project. p.64
  - That provision should be made for continuation of the masterclass series, perhaps seeking company input to areas of greatest interest.
  - Ensure that company communications are properly maintained and that companies are kept fully appraised of research progress and outcomes.

p.65

- COMMERCIALISATION
  - That the partners consider the flexibility in the existing budget to make best use of available resources.
  - That the partners consider ways to leverage the opportunities presented by the student population, in particular with respect to student projects with companies and support for start-up companies.
- WIDER LINKAGES

➢ That the Link continues to engage with the School of Informatics on the wider commercialisation strategy, ensuring that the contribution

	of the Link is recognised and maximised. ➢ That the Link continues to nurture and develop relationships with PoC and with the ITIs as part of a strategy for the ongoing development of Link research and commercialisation activities.	
Stated Objectives	At the application stage to SE the ESL identified the following four objectives: • To develop research synergy in areas of immediate and medium term technological potential between Edinburgh and Stanford Universities. In order to lever additional funding and thereby strengthen the international competitiveness of Scotland's research base in key emerging technologies; • To develop and exploit links with high technology industries to fund research, particularly with those companies located both in Scotland and Stanford, in order to increase the R&D intensiveness of Scottish based businesses and exploit the technologies arising from collaborative work; • To contribute to links between the two universities from which both will benefit, thereby facilitating a range of activities, including academic exchanges, sabbaticals and scholarships; and, • To develop networks between Scotland's business and academic communities and those in Stanford with the aim to encourage the development of greater dynamism and create an entrepreneurial culture inspired by Stanford's experience. The SE Board approved the proposed Edinburgh/Stanford University collaborative research interaction in Language Technology in 2001. The aim of SE funding is to produce a sustainable research pipeline from the initial phase of pure research through research prototypes to eventual commercial exploitation as a basis for long-term economic development in Scotland. In order to achieve this vision SE agreed to fund the following activities of the ESL: • Undertaking projects in the area of speech and language processing, and undertaking research in order to develop research prototypes, evaluate the prototypes and wider outcomes of the research and taking steps to nurture and exploit arising IPRs which are capable of commercial exploitation; • Edinburgh and Stanford supporting their graduate level degrees and providing students with leading edge training in the area of speech and language processing; • Both universities supporting the mobility of academic staff and students with the aim of creating greater mobility between academia and industry; and, • Undertaking technology transfer activities such as university-industry conferences, meetings and projects in order to make IPRs available for commercial exploitation with Scottish companies being given first mover advantage to carry out the exploitation.	University of Edinburgh/Stanford University Language Technology Collaboration Proposal, Appendix 1, Scottish Enterprise Board, 2001 The Edinburgh Stanford Link, Annual Report, 2004-2005
Recorded Outputs/Impacts	Between 2002 to 2005 the ESL has led to various outputs including: • the Link has enabled the work of 10 Edinburgh MSc students and 8 ongoing PhDs through its training programme which has contributed to the portfolio of Informatics and the pool of future researchers and developers in Scotland. • The Informatics Entrepreneurship course provided intensive training for over 40 participants in 2004-05. • Three "rounds" of research proposals until 2005 with: o 9 projects approved in the first round – which commenced at the start of 2003 and accounted for approximately £2.4 million of funding. Over a dozen staff at each Edinburgh and Stanford have been involved in these projects as "principal investigators" and 10 employed researchers; o 4 projects funded in the second round in early to mid 2004; and, o 5 projects funded in the third round in late 2005. o In line with its reviewed commercialisation strategy the Link has:	The Edinburgh Stanford Link, Annual Report, 2004-2005 From pg. 9-11

	o had discussions with 30 companies and other organisations, such as the BBC, and NESTA Futurelab; and is o actively working with approximately a dozen companies with consultancy contracts worth over £100k having been signed or in view to be signed soon. o Spinout and start-up companies were originally expected to be a major route for Link commercialisation however only one start-up has been created by two former Link MSc students but is currently on hold. Spin-outs and start-ups are no longer expected to be a major output as was originally anticipated however further possibilities do exist. o The programme has one patent in the area of information personalisation to date. To date, the Link has given rise to:	
	• 19 full-scale research projects currently underway or completed • 14 small projects, travel grants etc • 59 academic publications • 58 talks and presentations of research • 13 associated student projects • 10 funded MSc students • 8 funded PhD students • 23 companies actively engaged with • 60+ companies involved in discussions • 1 patent • 6 software licenses sold • 45 press articles on the programme	From pg. 12
	Detailed Commercialisation Outputs: • At the end of 2004 the Link negotiated a small scoping exercise with the ITI Life Sciences which led to the successful negotiation of a £5.3m research contract between ITI Life Sciences and Cognia. Separate background IP arrangements (including some Link-generated) were also agreed. As of June 2005 Cognia had hired nine new staff members and were considering further expansion. The value to the University of the research contract is approximately £2m. • In 2004 the ESL agreed an evaluation license for the Festival 2 speech engine with the World Health Organisation (WHO). • During the same period, the Link agreed three evaluation licences with consulting client MySentient. However, the University ceased dealing with the company over unpaid consulting work and is now pursuing the matter in the courts. • In the early part of 2005, the Link commercial director agreed licensing options with the ITI Life Sciences for around 20 pieces of information extraction software. The agreed Option is worth £7,500 per year, renewable annually for up to three years. • The Link's efforts to commercialise the Story Station story telling software received a boost from Aberdeen-based EDNET who in mid-2005 took an evaluation licence and will be conducting trials in 20 schools in the latter part of 2005. • The Link completed a Phase 0 scoping exercise for the ITI Life Sciences worth just over £20,000 involving Professor Ewan Klein and Dr Claire Grover in late 2004 and early 2005. Also as part of the final ITI/Cognia deal, much of Professor Klein's time will be billed as consultancy, running in total to around £70,000. • The Link also completed the first and second stages of an £80,000 contract with US and Ireland-based dialogue developer MySentient Inc, but ceased working with the company due to unpaid invoices. The matter is now the subject of legal action. Key project outputs to date (2007):	From pg. 22-23 ESL Progress Report, 2007 p.12

	➢ 18 full-scale research projects currently underway or completed ➢ 19 small projects, travel grants etc ➢ 100 academic publications ➢ 97 talks and presentations of research ➢ 18 associated student projects ➢ 13 funded MSc students ➢ 16 funded PhD students ➢ 3 completely new entrepreneurship courses in two Schools	➢ 250 completed or current entrepreneurship students ➢ 40 companies actively engaged with ➢ 119 companies involved in discussions ➢ 27 masterclasses with over 400 attendees ➢ 4 patents granted or applied for ➢ 7 software licenses sold ➢ 75 press articles on the Link since its inception	
	• Generating a culture of entrepreneurialism amongst Edinburgh's students, graduates and staff; • Ensuring that each of the two university technology transfer offices provide effective marketing of technology and transferring of best practice between the universities. Recent commercialisation strategy is based on developing capacity to assess the "market" in Scotland and determine which areas are most likely to be involved in commercial uptake in the reasonably short-term. Rationale: The Link project makes a significant contribution to the Scotland's strategic economic development priorities detailed in 'A Smart Successful Scotland', and the corresponding operational priorities of SE, all which aim to address key failures in the Scottish market place. These issues are identified as: • Increased commercialisation of research and innovation. o The University of Edinburgh has a global reputation for its advances in Language Technology research and innovation. However, many technology businesses in Scotland are unclear or unaware as to how to translate this innovation into business opportunity. To over come this, the Edinburgh Stanford Link takes a unique three-pronged approach that; o Raises awareness among the business community of what the research base has to offer; o Encourage businesses to engage with the University and absorb the research and innovation; and, o Encourages the formation of new business ventures which can exploit the strength of the research and innovation. • Low levels of business research and development. o The EU average expenditure on business research and development is 50% higher than that of Scotland, with Scottish R&D expenditure per employee at 68% of the UK level. With an intense focus on the relationship between academia and businesses, the Link will encourage companies to lever the knowledge base that exists within the university through collaborative applied research projects or consulting. • Greater entrepreneurial dynamism and creativity. o The Link will address this issue through its Entrepreneurship courses and, as detailed earlier, will further develop upon this concept with the support of ERDF. • Global success in key sectors.		ESL ERDF Application, 2005

- A key priority for the Link is in realising the commercial and economic benefit of the knowledge base. Therefore, the Link will play a critical role in assisting Scottish businesses to maintain a competitive advantage by keeping them at the forefront of the latest speech and language technologies.

Business start up levels are low compared to the rest of the UK and many of Scotland's International competitors.

- The Link project will address this failure by stimulating and supporting start up activity from within the academic community that will then feed directly into the pipeline of other support mechanisms.

Stated or Anticipated Outputs/Impacts

Impacts:

It is anticipated that the economic impact of the Link in Scotland will be significant. Over and above the 15 MScs and 8 PhDs funded by SE which will add to the Scottish skill base in Language Technology, further gains are anticipated with the dissemination of research results and skills into the economy through a variety of channels including employment in spin out companies and further research as demonstrated in the table below:

Impacts	Yr.1	Yr. 2	Yr. 3	Yr. 4	Yr.5	Yr. 6	Total
Direct Staff	2.5	5.25	6	5.25	2.75	0.25	22
Add. Jobs in Scotland	2	4.5	5	4.5	2.5	0	18.5
Add. Goods and Services	£180k	£360k	£400k	£400k	£270k	£50	£1,660k
Research Disclosures		2	4	4	4	6	20
Licence Income			£25k	£75k	£175k	£225k	£400k
Start-ups		2	2	4	4	6	18
Jobs in Start-ups							
- Direct		35	45	55	55	55	245
- Indirect		30	50	70	100	140	390
Additional Research Funding	£500k	£500k	£500k	£500k	£500k	£500k	£3,000k
Tech. Transfers to Scottish Companies	1	2	4	6	6	6	25
Graduate Retention		60%	65%	70%	75%	75%	
FDI projects		1	2	2	2	2	9
VC Investments		£1m	£2m	£3m	£4m	£5m	£15m

It is anticipated that the indirect impacts of the Link will produce the most significant benefits for the Scottish economy such as the reputation of Scotland as a rich source of commercialisation, with a skilled workforce and the growth of a more entrepreneurial culture.

ESL Key Performance Indicator Targets were as follows:

Industrial Collaboration	Target 2003/04	Actual 2003/04	Target 2004/05	Actual 2004/0	Target 2005/06	Actual 2005/	Target 03/06 –	Actual, this year

University of Edinburgh/Stanford University Language Technology Collaboration Proposal, Scottish Enterprise Board, 2001

Table - as above, page 6

Edinburgh Stanford Link

				5		06	04/07	to date
NDAs	10	11	10	12		9	10	1
Scottish	8	11	8	6		7	5	
Rest of UK	1	0	1	1		1	3	1
International	1	0	1	5		1	2	
Research Contracts	5	0	5	3		4	7	2
Scottish	1	0	1	2		4	6	2
Rest of UK	1	0	1	0		0	1	
International	3	0	3	1		0		
Link / Student Projects with companies	15	7	15	5		7	10	2
Scottish	13	7	13	5		6	9	2
Rest of UK	1	0	1	0		0	1	
International	1	0	1	0		1		
Consulting	5	1	5	5		3	4	
Scottish	1	1	1	2		2	2	
Rest of UK	1	0	1	2		0	1	
International	3	0	3	1		1	1	
Disclosures	8	4	8	11		10	10	1
Patents	2	1	2	0		0	1	1
Licenses - commercial	4	3	4	1		1	5	1
Scottish	3	3	3	1		1	2	1
Rest of UK	0	0	0	0		0	2	
International	1	0	1	0		0	1	
Licenses - evaluation	5	0	5	5		3	3	
Spin-outs / Start-Ups	0	1	0	5		3	3	1

Mid-Term Evaluation – Final Report – April 2005

and

File: Outcomes / Impacts – Targets – Copy of Updated Link Targets – Aug 2006

Promotional Events	30	30	30	28		24	20	2
Scottish	7	8	7	11		9		2
Rest of UK	1	0	1	0		1		
International	22	22	22	17		14		
Attendances	c500	400	c500	970		800		
Business workshops - Number	2		2	1		6	6	
Business workshops - Attendance	20		20	6		64	64	
Revenues £k	150	45	150	166		652	650	?
Companies contacted	80	60	80	47		59	48	27
Companies visited / visiting	30	38	30	37		23	25	6
Scottish								19
Rest of UK								5
International								4

Evaluation by Mainstay Innovation Management

Programme impacts	Assumptions	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Comments
Licence income	Edinburgh Uni only; av. £25K /licence		£25K	£25K	£75K	£175K	£225K	Yrs 5 and 6 will depend on how licence-friendly the second tranche of projects are
Start-ups	Worldwide target		2	2	4	4	6	A target of two to three more spin-outs in Scotland over the next four years looks sensible. Of equal concern to job generation is looking after the existing ones!
Additional research funding	Worldwide target	£500K	£500K	£500K	£500K	£500K	£500K	Yr 1 figure for Stan is unknown; for Ed it is ~£0, except for some funding from Rhetorical for studentships
Tech. Transfers to Scottish co's	Licencing / sponsored research / consulting deals	1	2	4	6	6	6	Six more tech transfers by Oct '04 looks ambitious but do-able; 18 more in the next three years depends on there being many relevant application co's locally & v. close integration of these with Ed-Stan
FDI projects	Yet to be agreed with LIS?		1	2	2	2	2	Needs to be discussed with FDI asap
Progress to date	Anything pre-October 01 does not count!	Linear B spin-out						

ESL - Commercialisation Assessment Report – Jan 2003

Slide 41

Copied from Appendix 4 of SE's Board approval paper (June 01). Assumptions made with input from Gerard Kelly.

The table above shows projections of various programme impacts that were estimated when the Link was established.

Economic Impact Assessment The Edinburgh Stanford E Bridge

The"Economic Impact Assessment - The Edinburgh Stanford E Bridge Report to Scottish Enterprise" used a variety sources to provide projections on the expected performance of the e-bridge / Link project. These sources included:

- A detailed report by CURDS entitled "The Commercialisation Strategy of Edinburgh University, A Report to Edinburgh Research and Innovation", published in 2000;
- The McNicoll Report to the Committee of Scottish Higher Education Institutions" (November 1999); and,
- Information from the Office of Technology Licensing, Stanford University.

Report to Scottish Enterprise by MC Economics Ltd

	In light of these sources, and on the basis that the e-bridge would see Scottish Enterprise increasing the gross core research income to the University of Edinburgh by £14 million over the first 3 years (Before taking into account the potential commercialisation of research) the Report made the following assumptions: • The investment by SE would create a total of 192.5 man years in Scotland over 4 years – an average of 43.1 jobs; • The investment would result in a total income creation of £11.9 million over the 4 years of the project – around £4 million per annum; and, • If the extra staff spend part of their salaries in Scotland on goods and services the estimated multiplier effect on the Scottish economy should be 1.2	December 2000
Funding	It was recommended that from July 2001 over a five year period SE should approve £5,293,736 of funding of which Edinburgh University would receive £2,251,804 and Stanford University would receive £3,041,932. In addition to a further funding of £706,306 over this period to develop a joint SE Network/Edinburgh University Technology Transfer Initiative to exploit the outputs of this Link for the benefit of Scotland. This would require total funding of £6,000,042 over 5 years. Although the initial cost plan for the ESL was £6.7m, this included overhead costs for UoE, and the SE Board approved funding of £6m, as it is not SE's general practice to fund university overheads. Rather, overheads are considered to be the university's contribution to the project. The funding was to be split between UoE and Stanford, with approximately £0.7m allocated for technology transfer and commercialisation activities. This is shown in the table below. **Table 2.1: Project Funding (£)** In the latter part of 2005, SE Knowledge Transfer, the University of Edinburgh and colleagues in Scotland Europa jointly developed applications to both East and West Scottish European Partnerships for the ESL. Since then the partnerships confirmed a total of £400,000 had been approved for the ESL. Resulting in an estimated drawdown of £177,000 in 2006/2007 and an ERDF drawdown of £223,144 in 2007/2008. The ERDF drawdown is dependent on SE spend, as the above figures are maximum figures.	University of Edinburgh/Stanford University Language Technology Collaboration Proposal, Scottish Enterprise Board, 2001 Edinburgh Stanford Link Mid-Term Evaluation – Final Report – April 2005 SE, ESL ERDF Award, For Approval

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Totals
UoE	287,400	471,063	553,301	521,404	368,282	59,354	2,251,804
Stanford	342,557	631,035	827,132	734,292	461,962	44,954	3,041,932
Sub Total	**629,957**	**1,102,098**	**1,380,433**	**1,246,696**	**830,244**	**104,308**	**5,293,736**
Tech transfer	95,331	130,711	137,824	146,206	156,897	39,337	706,306
Total	**725,288**	**1,232,809**	**1,518,257**	**1,392,902**	**987,141**	**143,645**	**6,000,042**

Projects

See project Matrix below.

Activities

The main operation of the Link is to identify and approve research projects which are proposed by research teams and approved and monitored by the "Proposal review and project monitoring panel" (PRPMP). The eligibility of the projects in terms of commercialisation is assessed by the Commercialisation Team which includes staff from SE and Stanford. The team also identifies and follows up commercial contacts, develops proposals in conjunction with researchers, and briefs the Steering Group.

The Edinburgh Stanford Link, Annual Report, 2004-2005

Costs

The table below shows expenditure to date on the Link programme. There are two separate grants covering research and training and commercialisation with expenditure in Stanford confined to research and training.

The Edinburgh Stanford Link, Annual Report, 2004-2005, pg. 25

Actual to date	Yr 1 -01/02	Yr 2-02/03	Yr 3-03/04	Yr 4-04/05	Yr505/06	
Main grant:	6m,Oct-Mar02	Apr02-Mar03	Apr03-Mar04	Apr04-Mar05	Apr05-Dec05	Running total
Staff Costs	£21,719	£227,957	£465,733	£602,382	£228,454	
Student costs	£36,820	£105,339	£118,501	£173,931	£81,782	
Travel & Subsistence	£11,055	£36,562	£43,189	£67,508	£22,210	
Equipment, others	£15,999	£45,565	£66,053	£87,565	£34,095	
Other Allowable Costs	£89,078	£198,832	£220,356	£243,778	£83,298	
Exch. rate adjustments		-£502	-£2,993	-£12,578	£303,480	
Total research/training	£174,671	£613,754	£910,839	£1,162,586	£753,319	£3,615,169
Commercialisation:	6m,Oct-Mar02	Apr02-Mar03	Apr03-Mar04	Apr04-Mar05	Apr05-Dec05	
Staff Costs	£2,349	£16,961	£64,427	£78,874	£69,397	
Travel & Subsistence	£1,997	£2,669	£5,447	£7,529	£2,420	
Equipment, others	£3,842	£9,381	£21,670	£8,722	£3,509	
Other Allowable Costs	£17,660	£26,326	£10,056	£16,861	£12,660	
Total commercialisation	£25,848	£55,337	£101,600	£111,986	£87,986	£382,757
TOTAL CLAIMED	£200,519	£669,091	£1,012,439	£1,274,572	£841,305	£3,997,926

The table below shows the total expenditure of the Link to March 2005

Table 2.2: Project Expenditure to date (March 2005)

Category of Expenditure	**£**
HCRC Research Projects	1,157,009
HCRC training, PhD, MSc, small/seed projects and management	429,672
HCRC Total	**1,586,681**
CSLI Research Projects	943,400
CSLI infrastructure and industrial liaison	336,276

CSLI small and seed projects	14,914
CSLI Total	**1,294,590**
HCRC commercialisation	294,008
Total Project Expenditure (claims to date)	**3,175,279**
Committed (still to be claimed)	1,998,429
Total Project Expenditure (claims to date plus committed)	**5,173,708**
Original budget allocation	5,963,240
Balance available to be awarded to research projects	789,532

Source: HCRC

As shown, the Project has spent or committed most of its budget. Although the commercialisation budget has spent less than half of its original allocation (£294K of £700K), the reminder of this budget is already committed on salary costs for the Commercialisation Manager and part of the salaries for one of the research programmes and for the Link Co-ordinator.

Stanford's share of the funding was capped in US dollars and, as a result of favourable exchange rates, £789,532 remains in the research budget and will be used to fund new projects. The intention is that this money will be used to support projects that build on the outputs of the first two rounds and that target the opportunities created in the areas of overlap between existing research.

Edinburgh Stanford Link

Mid-Term Evaluation – Final Report – April 2005

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
Sounds of Discourse	Edinburgh/ Stanford	£66,657 and $31,383	Edinburgh : £66,657 Stanford:	7 research publications	The aim of our research is to develop an understanding of how prosody relates to discourse function in British and American		The Edinburgh Stanford Link, Annual Report,

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
			$31,383		English on both a theoretical and phonetic basis. These findings will be used to improve the prediction of contextually appropriate in-tonation in existing speech synthesis systems.		2004-2005
Machine Learning of Entity Recognisers for Modular Retargetable Natural Language Processing aka as SEER (Stanford Edinburgh Entity Recognition)	Edinburgh/ Stanford	£150,246 and $101,477	Edinburgh : £150,246 Stanford: $101,477	12 research publications	This project aims to extend and generalise the current state-of-the-art in entity recognition so that it can become a reliable enabling tech-nology for a wide range of applications and higher-level NLP tasks. Our goal is to develop the means to recognize and classify a much wider range of entities than are traditionally treated, and to develop techniques which can be applied in a wide range of text types.		As above
Enriching dialogue system architectures with reactive planning	Edinburgh/ Stanford	£126,205 and $223,844	Edinburgh : £126,205 Stanford: $223,844	- 3 research publications - 1 PhD student paid part-time by the project - 4 MSc projects	Our aim is to develop a new architecture for practical dialogue systems that will enhance the flexibility and robustness of possible conversational interactions, and thus extend the capabilities of dialogue systems.		As above
Critical agent dialogue	Edinburgh/ Stanford	£181,724 and $169,156	Edinburgh : £181,724 Stanford: $169,156	5 research publications	The aim of the CrAg project is to build and evaluate a simple natural language generation system which can produce dialogue involving relatively subtle language features reflecting dimensions of personality.		As above
Alignment between humans and computers during dialogue and its implications	Edinburgh/ Stanford	£203,807 and $96,116	Edinburgh : £203,807 Stanford: $96,116	4 research publications	This project tests the extent to which people align with computers, and how they react to computers that align with them. The research to date throws standard explanations for alignment into doubt, but is now examining the affective dimensions of alignment in human computer interaction.		As above
ROSIE: RObust Semantic Interpretation	Edinburgh/ Stanford	£199,607 and $299,494	Edinburgh : £199,607 Stanford:	8 research publications	The ROSIE project seeks to develop deep linguistic processors that are reliable and robust enough to analyse naturally occurring		As above

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
			$299,494		language conversations. Also, the project is developing techniques to more efficiently create annotated corpora.		
Collaborating using diagrams	Edinburgh/ Stanford	£98,860 and $88,079	Edinburgh : £98,860 Stanford: $88,079	5 research publications	The aim of this project is to find out how peo-ple collaborate to perform a task that requires them both to talk and to draw. We seek to understand how people can use graphics and language in communication and reasoning, so that we can: discover the complex processes underlying dialogues with graphics; use this knowledge to develop better tools and techniques to enable people to work together effectively; learn how to make collaboration more effective, especially across distance.		As above
Enhancing the Ability of the Biomedical Literature to Support Biomedical Discovery	Edinburgh/ Stanford	£118,196 and $136,880	Edinburgh : £118,196 Stanford: $136,880	2 research publications	The objectives of the proposed work are to establish whether further linguistic analysis of biomedical texts can produce features that increase task-level effectiveness; whether full-text analysis or analysis of targeted portions of the text other than the abstract can serve as a richer source of more discriminating features; and what the cost is of producing more complex features based on greater amounts of text.		As above
Paraphrase analysis for improved generation	Edinburgh/ Stanford	£79,774 and $59,692	Edinburgh : £79,774 Stanford: $59,692	6 research publications	The aim is to discover what factors influence the choice of one way of putting a thought into words, rather than another, with particular emphasis on paraphrases differing only in word order. This information is essential if natural language generation systems are to produce natural sounding prose.		As above
Round Two Funded Projects							
Combining Shallow Semantics and Domain	Edinburgh/ Stanford	£266,791 and	Edinburgh : £266,791	2 research publications	We propose to develop improved methods for extracting semantic content from free text.		As above

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
Knowledge: integrating multiple knowledge sources for information extraction (EASIE)		$267,890	Stanford: $267,890		These will build on existing methods for information extraction (IE), but will be extended to meet four additional objectives:		
Automating Contact Centres — Language-ready Business Process Modelling (Feasibility study)	Edinburgh/ Stanford	£67,395 and $41,233	Edinburgh : £67,395 Stanford: $41,233	We have developed a method for mapping business process models into Information State Update dialogue managers. Developers can use a graphical tool to build a process, which is then automatically converted into a DIPPER-based ISU dialogue system. The developer can then test the system, modify it via the GUI, and recompile and test again. There is a demo of this system	Our high-level research question is how the Business Process Models used in industry must be enhanced in order to support human-computer dialogue. In tandem with this question is the issue of how dialogue managers with access to such “language-enhanced” process models must be modified to robustly cover typical contact centre interactions.		As above
Automatic Speech Recognition using loosely-coupled HMMs with articulatory-acoustic features	Edinburgh/ Stanford	£167,883 and $192,403	Edinburgh : £167,883 Stanford: $192,403	3 research publications	This project addresses a shortcoming of current automatic speech recognition (ASR) systems — the way they deal with the processes of casual or fast speech, such as heavy coarticulation, vowel reduction and segment deletion.		As above
Expressive Prosody for Unit-selection Speech Synthesis	Edinburgh/ Stanford	£193,124 and $329,295	Edinburgh : £193,124 Stanford: $329,295	4 research publications	Current unit-selection speech synthesis systems cannot usually generate speech with prosody that conveys specific meaning or information structure, such as contrastive stress, theme/rheme distinctions, list structures, emphasis and so on. The proposal is to develop methods for predicting and realising more appropriate prosody.		As above

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
Round Three Funded Projects							
Synthesis: integrated models and tools for fine-grained prosody in discourse	Edinburgh	£108,937 and $181,998	Edinburgh : £108,937 Stanford: $181,998	5 research publications	The project will integrate the existing data in NXT format, augment it with prosodic information, and release it to show-case our technology, simultaneously making necessary tool improvements. The combination of rich annotations and improved tools will also allow us to construct new sophisticated models of the interactions between spoken prosody and metrical structure, syntax, semantics, and discourse. We will use these models to improve the prosodic naturalness of speech synthesis and detect saliency for improving speech understanding.		ESL Progress Report, 2007
EASIE Project Extension	Edinburgh	£52,272	Edinburgh	N/a	A company has described a need for a new kind of information extraction system which could be created using some of the tools and techniques that are currently being used in the EASIE project. This system is one which extracts and compares descriptions of persons in police records in order that multiple encounters with the same person might be discovered. Such a system could have wide application in security contexts, active interest having been expressed by the British Transport Police.		The Edinburgh Stanford Link, Annual Report, 2004-2005
Efficient model-level integration of novel methods into HMM speech recognition	Edinburgh/Stanford	£86,402 and $4,359	Edinburgh : £86,402 Stanford: $4,359	Further research and testing	Developing principled methods for dealing with the variation which arises during natural speech is one of the core areas of automatic speech recognition research at CSTR. In this work, we propose to use a graphical model framework (dynamic Bayesian networks: DBNs) to combine the efficiency of a state-of-the-art HMM system with the strengths of our		As above

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
					novel feature-based approach.		
Scaling up Reinforcement Learning of Dialogue Management for Industrial Applications	Edinburgh/ Stanford	£74,570 and $200,000	Edinburgh : £74,570 Stanford: $200,000	Further research and testing	We aim to scale up our previous work for the Link, on learning and reactive planning in dialogue, to application prototypes for commercially realistic information seeking interactions. The project will also provide developer tools for the technology. This system will learn effective interaction strategies, respond robustly to unexpected and noisy user actions, and give users significantly more control over dialogues than currently possible. This project will produce a development tool for constructing and optimizing flexible slot-filling dialogue systems.		As above
Understanding and Leveraging Alignment in Human-Technology Interaction	Edinburgh/ Stanford	£145,116 and $127,806	Edinburgh : £145,11 Stanford: $127,806	Further research and testing	We are now in a position to address the question of how people are affected by computers aligning with them. We shall therefore conduct a series of experiments to investigate these issues by manipulating characteristics of the computer's behaviour and seeing how these affect the users' behaviours and attitudes towards the computer. Because making computers align with users involves considerable programming effort, it is important to determine the "bang for the buck" with respect to various aspects of alignment. Our research will use the experimental methods that we have developed in our current Edinburgh-Stanford Link grant to address these issues.		As above
Other ESL Company and Project Support							
Memex	Edinburgh /			Memex provides unique	Memex is a leading intelligence software	"Our deal	Companies

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
	Stanford			and powerful software applications which meet the ever-increasing needs of analysts and agencies worldwide, including police, defence and fraud investigators. The key element of Memex's applications is their ability to assess enormous amounts of data very quickly. The software licensed via the Edinburgh Stanford Link is being integrated into the Memex solution in order to accelerate text identification and improve accuracy. The software is derived from code developed during academic research at the University of Edinburgh by PhD student James Curran and research Fellow Stephen Clark. The code identifies sequences of words in text which denote "named entities" such as persons, locations, organisations, dates and	developer with clients among the world's police and defence agencies. Memex provides unique and powerful software applications which meet the ever-increasing needs of analysts and agencies worldwide, including police, defence and fraud investigators The company has licensed software developed at the University of Edinburgh's Human Communication Research Centre (HCRC), for integration with its core product. The license was arranged through the Edinburgh-Stanford Link, the first deal of its kind since the Link's creation and launch. The software uses new means of identifying data within text at very high speeds while achieving levels of accuracy significantly higher than industry standards. The Link helped by identifying the research strengths within Edinburgh University that Memex could access, and brought the company and the researchers together.	with the Edinburgh Stanford Link was the first of its kind. It cements our links with the academic research sector, and we will also benefit through access to leading minds in the field of human communications research. We are confident that our relationship with the Link will keep Memex at the forefront of our market."	and Project Info file, SE

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
				times. It uses statistical techniques, based on the typical contexts in which a named entity occurs, rather than conventional rule-based methods. The code can analyse 100,000 words of text per second, and identifies named entities in newspaper text with state-of-the-art accuracy, currently between 85 and 90 per cent.		*David Carrick, managing director, Memex.*	
ITI LifeScience / Cognia	Edinburgh/ Stanford			In its May 04 – December 04 report, the Link reported that it had, *"completed a Phase 0 scoping exercise for the ITI Life Science worth just over £20,000."* By the time of the Jan 05- June 05 report, its was reported that, *"After successfully concluding an early scoping exercise with the ITI Life Sciences, the Link commercial director successfully negotiated a £5.3m research contract between ITI Life Sciences and biomedical information provider*			As above

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
				Cognia." Also agreed at this particular time was a separate background IP arrangement and rental arrangement for Cognia EU Ltd to move into University of Edinburgh accommodation. The move saw Cognia hire nine new members of staff. The value to the University was around £2 million.			
Informatics Entrepreneurship Course	Edinburgh/Stanford				During the period May – December 2004, the Link successfully launched courses in Informatics Entrepreneurship and Digital Design and Multimedia. This was in line with the Link's contractual commitment to promote a more entrepreneurial culture within the University of Edinburgh. The January – June 2005 Link report concluded that the newly-launched classes had been particularly well received. The same conclusion was made in the courses second year.		January – June 2005 Link Report
NestaFuturelab	Edinburgh/ Stanford			The Link helped introduce NestaFuturelab, the			Edinburgh Stanford Link Oct 2003 –

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
				educational division of the National Endowment for Science, Technology and the Arts, to the work of Dr Judy Robertson (HCRC), who succeeded in raising around £15,000 from the body to fund four months work on educational software development.			February 2004
Personality Style Checker	Edinburgh/ Stanford			The Edinburgh-Stanford Link has one patent pending for a piece of software called Personality Style Checker, developed by Dr Jon Oberlander (HCRC). The software analyses text for character traits. Due to the complexities of patenting software in Europe, we are primarily looking for protection in the USA. Further research is currently underway to also assess emotional state from written text, and is being carried out in conjunction with Scottish SME.			Edinburgh Stanford Link paper Oct 2003 – February 2004
Story Station children's story writing software	Edinburgh/ Stanford			The Link has agreed two £300 onsite school licences for the Story			Edinburgh Stanford Link paper,

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
				Station children's story writing software, developed by Dr Judy Robertson (HCRC). These are test and evaluation licenses whereby both schools will hold feedback sessions with us to evaluate Story Station and advise on improvements. The two schools are Aberdeen Grammar School (secondary) and Bonnyrigg Primary School (primary).			February 2004 – May 2004
Royal Commission on Ancient and Historical Monuments of Scotland	Edinburgh/ Stanford				The Link negotiated a small research grant worth £6,000 from the Royal Commission on Ancient and Historical Monuments of Scotland (RCAHMS) that will result in a prototype website with personalised intelligent language generation in three languages. The RCAHMS expect to use this demonstrator to apply for a second, substantially more significant research grant.		Edinburgh Stanford Link paper, February 2004 – May 2004
Programme to undertake more student projects	Edinburgh/S tanford				At the start of 2004 the Link embarked on a programme to undertake more student projects (both MSc and forth year undergraduate) in conjunction with local SMEs. Currently we are working on seven projects, primarily in the language technology arena, and are finalising agreements with several others. Projects range in scope from intelligent home applications to mission planning systems for autonomous submarines		Edinburgh Stanford Link paper, February 2004 – May 2004

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
					to research for automated call centres. In most cases, these companies have never worked with the University of Edinburgh before.		
MySentient Inc.	Edinburgh/Stanford				The Link completed several consultancy contracts over the past few months. It recently agreed the first stage of a possible £80,000 contract with US and Ireland-based dialogue developer MySentient Inc.		Edinburgh Stanford Link paper Oct 2003 – February 2004
VISiTV	Edinburgh/Stanford				The Link has recently funded a small research project inspired by VISiTV that involves modelling the language used in a virtual horserace in the hope that we might be able to automate the commentary using a synthesised voice.		Edinburgh Stanford Link paper May 2004 – December 2004
ITI / Cognia	Edinburgh/Stanford			• Mile stone 5 Delivered • Background IP License terminated • Project runs to mid Feb 08			Steering Group Meeting Review, 29th August 2007
Multi-Ling/DJ4me	Edinburgh/Stanford			• PoC ended May 2007 • Initial application to PRP in May 2007 turned down • New application to PRP 29 August 2007 • Critical staff retention funded by ESL & PRP			As above
Combi-lex lexicon (PoC)	Edinburgh/Stanford			• 2 evaluation licenses (Cereproc,			As above

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
				Phonetic Arts) • Feedback: more lexicon development req'd • Extra development funded by ESL (3p/m) • Due for completion end Aug 2007			
Memex/British Transport Police (ERDF)	Edinburgh/Stanford			• Crime report/stop & search databases annotated • Technical work on target (project to end in Jan 2008) • Licensing opportunity to Memex			As above
CSTR Cereproc API development (ETF)	Edinburgh/Stanford			• SAPI server developed • CAPI server designed, in development • Now due end Oct (was Sept 2007) • Licensing opportunity to Cereproc			As above
SFX/Physics (ERDF)	Edinburgh/Stanford			• Feasibility study ahead of SCORE application • Application pending			As above

ESL Project Review Matrix							
Project Name	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
First Round of Funded Projects							
				– staff availability issue			
SFX/CSTR/Codestuff Cerevoice port (ERDF)	Edinburgh/Stanford			• Cerevoice re-architected for small footprint • Port to Arm9 completed (Codestuff) • Feedback required from SFX on memory issue			As above
Projects in the pipeline as of 29/08/07	**Institution**	**Cost**	**Funding Source**	**Outputs**	**Description**	**Other**	**Source**
DUDE PoC application	Edinburgh/Stanford				• PoC feasibility completed (George Boag) • Benchmarking w/ Graham Technology 19 Sep 2007		Steering Group Meeting Review, 29th August 2007
Multi-Ling/DJ4me	Edinburgh/Stanford				• Possible 6 month continuation project • Aim to spin out if R&D successful • UoE licensing/equity opportunity		As above
Slam Games (ERDF)	Edinburgh/Stanford				• Room virtual collaboration centre • Project w/ Austin Tate (AIAI) • 6 months c£42k		As Above

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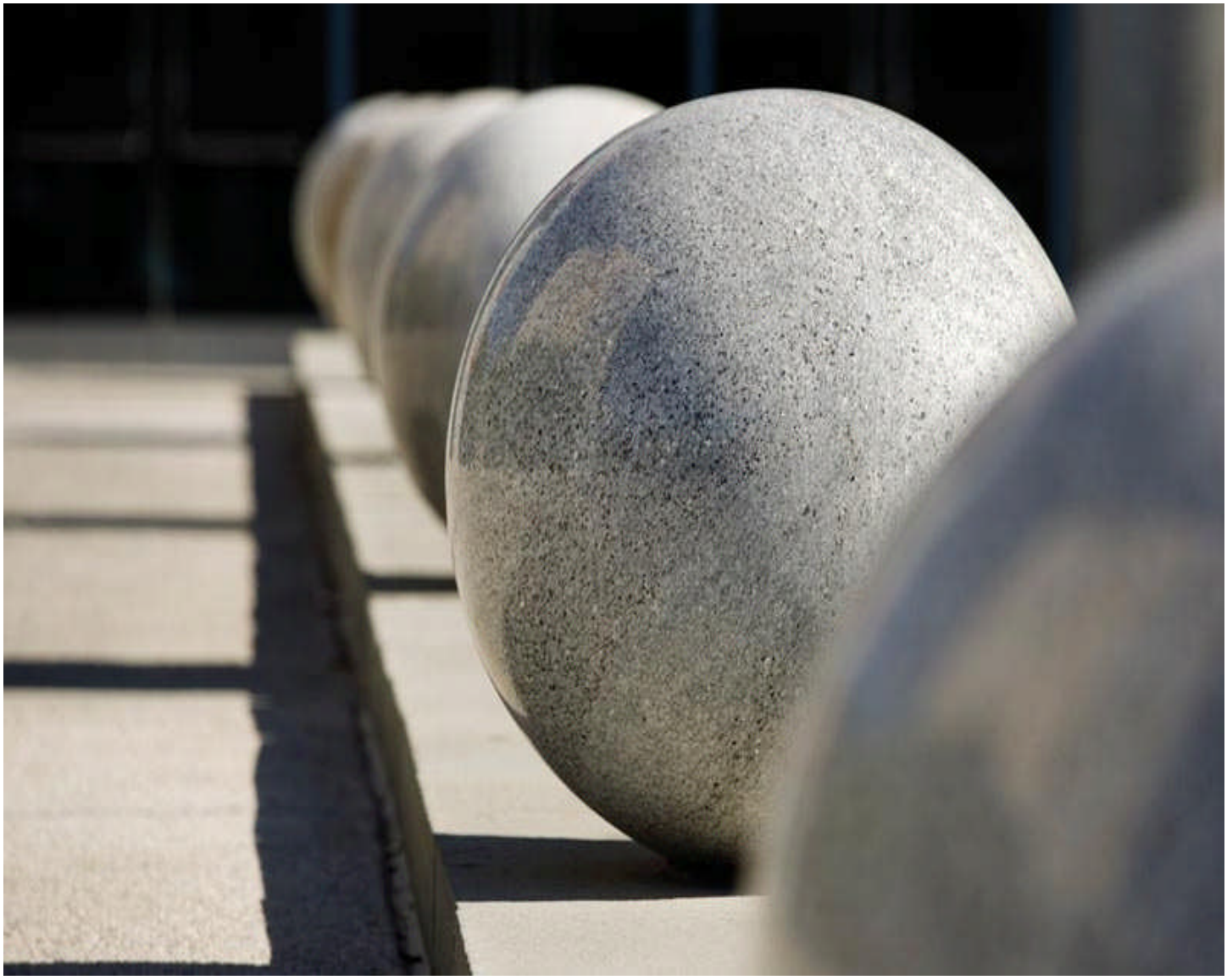
Appendix B: Consultees



Appendix B - Consultees

Name	Institution
Colin Adams	Informatics
Richard Boyd	ESL Steering Group
Mike Clouser	ESL
Keith Devlin	MediaX
Tom Duke	Memex
Keith Edwards	ESL
Adrian Gillespie	Scottish Enterprise
Norman Harris	SFX Technologies
Danny Helson	Edinburgh University
John Lee	ESL
Paul Lewis	Scottish Enterprise
David Lockwood	Tallis
Margaret McGarry	Scottish Enterprise
Johanna Moore	Edinburgh University
Tim O'Shea	Edinburgh University
Byron Reeves	Stanford University
Dr David Rubin	Cognia
Derek Waddell	Edinburgh University

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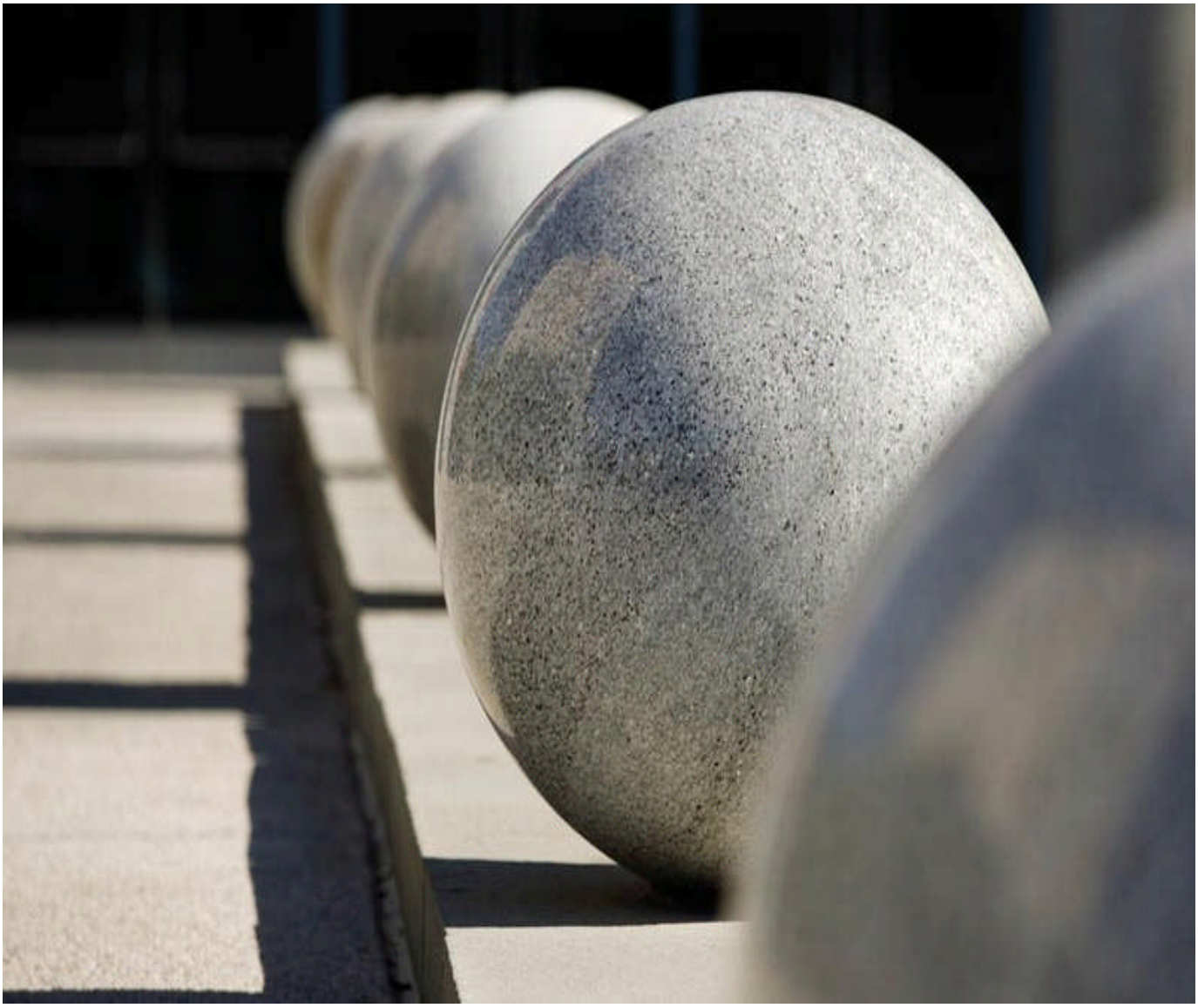
Edinburgh Stanford Link Evaluation

Final Report

Appendix C: Interview Frameworks



Appendix C – Interview Frameworks

Stakeholders / Key Partners

1. **Strategic context and role**

    a. What is your involvement to date with the Edinburgh Stanford Link ("the Link") and what were the key factors influencing this involvement?

    b. What do you perceive to be the key objectives of the Link at a strategic and operational level?

    c. What role does SE / your organisation play in supporting commercialisation activity outside of the Link?

    d. Do the Link activities complement and add value to other commercialisation activities undertaken at Edinburgh / Stanford and elsewhere?

        i. If Yes please provide details

        ii. If No please identify why and the impacts

    e. Which other organisations do you see having a role in commercialisation activity and why?

        i. Do these organisations inter-act with SE and the Link?

            1. If not why not?

            2. If yes please explain how (in terms of roles and wider impacts)

    f. Has the Link displaced any activities previously undertaken by Scottish Enterprise and / or other bodies?

        i. If so how is this evidenced? and,

        ii. What have been the impacts?

    g. Describe how the Link facilitates / enables the development and commercialisation of research activities. Please identify any issues you see with the selection and appraisal processes for securing support for these activities

h. If the Link had not been implemented what impact do you think this would have had on commercialisation and exploitation opportunities in Scotland?

2. Outcomes and Results (Strategic Value)

a. What do you see as the key outcomes achieved by the Link? Please provide examples.

b. What benefits do you believe the Link has generated for you / your organisation and more widely? Please provide details.

c. Can you identify any negative outcomes or impacts for you / your organisation which can be attributed to the Link? Please evidence this view.

d. Against what Key Performance Indicators (KPI) is and / or should the activities of the Link be judged?

e. What do you consider a reasonable timeframe over which the results, benefits and outcomes of the Link should be measured? Please identify any key implications for going forwards.

f. Is the Link addressing the gap originally identified between research and market commercialisation?

    i. If so, please state why you believe this to be the case

    ii. If not, please state why you believe this and which gap it should be addressing instead

g. What impact do you think the Link has had on the development of research with a strong potential for future commercialisation in Scotland?

h. What influence / impact do you believe the Link has had on Scottish Universities, Institutions, and companies in relation to commercialisation of research?

i. Do you believe the Link has facilitated greater / increased interaction and collaboration between Scottish Universities and industry?

    i. If yes, please identify how and give examples

    ii. If no, please detail why you believe this

j. What aspects of the realised or anticipated benefits from the Link are sustainable and what is / will be required to secure this sustainability in the longer term? Please provide details.

k. Do you believe the Link has influenced the development of a more entrepreneurial culture within the University and / or Scotland?

   i. If yes please provide examples

   ii. If no please identify your reasons

3. Outcomes and Results (Future Development)

a. What, in your view, are the strengths and weaknesses of the Link in terms of delivery, role, and effectiveness?

b. Are there any improvements that you believe could be made to the current arrangements? Please detail the areas and why you believe this to be the case.

c. Are there any current areas of research activity that are not being addressed by the Link where you believe potential commercialisation opportunities could exist? Please identify how you believe the Link could address these opportunities

d. What do you see as the future role for the Link, including whether or not you believe that it should continue. Please identify reasons for your view.

e. What in your opinion would be the position if the Link ceased to operate?

f. Is there more that could be done to secure potential commercialisation benefits and, in particular, make them more sustainable? Please provide details.

4. Others

a. What lessons have you learnt from your involvement with / or knowledge of the Link in relation to commercialisation and bringing products to market? Please provide details.

b. Do you see a wider role for the private sector in supporting initiatives of this type?

   i. If so, what and how this could be developed.

ii. If no why?

Projects: Current and Completed

1. Background

a. What is your understanding of the objectives and rationale for the Link?

   i. For Edinburgh / Stanford University?

   ii. For Scotland?

b. What has been your involvement to date with the Link?

Direct Research	....	Consultancy	....	Contract Research	....	Other	....

c. If you have participated or are you participating in Link funded research please provide a description of main research activity:

d. What was the primary rationale for the research?

Academic	....	Commercial	....	Both	....	Other	....

Please detail:

e. What were the principal reasons for seeking support from the Link?

To access new funding for new research?	....	To access new funding for existing research?	....
To pursue research of commercial interest?	....	To pursue research of academic interest?	....
To develop collaboration with Stanford and or Edinburgh University?	....	To access commercialisation support?	....
To promote / secure greater engagement / collaboration with industry	....	To secure other public sector support?	....
To secure funding as part of other collaborative activity?	....	Other? Please specify.	....

f. What are / were you expectations of Link?

g. Where your expectations met?

i. If yes, please detail how?

ii. If not, please explain why?

h. What would the position have been for your research if Link funding had not been available?

1. Research would not have gone ahead?	Yes	....	No	....
2. If no, would the research have taken place in a different form:	Yes	....	No	....

Later (timeframe)	
Smaller scale (%)	
Lower quality (%)	
Different outcomes (please detail these)	

3. If no, were alternative sources of funds considered?	Yes	....	No	....
4. If yes to 3. were such funds secured?	Yes	....	No	....

5. If yes to 4. please identify source and scale of funding secured:	

6. If yes to 4. was commercialisation a requirement for securing the funding?	Yes	....	No	....

7. If yes to 4. please provide details of the results and outcomes of the research activity:	

8. Would the results / outcomes identified at 7. have enabled a new submission for Link funding to be made?	Yes	....	No	....
9. If yes to 8. has a submission been made?	Yes	....	No	....
10. If yes to 9. was this submission successful?	Yes	....	No	....

11. If yes to 10. please detail the current status of the project and its expected outcomes	

Please provide basis / rationale for above comments:

i. Is the Link addressing the appropriate gap between research and market commercialisation?

   i. If so, please state why you believe this to be the case:

   ii. If not, please state why you believe this and which gap it should be addressing instead:

j. What do you consider a reasonable timeframe over which the results, benefits and outcomes of the Link should be measured? Please identify any key implications for going forwards.

2. Experience of Link

a. How would you rate your experience of the Link in terms of the following elements? (5 = very good or strongly agree to 1 = very poor or completely disagree)

	1	2	3	4	5	N/A
Clarity and ease of use of the application and selection processes?						
Quality of project management of the Link?						
Marketing and promotional material for the Link?						
The strength of the relationship with Edinburgh / Stanford?						
Access to industrial partners via the Link?						
Level / extent of industrial collaboration?						
Quality of industrial collaboration?						
Provision of commercialisation advice and support?						
Quality of commercialisation advice and support?						

Access to wider dissemination and networking activities?						
Complementarity with other sources of funding?						
Do you believe that the development of the Link has been beneficial to the reputation of Edinburgh / Stanford?						
Overall, would you classify your overall impression as positive?						

Please provide appropriate evidence or examples to support or explain your views:

b. To what extent (if any) has your experience of / with the Link changed your attitude or approach at an individual and organisational level? Please provide details. We are particularly interested in areas related to the commercialisation of research.

c. Do you believe that the Link represents a sustainable model for the development of research activity that could be commercialised? Please give reasons for your view.

3. Specific Impacts of the Link

a. Please identify any significant impacts of the Link in terms of:

i. The number of research projects undertaken:

Yes …. No …. Too early to tell ….

If yes please provide details:

ii. The number of new research areas developed:

Yes …. No …. Too early to tell ….

If yes please provide details:

iii. The level of commercial focus to your research activity:

Yes …. No …. Too early to tell ….

If yes please provide details:

iv. Requirement for increased numbers of research staff:

Yes …. No …. Too early to tell ….

If yes please provide details:

v. Raising levels of staff competencies and skills:

Yes …. No …. Too early to tell ….

If yes please provide details:

vi. Increased levels of networking or knowledge dissemination:

Yes …. No …. Too early to tell ….

If yes please provide details:

vii. Increased levels of university industry linkages and cooperation:

Yes …. No …. Too early to tell ….

If yes please provide details:

b. Please identify any specific changes / benefits attributable to the Link, in terms of:

i. The development of new IP:

Yes …. No …. Too early to tell ….

If yes please provide details of current or projected:

ii. Registration of IP (e.g. patents):

Yes …. No …. Too early to tell ….

If yes please provide details of current or projected:

iii. Licensing of IP (e.g. patents):

Yes …. No …. Too early to tell ….

If yes please provide details of current or projected:

iv. Creation of new spin-out companies:

Yes …. No …. Too early to tell ….

If yes please provide details of current or projected in terms of employment:

Full Time	……..
Part Time	……..

Other (e.g. Contract) ……..

v. Generation of income:

Yes …. No …. Too early to tell ….

If yes please provide details of level and timeframe for realisation:

c. Please provide details of any other changes / benefits attributable to the Link. This could include academic benefits, reputational issues, cultural change, improved links with business, etc.

d. Going forwards, please detail any future activities or requirements (for example, further research activity or funding needs) related to the Link funded activity:

e. Please identify (and provide appropriate details) if any of the expected / projected outcomes / impacts identified above are dependent upon or linked to the activities / requirements identified in the previous response:

4. Outcomes and Results (Future Development)

a. What, in your view, are the strengths and weaknesses of the Link in terms of delivery, role, and effectiveness?

b. Are there any improvements that you believe could be made to the current arrangements? Please detail the areas and why you believe this to be the case.

c. Are there any current areas of research activity that are not being addressed by the Link where you believe potential commercialisation opportunities could exist? Please identify what these areas are and how you believe the Link could address these opportunities

d. What do you see as the future role for the Link, including whether or not you believe that it should continue. Please identify reasons for your view.

e. What in your opinion would be the position if the Link ceased to operate?

f. Is there more that could be done to secure increased potential commercialisation benefits and, in particular, make them more sustainable? Please provide details.

5. Others

a. What lessons have you learnt from your involvement with / or knowledge of the Link in relation to commercialisation and bringing products to market? Please provide details.

b. Do you see a wider role for the private sector in supporting initiatives of this type?

i. If so, what and how could this be developed.

ii. If no why?

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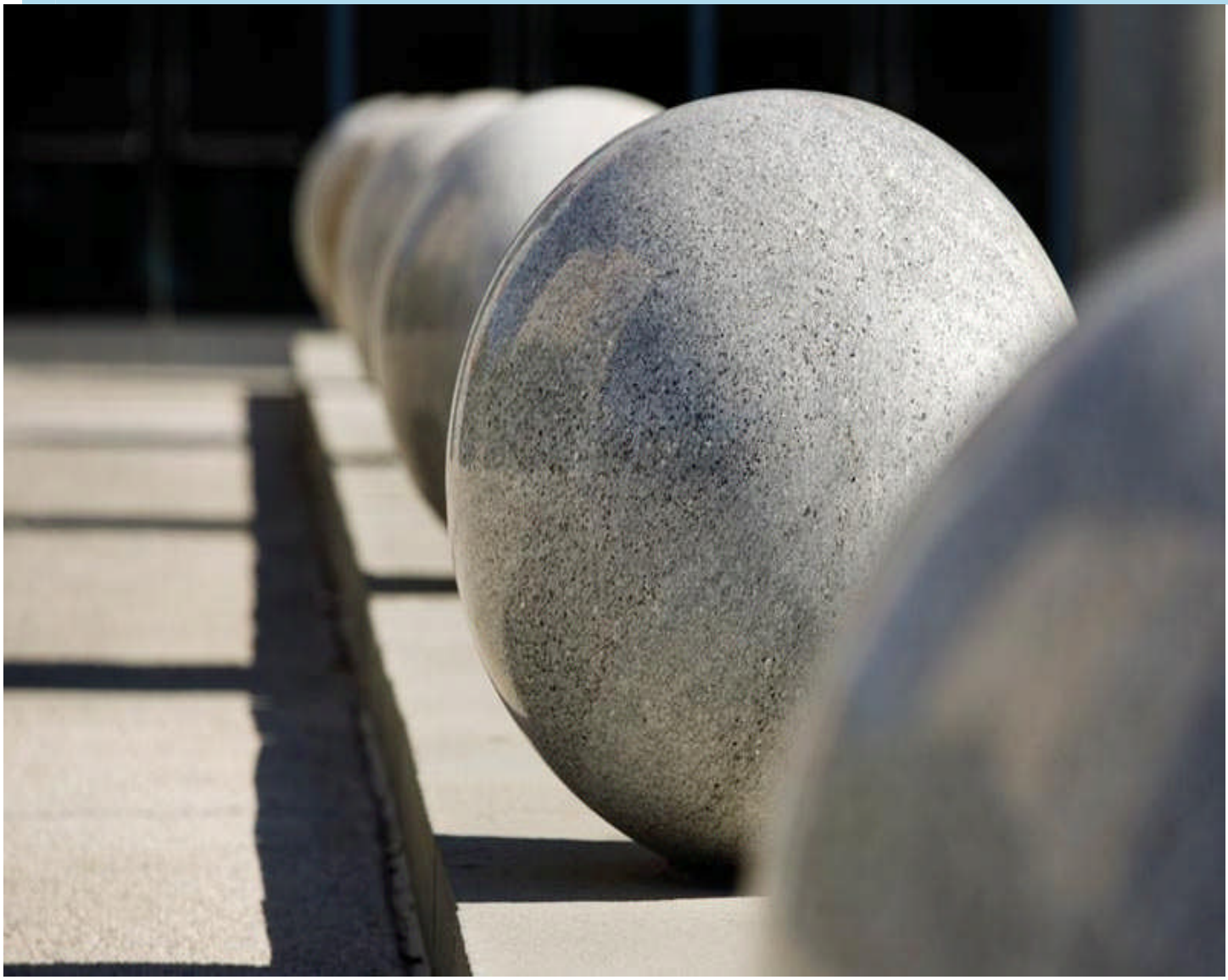
Final Report

Appendix D: Economic Impacts



Appendix D – Economic Impacts

In this Appendix we detail the approach we have adopted to analysing the likely range of economic impacts which have (and could in the future) be generated by ESL activities.

We have outlined, therefore, the basis upon which we have identified and measured the:

- Effects of the Link's current activities; and,
- Potential future impacts that might occur.

In assessing such effects we have drawn upon various guidance material provided by Scottish Enterprise to analyse impacts. In addition – given the limitations of the data available from the Link – we have also drawn upon:

- Scottish Executive data concerning multiplier values and gva per employee over relevant industrial sectors; and,
- Extant information concerning commercialisation and related activities and outcomes in other Scottish and UK universities.

Current Effects

As indicated previously – at Table 2.3 – a total level of £6.2 million has been committed to ESL activities over 2001 to 2007. It is our understanding that, of this total, around £1.97 million has directly supported activities at Stanford. Accordingly we have discounted this amount from our economic impact evaluation on the grounds that there were unlikely to be any direct benefits, within the Scottish economy, from such expenditure.

Consequently, as illustrated in Table D1 overleaf, it is apparent that of the remaining £4.23 million expenditure (e.g. £6.2 million - £1.97 million):

- Around £2.65 million of this spend related to Edinburgh University staff and student costs;
- Approximately £0.57 million supported direct project and programme costs (including project expenses, marketing, business development and conferences); and,
- The remaining £1.01 million relates to 'indirect' support services (such as legal and professional fees, rents and administration costs).

Table D1: Total Scottish Related ESL Expenditure 2001 to 2007	
Item	Total (£m)
Edinburgh University Staff/Students	2.65
Direct Project/Programme Costs	0.57
Indirect Support Services	1.01
Total	4.23

In assessing the net (as opposed to gross) effects of these different streams of expenditure we have reviewed, as detailed below, the likelihood of "direct leakage' and potential substitution/displacement effects prior to assessing potential employment and gva impacts.

(a) Direct Leakage

In our view, based on our consultations with stakeholders and ESL staff and management, it is likely that most (if not all) the expenditure relating to Edinburgh University staff and student costs may be categorised as "locally or Scottish based".

In contrast it is likely that a proportion of the direct project / programme costs and indirect support services may have been sourced from non Scottish sources. Consequently, as illustrated in Table D2 below, we have assumed:

- No leakage (i.e. 0%) in relation to Edinburgh University personnel costs; and,
- A 'worst case scenario' of up to 50% leakage in relation to all other services.

Table D2: Assumed Impact of Direct Leakage on Total ESL Expenditure 2001 to 2007			
Item	Total (£m)	Assumed Leakage %	Total (£m)
Staff/Students	2.65	0	2.65
Direct Support	0.57	(50)	0.285
Indirect Support	1.01	(50)	0.505
Total	4.23	(19)	3.44

(b) Substitution / Displacement

As indicated, in Section Two of our main report and detailed at Appendix A, the ESL has supported 18 research projects over three funding periods during 2001 to 2007. All of these projects (with the exception of the EASIE project extension) involved joint University teams from Stanford and Edinburgh. On the basis of our consultations with stakeholders (and, in particular, representatives from Stanford) it is apparent that none of these projects would have been taken forward on a joint working basis without the ESL.

Consequently, as illustrated in Table D3 below, we have assumed that:

- All costs associated with these research projects – in terms of Edinburgh University staff and students involvement – should be regarded as 100% additional (i.e. in the absence of the ESL none of these projects are likely to have been undertaken in either the form, timescale or with involvement of Stanford);
- Similarly the likelihood of the other activities supported by the key direct project and programme costs are unlikely to have been undertaken (i.e. in terms of business links, entrepreneurial modules and so forth) without ESL.
- Some of the activities relating to indirect support services expenditure probably would have occurred even in the absence of ESL.

Table D3: Assumed substitution and displacement effects over 2001 to 2007

Item	Total (£m)	Assumed Displacement %	Total (£m)
Staff/Students	2.65	None	2.65
Direct Support	0.285	None	0.285
Indirect Support	0.505	None	0..505
Total	3.44		3.44

(c) Deadweight

In regard to potential deadweight effects it is likely, in our view, that a proportion of Edinburgh University staff time would have been dedicated to other research activities (although not of the nature that occurred as a result of the Link). Similarly it might also be anticipated that, in the absence of the ESL, a proportion of student time would also have been dedicated to research that could have been supported by alternative funding regimes. Finally we believe – on the basis of our findings - that some of the activities relating to indirect support services expenditure probably (such as property rental) would have occurred even in the absence of ESL.

Consequently, we have assumed a 'worst case' scenario of 50% deadweight of staff and student time and 27% indirect support. As a result – and as illustrated in Table D4 below – if this was the case the total net direct ESL expenditure 'benefit', after accounting for leakage, substitution and displacement and deadweight is likely to be in the region of £1.979 million.

Table D4: Assumed effects of deadweight over 2001 to 2007

Item	Total (£m)	Assumed Deadweight %	Total (£m)
Staff/Students	2.65	50	1.325
Direct Support	0.285	0	0.285
Indirect Support	0.505	27[1]	0.369
Total	3.304	40	1.979

1 This represents the proportion of costs on admin and rents.

(d) Employment

The expenditure level identified in Table D4 can be cast in terms of full time equivalent years of employment (or "fteye"). We have drawn several assumptions in regard to the likely levels of fteye supported by the Link, namely that:

- All costs associated with ESL research projects – in terms of Edinburgh University staff and student involvement – should be regarded as 100% additional (i.e. in the absence of the ESL none of these projects are likely to have been undertaken in either the form, timescale or with the involvement of Stanford);
- The average level of staff/student costs is around £25,000 per fteye to reflect the divergent nature of staff salary costs and student re-imbursement (as well as the level of expenditure per staff/student per annum across the Scottish Enterprise Proof of Concept Programme); and,

- For both types of support services used by ESL an annual cost per employee of around £75,000 in line with labour intensive business services.

On the basis of the above assumptions we estimate that – as illustrated in Table D5 overleaf – the net expenditure associated with Link activities, over 2001 to 2007, has potentially supported up to 62 additional full time equivalent years of employment.

Table D5: Assumed Levels of Direct Full Time Equivalent Years of Employment over 2001 to 2007

Item	Net Direct Expenditure (£m)	Assumed Income per employee per annum (£)	Estimated full time year of employment (fteye)
Staff	1.325	£25,000	53
Direct Support	0.285	£75,000	4
Indirect Support	0.369	£75,000	5
Total	1.979		62

(e) GVA

Given the estimates relating to ESL employment levels above we have also analysed associated gva impacts based on Scottish Executive data. As indicated, in the introduction to this Appendix and outlined in Table D6 below, we have selected labour categories from the Scottish Executive database that we believe best accord with the expenditure streams associated with the Link, namely:

- "Research and Development" in relation to staff and students project activities; and,
- "Other Business Activities" in relation to direct and indirect support services.

Table D6: Assumed Levels of GVA associated with Net Direct Expenditure of the ESL over 2001 to 2007

Item	Estimated Fteye	GVA per employee per annum	Total GVA £m
Staff/Students	53	18,100[1]	0.96
Direct Support	4	29,800[2]	0.12
Indirect Support	5	29,800	0.15
Total	62	-	1.23

.

[1] SIC Division 73: 'Research and Development' gva per employee, Scottish Executive, Scottish Economic Statistics, 2004.

[2] SIC Division 74: 'Other Business Activities' gva per employee, Scottish Executive, Scottish Economic Statistics, 2004.

As illustrated, in Table D6, adoption of these categories implies that a total of £1.23 million gva has been generated as a result of direct net ESL expenditure.

Indirect and Multiplier Effects

In assessing the indirect and multiplier effects of the net direct expenditure associated with the Link we have applied various level II multiplier values from the Scottish Executive Output, Income and Multiplier categories, namely:

- Market research multipliers for the staff and student categories of expenditure and gva (identified at Tables D4 and D6); and,
- Research and development multipliers for project expenditure.

As illustrated, at Table D7 below, applying these multipliers (to the direct net additional impacts identified) suggests that the indirect and knock on net effects of the ESL could have been in the region of 36.5 full time equivalent years of employment and £1.02 million gva.

Table D7: Indirect and Multiplier Effects

Employment				
Item	Staff Students	Direct Support	Indirect Support	Total
Net Employment (fteye)	53	4	5	62
Employment Multiplier	0.563[1]	0.707[2]	0.707[2]	-
Multiplier Impacts	30	3	3.5	36.5
GVA				
GVA	0.96	0.12	0.15	1.23
GVA Multiplier	0.878[3]	0.647[4]	0.647[4]	-
Multiplier Impacts	0.84	0.08	0.10	1.02

[1] Category I08, Research and Development, Type II employment multiplier, Scottish Executive.
[2] Category III, Market Research, Type II employment multiplier, Scottish Executive.
[3] Category 108, Research and Development, Type II gva multiplier, Scottish Executive.
[4] Category III, Market Research, Type II gva Multiplier, Scottish Executive.

Finally, aggregating both the direct and indirect impacts identified suggests, as illustrated in Table D8 overleaf, that the total **direct net effects** of the Link are likely to have been:

- Around £3.6 million income generated within the Scottish economy;
- 98.5 additional full time equivalent years of employment; and,
- Around £2.25 million additional gva.

Table D8: Total Net Direct Impacts			
Income (£m)			
Item	Direct (Income)	Indirect & Induced (Income)[1]	Total (Income)
Staff	1.325	1.16	2.5
Direct Support	0.285	0.18	0.5
Indirect Support	0.369	0.24	0.6
Total	1.979	1.58	3.6
Fteye			
Staff	53	30	83
Direct Support	4	3	7
Indirect Support	5	3.5	8.5
Total	62	36.5	98.5
gva (£m)			
Staff	0.96	0.84	1.8
Direct Support	0.12	0.08	0.2
Indirect Support	0.15	0.1	0.25
Total	1.23	1.02	2.25

[1] These effects are derived on the basis of the gva multipliers adopted at Table D7.

Wider Catalytic Impacts

In considering the wider influences of the Link and the related benefits associated with these effects we have evaluated the stated outputs of the Link, as of August 2007, in terms of the:

- Current impacts that are likely to have been generated already; and,
- Range of impacts that might be anticipated to occur in the future.

Current Impacts

As illustrated in Section Two, and detailed at Appendix A, the ESL has generated a range of outputs and outcomes. In considering the current impacts of these effects we outline, in Table D9 below, each of these effects in terms of:

- Their stated amount and value where recorded;
- Likely impact to date; and,
- The basis upon which we have assumed such impacts can or should be measured.

Table D9 – Wider Outputs and Current Impacts

Stated Output	Amount / Value	Likely Wider Impact to Date	Assumptions
Research Projects	18	Licences, spin outs, patents and additional research funding	Captured under separate output measures below
Other Projects	19	As above	As above
Academic Publications	100	Increased reputation	Potentially contributory factor in securing additional research funding and interest in Department : impacts likely to be captured by other measures
Talks and Presentations	97	Increased reputation	As above
Student Projects	18	Platform for future 'R & D' outcomes, increased skills and retention and reputational benefits (and it is our understanding that at least one of these projects has been taken forward already for further development)	Potentially contributory factor in securing additional funding through increased interest and reputation of the University: impacts may be captured, in part by funding measures
Student/Staff Collaborations	29	Increased productivity/reduction in cost base of companies	Stated net impacts of representative companies
Consultancy Contracts	11	Increased productivity/reduction in cost base of companies	Stated value of contracts (as a minimum reflection of potential benefit)
Stated Output	Amount / Value	Likely Wider Impact to Date	Assumptions

Students	29	Input rather than output	Impacts already captured by direct effects
Entrepreneurship Courses	3	Input rather than output	Increased reputation and attraction of new students / retention of existing personnel
Entrepreneurship Students	250	Input rather than output	As above (in relation to entrepreneurship courses)
Companies engaged with	40	Increased sales through the development of new and the enhancement of existing products / services	We have assumed that the companies we consulted are 'representative' of all those engaged with by the Link and hence their stated outcomes may be 'aggregated up' to reflect overall impacts
Master Classes	27 (400 attendees)	Increased opportunities to ensure 'R&D' and other commercially related linkages may forged between: • Companies • Research departments • Combinations of the above Increased understanding of entrepreneurship and management practices that can be implemented to improve performance. Increased reputation of Edinburgh University	We have assumed that the attendees we have consulted are representative of all attendees and, therefore, that the types of current (and future) impacts they identified for their organisations are also representative across the 400 stated attendees.
Patients / Licenses	4 and 7 respectively	Increased revenue and consequent related employment and gva impacts	Based on stated amounts secured by ESL
Additional Funding Support		As above	As above

As illustrated, by Table D9 above, the Link has generated a significant range of diverse outputs and impacts. In endeavouring to capture these in measurable terms we have assumed that:

- Measures of income – in relation to additional ESL research funding and licensing – can be utilised as a basis to calculate related employment and gva effects;
- Sales revenue and/or productivity improvements – outlined by the those companies we consulted that were engaged with the Link or attended master classes – are both ' representative' (and thus may be used as a basis to "gross up" impacts) and can be adopted to evaluate employment and gva effects;
- Reputational effects and increased interest in the University to take forward commercialisation and collaborations is likely to be reflected by the above; and,

- Increased staff/student retention (which is likely to be a product of all the above) is likely to have already been 'captured' within our evaluation of direct impacts (i.e. in terms of our assumption that 50% of research projects and thus staff/student time would not have been utilised without the Link).

Based on the above assumptions Table D10 below illustrates the wider inputs that ESL is likely to have generated.

Table D10 – Current Wider Impacts of ESL	
Item	Value (£m)
Additional Research Funding[1]	2.4
ERDF[2]	0.4
Consulting Contracts[3]	0.5
Licensing[4]	0.16
TOTAL[5]	3.46

[1] ESL: Summary of Outcomes against original objectives, Edinburgh University 2007.

[2] ESL Annual Report, 2004/05.

[3] ESL Progress Report, 2004.

[4] Based on the assumption of 7 licences at an average annual income of £7,500 over a 3 year period as per stated (single) IT Licence agreement identified in the ESL Annual Report, 2004/05.

[5] Our consultations with companies suggested that while engagement with the Link had generated various benefits it was too early to measure any sales/productivity impacts

On the assumption that the majority, if not all, of the expenditure identified (of £3.46 million) supported 'r&d' activity of a similar nature to other ESL projects then the level of:

- fteye supplied is likely to be 136 (i.e. £3.4 million / £25,000 as per Table D5); and,

- gva generated could be up to £2.4 million (i.e. 136 fteye x £18,100 as per Table D6).

Applying appropriate multiplier values to these estimates suggests, as indicated in Table D11 below, that the current wider impacts of the Link are likely to be in the region of 232 fteye and £4.0 million gva.

Table D11 – Current Wider Impacts	
Item	Value (£m)
Fteye	136
Employment Multiplier[1]	0.707
Multiplier Impact	96
Total	232
Item	Gva
Gva	2.4
Gva Multiplier[2]	0.647
Multiplier Impact	1.6
Total	4.0

[1] Category 108, Research and Development, Type II employment multiplier, Scottish Executive

[1] Category 108, Research and Development, Type II gva multiplier, Scottish Executive

Finally, aggregating both the direct, indirect and wider catalytic impacts identified suggests, as illustrated in Table D12 overleaf, that the total net current effects of the ESL are likely to have been:

- Annual £9.4 million income generated within the Scottish economy;
- 330 additional full time equivalent years of employment; and,
- Around £6.25 million additional gva.

Table D12: Total Net Current Impacts			
Item	Direct	Wider Impacts (Income)	Total
Staff/Students	£2.5m	-	-
Direct Support	£0.5m	-	-
Indirect Support	£0.6m	-	-
Total	£3.6m	£5.8m[1]	£9.4m
(Fteye)			
Staff/Students	83	-	-
Direct Support	7	-	-
Indirect Support	8.5	-	-
Total	98.5	232	330.5
(Gva)			
Staff/Students	£1.8m	-	-
Direct Support	£0.2m	-	-
Indirect Support	£0.25m	-	-
Total	£2.25m	£4.0m	£6.25m

1 Assumed revenue per employee of £25,000 per annum.

Future Impacts

In assessing the potential range of future impacts that might be generated by the activities of the Link we have assumed two 'future states of the world', namely a:

- '**Worst Case Scenario**'; whereby no further impacts are likely to be derived; and,
- '**Best Case Scenario**'; whereby additional and longer term impacts will occur as a result of the ESL.

In the former, worst case, the future effects of the Link will remain unchanged from these currently identified (of £9.4 million net income, 330 fteye and £6.25 million gva as outlined at Table D12 above).

In the latter, best case, we have drawn on a range of sources to derive assumptions on the potential future impacts that might emerge, namely that:

- There are likely to be further licences and spin outs as a result of student projects (not least because of their engagement in entrepreneurship studies); and,

- Based on our interview programme a proportion of the companies that ESL has engaged with directly or, indirectly, through the ESL Master Classes are likely to experience increased sales and/or improvements in their net revenue position.

In relation to the former impacts we have assumed that the:

- Ratio of licences to student projects – as illustrated previously at Table D9 - will be 7 to 18 as per existing ESL performance; and,

- Ratio of spin outs to licences from the 18 student projects will be around 2.5 to 10 in line with UK University rates (as evidenced in: "The UK is good at science, poor at the exploitation of science. Discuss", PMSU, 2006.

In regard to the latter impacts – namely the potential uplift in sales and/or net revenues of companies engaged with the Link – we have assumed that:

- Up to half of the 240 companies involved will derive some form of benefit in line with our interview results (with companies engaged with the ESL);

- Such effects could represent up to 5% of total revenues per annum;

- If the sample of firms we identified are representative total revenues per company are likely to be in the region of £1 million to £5 million per annum; and,

- The impact that might be ascribed to the Link of such effects is likely to be (at minimum) two years.

Accordingly as detailed, in Table D13 below, by adopting these assumptions under the best case scenario the Link might generate a further £19 million income, 191 fteye and £4.35 million gva.

Table D13
Best Case Scenario

Impacts	Future Spin Outs	Future Licences	Future Sales	Total
Income	£4.0m	£0.11m[2]	£15m[3]	£19.11m
Fteye	40[4]	1.5[5]	150[6]	191.5
Gva	£1.56m	£0.09m[7]	£2.7m	£4.35m

[1] i.e. £1 million income per annum, 2 spin outs and 2 years attribution: £1.0 million x 2 x 2 = £4.0 million

[2] i.e. £7,500 per annum, 7 projects and 2 years attribution: £7,500 x 7 x 2 = £0.16 million

[3] i.e. 120 companies, average annual revenue of £2.5m, 5% benefit and 1 years attribution: 120 x £2.5 m x 0.5 x 1 = £15 million

[4] i.e. 10 fteyes per spin-out over 2 years: 10 x2 x 2 = 40.

[5] i.e. Average income for employee per licence of £75,000: £110,000 / £75,000 = 1.5

[6] i.e. Average revenue per employee of £100,000: £15 million / £100,000 =150

[7] Average gva likely to be around 83% of income: £0.11 million x 0.83 = £0.9 million

[8] To reflect the capital intensive nature of the informatics sector we have assumed that the 'research and development gva level of £18,000 is appropriate: £18,100 x 150 = £2.7 million.