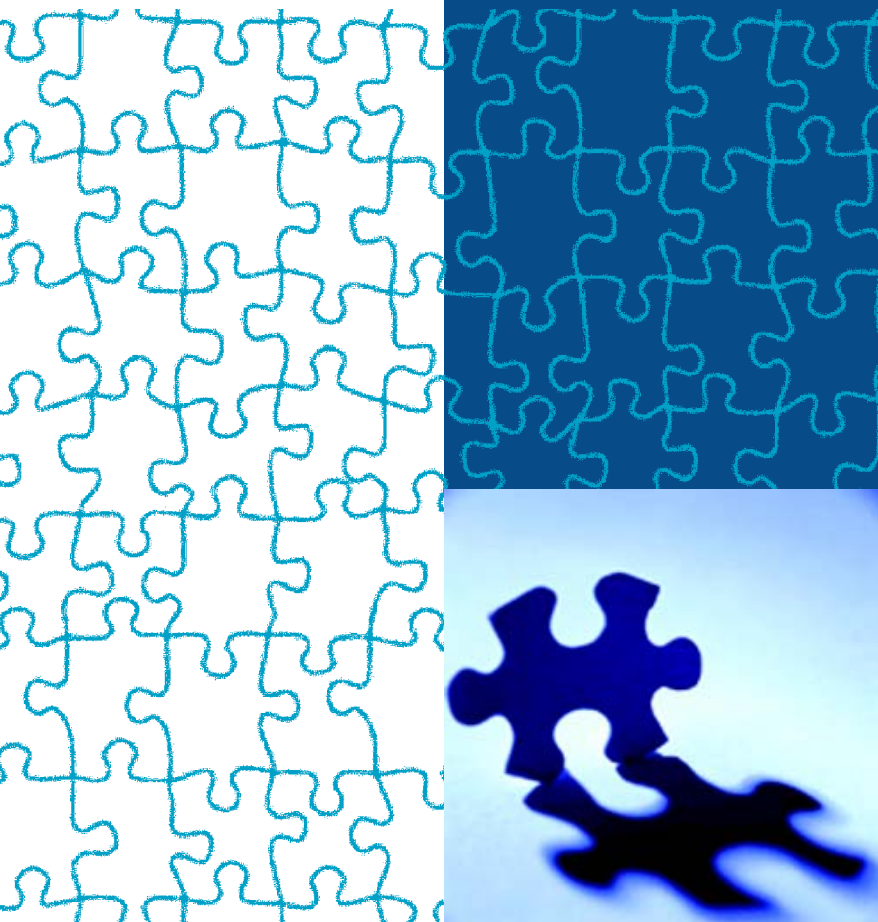


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Collaborating
for Efficiency

Report of the
Entrepreneurial
Sub-group



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Entrepreneurial Sub-group

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1. Executive summary

1.1 Overview

The Collaborating for Efficiency Entrepreneurial Sub-group was established with terms of reference that, in summary, required them to:

- Provide a definition of entrepreneurial activity.
- Identify and consider the scope of opportunities to improve efficiency in the pursuit of entrepreneurial activities by TEIs.
- Identify and consider the scope of opportunities to increase collaboration in undertaking entrepreneurial activities by TEIs.

The Sub-group considered that the focus should be entrepreneurial activities that relate to commercialising intellectual property and knowledge that arises from TEI research or knowledge, or in other words relates directly to the core TEI functions of teaching and research. It acknowledges that all TEIs engage in a wide range of other revenue-generating activities but considers them to be outside of its terms of reference, because they frequently reflect “business as usual” albeit often exciting activities.

Activities undertaken by the Sub-group were clustered around:

- Commissioning reports on international commercialisation practices, entrepreneurial activity in New Zealand TEIs, New Zealand TEIs’ opinions on opportunities, constraints and impediments relating to entrepreneurial activity, potential benefits of commercialisation and a review of the policy framework in New Zealand.
- Discussions on barriers, impediments and opportunities to commercialise intellectual property (IP) and knowledge in New Zealand which reflected the local and international experience of the Sub-group members.

In undertaking its deliberations, the Sub-group identified four key issues which are integral to the discussion on commercialising IP and knowledge. These are:

- The considerable diversity of the TEI sector in terms of the current / potential value to individual TEIs of commercialising their IP and their capability and experience to commercialise IP.

- The existence and size of TEI intellectual property that is unexploited or undiscovered.
- The relative importance of IP commercialisation revenue to TEIs.
- The scope and size of opportunities for commercialising IP within New Zealand and overseas.

Underlying the responses to these issues is the Sub-group's concern about the lack of clarity surrounding the Government's expectations for TEIs in the commercialising of IP and knowledge.

Finally, the Sub-group is concerned about the perpetuation of "myths" relating to the commercialisation of IP, and in particular, the prospect that these myths may unduly influence policy development and the expectations about TEI performance in commercialising IP. Four myths, taken from a recent Australian study are:

- Universities are a vast untapped source of intellectual property.
- Every time we license or sell a technology we are selling the farm.
- Universities are very behind their overseas counterparts in commercialising research.
- Researchers despise the very concept of business and wealth generation.

The Sub-group considers that these myths have direct application within New Zealand and supports actions to ensure that balanced and well informed opinions are expressed.

1.2 Recommendations

As a result of its analysis, discussions and experience, the Sub-group observes that the core teaching and research roles of TEIs must be preserved and strengthened. These roles require excellent staff, good students and appropriate levels of resources. The commercialisation of IP and knowledge in TEIs must be consistent with and support those core roles of teaching and research.

The Sub-group recommends that:

- TEI Councils and Managers be given clearer and more operational guidelines about Government expectations for them to commercialise IP and knowledge and to embark on collaborative activities. This may be made explicit in the Tertiary Education Strategy and so taken into account in the development of Charters and Profiles, through the Ministerial expectations of council members or through the nature of the structure of research funding. It would include the desirability of appropriate collaboration in commercialisation endeavours and the need to accept the risks inherent in entrepreneurial activities.
- TEIs which are likely to generate small numbers of commercialisation opportunities and therefore face difficulties in justifying the requisite level and amount of expertise required, be strongly encouraged to collaborate in establishing viable commercialisation units or to outsource their requirements.
- TEIs collaborate, both with other TEIs, and with other organisations, to establish and deliver courses for councillors, managers, researchers and other personnel to create an awareness and understanding of the best practice structures, systems and processes for commercialising IP and knowledge, together with the potential implications and impact of entrepreneurial activities.
- TEIs be provided with guidelines for developing internal culture and establishing incentives for researchers to co-operate in identifying commercialisation opportunities and to assist with developing research to the level which would enable “proof of concept”.
- The Public Finance Act be amended to increase the autonomy of TEIs to invest for the purposes of commercialising IP and knowledge.
- The Tertiary Education Strategy be strengthened in the areas of appropriate collaboration and performance in commercialisation of IP and knowledge to clarify the Government expectations of TEIs.
- Robust information on the performance of New Zealand TEIs be developed using the AUTM methodology and be used to inform the Government in its policy deliberations about funding and other issues relating to commercialisation of IP.
- Increased public funding be provided to TEIs, CRIs and other research organisations to increase the level of fundamental and basic research and, in turn, enhance the generation of potential commercialisation opportunities by TEIs.

- Increased public pre-seed funding (along the lines of the Pre-seed Accelerator Fund) be provided to overcome the gap between the development of TEI research and requirements for funding by venture capital organisations, while maintaining the necessary incentive for commercialization within the staff and TEI.
- Mechanisms be explored and, where appropriate, implemented for establishing appropriate linkages between TEIs (individually and collectively) and the New Zealand innovation “system”.
- Practical assistance with collaboration between TEIs, CRIs and other research organisations be provided through Government sponsored Science Enterprises workshops to develop and implement co-operative research and commercialisation initiatives.

2. Introduction

2.1 Terms of Reference

The terms of reference of the Sub-group include the preparation of a report on best practice in identifying and managing entrepreneurial activity within the public tertiary education sector, as well as considering partnership and collaborative opportunities within and outside the sector.

The full terms of reference are attached as Appendix 1. In summary they provide for:

- A definition of entrepreneurial activity.
- A scope of the opportunities to improve efficiency in the pursuit of entrepreneurial activity.
- A scope of the opportunities to increase collaboration in undertaking entrepreneurial activities.

In considering the definition of entrepreneurial activity, the Sub-group agreed that the general characteristics of such activity namely: innovation – thinking outside the square and capitalising on new or emerging opportunities, were appropriate, but that the scope of entrepreneurial activities to be considered by this Sub-group should be limited to commercialising IP that arises from TEI research or knowledge. Such an interpretation is consistent with the Government Growth and Innovation Framework. As a result it primarily includes entrepreneurial activity relating to core research and teaching and includes any patent, invention, design, copyright, know-how, trade secret or plant variety right (whether registrable or unregistered).

It is acknowledged that many TEIs engage in a range of other revenue generating, commercial or entrepreneurial activities that may relate directly or indirectly to their roles in teaching and research. These include:

- Organising and hosting conferences and providing conference facilities.
- Providing student and staff accommodation.
- Operating student and staff retail facilities.
- Leasing and renting space to third parties.
- Conducting professional development and continuing education programmes.

- Bulk purchasing and on-selling of class and course materials.
- Contracting to provide consultancy advice to external organisations.
- Undertaking testing and verification services using TEI equipment and facilities.

These activities are primarily revenue generating and their operation is not considered to pose any specific issues or major opportunities that relate to the core teaching and research activities of TEIs.

2.2 Key activities undertaken

The Sub-group has undertaken a number of key activities which provide the framework for the contents of this report. Amongst these key activities were:

- **Commissioning Independent Consultant Reports**

Four reports were provided by consultants commissioned by the Sub-group. These encompassed:

- review of international practices in the commercialisation of IP
- review of entrepreneurial activity in New Zealand TEIs
- survey of selected New Zealand TEIs on the opportunities, constraints and impediments to commercialising IP.
- potential benefits of commercialising IP in TEIs.

A synopsis of each of these reports is included as an annex to this report.

Both the commissioned reports and the annex are provided to inform readers, however their contents are those of the commissioned researchers and are not necessarily endorsed by the Sub-group.

- **Analysis of New Zealand Policy Framework**

A descriptive summary was prepared for the Sub-group on the policy framework and agencies relating to the commercialisation of IP in New Zealand. An overview of that report is included as an annex to the main report.

- **Discussions on Barriers, Impediments and Opportunities Relating to Commercialising IP**

The Sub-group met on four occasions to combine its local and international experience to identify the key issues discussed in this report.

2.3 Key issues

The Sub-group has identified four key issues which are considered integral to this discussion on commercialising TEI intellectual property, namely:

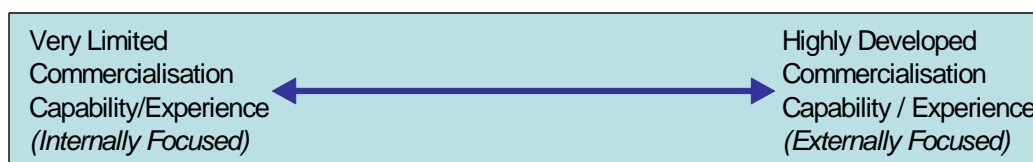
- The considerable diversity of the TEI sector in terms of the current / potential value to individual TEIs of commercialising their IP and their capability and experience to commercialise IP.
- The existence and size of TEI intellectual property that is unexploited or undiscovered.
- The relative importance of IP commercialisation revenue to TEIs.
- The scope and size of opportunities for commercialising IP within New Zealand and overseas.

These issues are discussed below.

■ Sector Diversity, Capability and Experience

The tertiary education sector in New Zealand, which encompasses more than 37 institutions under the umbrellas of universities, colleges of education, polytechnics and wānanga, is very diversified, both in terms of size and of the roles and functions of its institutions. Therefore their current and potential involvement in research and knowledge-creating activities that may lead to commercialisation opportunities will have considerable variability. For example, it is only universities which have a statutory role to undertake research. TEIs engaged in degree-level programmes have research responsibilities relating to staff and students involved in those programmes.

In addition to this operational diversity, there is evidence of considerable variation in the capability and experience of TEIs within the university, polytechnic, college of education and wānanga sub sectors to commercialise opportunities. As shown in the diagram below TEIs are at all points on a continuum.



What is required is a good correlation between the positioning of each TEI on that continuum and the capability/experience which is required in a TEI, given its size and functions.

The position of each TEI on that capability/experience continuum will present quite different challenges for that TEI in successfully commercialising IP because that positioning influences the nature and importance of impediments or challenges being faced by the TEI. As illustrated in the matrix below, two dimensions (internal and external) determine whether the environment is conducive to TEI entrepreneurial activity and collaboration. Those TEIs with limited commercialisation capability/experience will be immediately constrained by their internal environments, whilst those with considerable commercialisation capability/experience have usually overcome those internal constraints and are focused on ensuring that the external environment is conducive to their commercialisation activities.

TEI IP Commercialisation Capability/ Experience <i>Highly Developed</i>	Internal TEI Issues Substantially Resolved	External Issues provide constraints on further commercialisation activity
	Internal TEI Issues are Immediate Constraints	External Issues Not Seriously Considered
<i>Limited</i>	<i>Internal Issues</i>	<i>External Issues</i>

Portfolio of Issues to be Resolved

The relative focus by TEIs on those two dimensions is related to their current positioning on the capability / experience continuum.

■ **Under-developed commercialisation opportunities**

The second issue concerns the size and extent of TEI Intellectual Property that is unexploited or sitting on the shelf, i.e. untapped commercialisation opportunities. This issue is important because it should influence the level of resources to be applied both within the TEIs and amongst Crown and private sector organisations to ensuring that those untapped opportunities are addressed. However, the extent to which this untapped IP exists should not be overestimated. It is highly likely that there is only a limited amount of undeveloped IP and knowledge within the tertiary sector as it is probable that publication will have occurred if it was not protected. A key issue appears to be whether publication may have jeopardised protection and commercialisation.

There has been no systematic study of the performance of New Zealand TEIs in commercialising IP and knowledge. Only recently has Australia attempted to address this issue through a study led by the Australian Research Council (ARC) which used the methodology developed by the Association of University Technology Managers – USA (AUTM). The overall results of the Australian study are shown in the two tables below. (Note: those tables include research expenditure by universities and medical research institutions but exclude CSIRO).

• **Commercial Activity Relative to Research Expenditure**

For every \$1.0b (US) in research expenditure the following were achieved.

Country	USA Patents Issued	Licenses Executed	Income (\$US) from Licenses	Start Up Companies
Australia	34.3	115.4	\$31.6m	16.2
USA	127.9	143.0	\$44.9m	13.8
Canada	86.1	183.4	\$17.2m	37.5

The estimated research income (not expenditure) of TEIs in New Zealand is:

- EFTS subsidy (PBRF component)	\$US76m
- Other research income	\$US131m
Total	\$US207m

Using an indicative level of \$US200m as the research expenditure of New Zealand TEIs, then average annual performance which is comparable to Australia and the USA in patents, licences and start up companies would require the New Zealand TEIs to achieve the results listed in the table below.

	Comparative Performance (assuming \$400m of Research Expenditure)	
	Australia "Benchmark"	USA "Benchmark"
USA Patents Issued	7	25
Licenses Executed	23	57
Income from Licenses	\$6.5m	\$9m
Start Up Companies	3.3	2.8

The above two tables indicate:

- Significant variability across the three benchmark countries (Australia, USA, Canada) in the level and mix of commercial activity (ie. relating to IP and knowledge commercialisation) generated per \$1.0 billion of research expenditure.
- The commercial activity required by New Zealand TEIs, given the indicative level of research expenditure, can be assessed by using the benchmark performance of Australia and USA.

Unfortunately, no systematic analysis has been undertaken of the commercial activity (ie. relating to IP and knowledge commercialisation) of New Zealand TEIs. However, Uniservices (University of Auckland) has provided indicative data to the Sub group on the New Zealand performance in license agreements, royalties, patent filings, start up companies from 1991 to 2002. This is summarised below.

- License agreements	35	(University of Auckland only)
- Royalties	\$1.0m	(University of Auckland only)
- Patent filings	105	(includes 30 at University of Auckland)
- Start up companies	15+	(all TEIs)

The University of Otago also provided indicative data for a five year period from 1998 to 2002. They report:

- 2 spin off companies
- 34 patents (national)
- \$3.8m revenue from licenses and royalties.

■ **Relative Importance of IP Commercialisation**

The third issue concerns the priority which TEIs may give to improving their commercialisation performance. Of the 37 TEIs in New Zealand, it is estimated that probably 12 or fewer could expect to earn a stream of revenue from commercialising IP. Further, of that 12 revenue from commercialisation of IP and knowledge will almost always be a minor source of revenue, either directly or indirectly. Given this diversity and the complexity of the tasks associated with successful commercialisation of IP, individual TEIs should anticipate a minimum scale of commercialisation to justify prioritising resources to this activity.

There is no systematic study in New Zealand of the importance of commercialisation revenues, however in Australia it has been reported that the average university (only one part of their tertiary education system) earns less than 1% of its revenue from patents, licences and royalties, but more than 5% from contract research and consulting. Whilst the overall average of the Australian University system for revenue from patents, licenses and royalties is less than 1%, the range extends from less than 0.5% to more than 4% of total University revenue, with a small number of the strong research Universities dominating the average performance. This data, if illustrative of New Zealand performance, is likely to have an impact on resource allocation and the priority accorded by TEIs to improving their commercialisation performance.

■ **The Scope and Size of Opportunities, within New Zealand and Internationally**

The fourth issue concerns the scope and size of opportunities within New Zealand to commercialise IP: there is limited availability of receptor organisations. It is estimated that there are only 200 enterprises (includes ANSIC industry divisions for agriculture, manufacturing, electricity, construction, communication, transport and finance) with 100+ FTE employees.

This small number of potential receptor organisations combined with the specialised nature of the IP being generated by TEIs will require TEIs to frequently negotiate with international organisations to ensure that IP commercialisation opportunities generate maximum value and that potential value is not dissipated.

2.4 Myths of commercialising IP and knowledge

A number of myths have been established and perpetuated about the commercialisation of IP. The Working Party is concerned that these myths do not unduly influence policy development and expectations about the potential performance of TEIs to commercialise IP. Rather than develop its own list of myths, the Sub-group supports those identified in a recent Australian study (*Best Practice Processes for University Research Commercialisation – 2003*). Myths 1-4 below are copied from that Australian study.

Myth #1

Universities are a vast untapped source of intellectual property.

Universities do contain a great deal of knowledge and scholarly individuals. But intellectual property is a rare asset, shaped by knowledge, the market and the rules of economics. Moreover, the process of transforming knowledge into intellectual property and then to a good or service is highly complex. Indeed, in many cases the process of research commercialisation is as creative and as complex as research itself.

Comments: The Sub-group considers that New Zealand TEIs are unlikely to have significant untapped IP that could be readily and successfully commercialised, however it is acknowledged that examples exist of lost opportunities because IP has been published, prior to being adequately protected. There are a small number of New Zealand TEIs that engage in activities which are likely to generate IP opportunities.

Myth #2

Every time we license or sell a technology we are 'selling the farm'.

In a globally competitive world we must expect to sell a great proportion of the products of our efforts to markets overseas. This also has the benefit of linking us with global markets and operators, providing the basis of future economic activities. The challenge is to ensure we get a good price for our intellectual goods.

Comments: The small scale of the New Zealand business environment, the restricted number of receptor enterprises within New Zealand and the specialised nature of IP to be commercialised generates a strong requirement for offshore licensing or sale to enable commercialisation to proceed whilst maximising benefits to the TEI.

Myth #3

Australian universities are way behind their overseas counterparts in commercialising research.

The data available demonstrates that the best-performing Australian universities are achieving research commercialisation outcomes broadly comparable with the best in the US and Europe, and way above their average. However, there is considerable variability in performance, with a considerable gap to small and regional universities on the whole.

Comments: No systematic analysis has been undertaken of the performance of New Zealand TEIs relative to comparable Australian and international universities and other higher education institutions. An informal study by Uniservices suggests that New Zealand universities, such as Auckland, perform as well or better than comparable overseas universities.

Myth #4

Researchers despise the very concept of business and wealth generation.

The great majority of academics with a substantial research performance (on average about half) have a very strong interest in seeing the potential outcomes of their research being realised. This realisation may take the form of a new course, a book, a performance, a new scientific theory, or a technology, such as the computer or the Internet, which will change the world. Some can generate direct commercial returns, while from others the economic return is indirect, and the social return considerable.

Comments: There is no evidence to suggest that New Zealand TEI researchers are less interested in realising the outcomes of their research than occurs internationally. It is accepted that impediments, such as internal culture, differences in the required expertise and a lack of institution or researcher experience may exist to limit the commercialisation of IP, but these are able to be resolved.

3. Creating the environment for enhancing entrepreneurial activity and collaboration

3.1 Overview

As outlined in Section 2, the Sub-group has undertaken a number of activities to inform itself about international practices and to obtain information on New Zealand TEI experiences relating to the commercialisation of IP. The review of international practices relating to the commercialisation of IP and the analysis and survey of New Zealand TEI experience and expertise has provided a framework for the Sub-group to add its own expert input. However, the major influence on the content of this report is the experience, both in New Zealand and overseas, of the Sub-group members.

As already indicated New Zealand has a very diversified tertiary education sector, with groups of institutions having different legislative roles, and different functions and activities. It is anticipated that the development of Charters and Profiles will make those differences more explicit. As a result, it is expected that TEIs will continue to have very different involvements in the commercialisation of IP and knowledge.

Individual TEIs have quite different levels of capability and experience in undertaking the commercialisation of IP. These differences are in part the result of sector diversification and hence different needs for commercialisation capability and experience and in part the result of similar TEIs being at different stages of maturity in their involvement of commercialisation activities. As a result of these differences, individual TEIs have different priorities and face different issues and challenges in creating an enhanced environment for entrepreneurial activity and collaboration.

The proposed environment, as discussed in this section, is structured around:

- The internal environment within TEIs.
- The external environment facing TEIs.

The table below summarises the key dimensions which will influence the establishment and operation of an ideal internal or external environment.

<ul style="list-style-type: none">■ INTERNAL Environment<ul style="list-style-type: none">- Culture and Attitude

- Funding and Resourcing
- Capability
- Organisation
- Incentives
- Management

■ **EXTERNAL Environment**

- Statutory and Regulatory Environment
- Political Environment
- Business Environment
- Funding Environment
- Benchmarking Performance

3.2 Internal environment

3.2.1 Characteristics of an ideal internal environment

As indicated in the table above, the ideal internal TEI environment for maximising the opportunities to commercialise IP and knowledge comprises six key dimensions. Each dimension has a number of important attributes or characteristics. These are discussed below:

■ **Culture and attitude**

All TEIs seeking to expand their entrepreneurial activities and to enhance collaboration need to have an internal culture and attitude that not only supports such activities but has a realistic understanding of such activities, including their size, scope, establishment and operation. A positive internal TEI culture and attitude is considered to include:

- Positive support and understanding from the Vice Chancellor, CEO and Council for pursuing TEI entrepreneurial activities and collaboration
- Understanding that entrepreneurial activity involves both successes and failures and that it is a complex business that requires well developed expertise
- Acceptance that “monetary gain” is only one of a portfolio of benefits that a TEI may obtain from commercialisation of IP and knowledge

- Positive institutional atmosphere that promotes and facilitates academic interest and involvement in commercialisation of IP and knowledge
- Realistic attitude to the scale of financial and other rewards that TEIs can expect from commercialisation of IP and knowledge
- Positive “win-win” attitude to collaboration with other Crown organisations and private sector organisations with trust in partner’s capability and capacity to add value to entrepreneurial activity.

Whilst these attributes and characteristics may appear to be self evident, the active promotion of the appropriate culture and attitude within the TEI is considered of fundamental importance to the successful pursuit of activities to commercialise IP and knowledge.

■ **Funding and resourcing**

TEIs seeking to expand their IP commercialisation activities will need to ensure that appropriate internal resources and funding are allocated to enable good commercialisation practices to be adopted. Without adequate funding and resourcing potential opportunities may be missed and potential benefits may not be maximised. This requirement poses a significant issue for the majority of New Zealand TEIs which are likely to generate a limited number of commercialisation opportunities. It may require shared resourcing with other TEIs so that a critical mass of resources can be established.

The requirements for appropriate funding and resourcing are considered to include:

- Enhanced internally allocated funding for high quality fundamental research as a key driver in generating commercialisation opportunities within a TEI.
- Adequate ring-fenced TEI resources and funding to enable good practices to be adopted for the organisation and operation of their commercialisation activities.
- Acceptance that the justification for funding and resourcing activities to commercialise IP and knowledge recognises multiple benefits/outputs for the TEI and not just the impact on the financial performance of the TEI.

A considerable majority of TEIs in New Zealand will have a limited scale of commercialisation activity and be unable to adequately resource a commercialisation unit that will be able to provide the required experience and expertise. Innovative approaches such as outsourcing or collaborative resource sharing will be necessary to enable those TEIs to effectively commercialise their IP and knowledge.

■ **Capability**

Closely linked to internal funding and resourcing is the need for TEIs to have access to the capability required to pursue the commercialisation of IP and knowledge. The international reviews and New Zealand TEI surveys identify the shortage of, but the importance of, such capability to successfully undertaking commercialisation of IP and knowledge.

The required capabilities are considered to include:

- Access to high quality and well experienced commercialisation managers who are primarily focused on commercialising IP and knowledge and not distracted by attending to a range of other commercial revenue-generating activities.
- Enhanced appreciation and understanding by researchers and academic staff of good practices and processes for undertaking IP commercialisation so that the need for high quality expertise is fully understood and the required processes are implemented.
- Internal awareness, and acceptance, of the range of monetary and non-monetary benefits that may accrue to TEIs from commercialisation of IP.
- Acceptance that the background and expertise of academic staff seldom makes them the best people to negotiate and manage complex commercialisation projects that may extend over two or more years.

Capability incorporates both the appropriate commercialisation expertise and a well informed understanding by TEI researchers and academic staff of the requirements for successful commercialisation and the range of benefits that can accrue to TEIs.

■ **Organisation**

The organisation structure and internal relationships adopted by a TEI for its entrepreneurial activity and for enabling collaboration are considered as important contributors to establishing a positive internal environment for enhancing these activities. These activities are relatively specialised and require governance and management that reflect their specialised nature.

The organisation requirements are considered to include:

- Understanding by senior managers/Councils of TEIs of what constitutes good practice in the governance and management of entrepreneurial activities if they are going to be successful and maximise the opportunities to commercialise IP and knowledge.
- An organisation structure for commercialisation of IP and knowledge that provides a defined focus and enables the culture of academics to be married with the timeframes and business imperatives of entrepreneurial partners.
- A governance structure for directing and developing entrepreneurial activities that is experienced in and understands the risks of success and failure associated with these activities.
- Developing sophisticated business, CRI, research and industry liaison to provide efficient entry points to TEIs and to facilitate the expansion of TEI and business/research organisation relationships.

The organisation, governance, operating style and key competencies required for a successful TEI business unit which is responsible for commercialising IP and knowledge are quite different from the requirements for TEI core teaching and research. Accepting these differences and incorporating them into the commercialisation policies and practices will be essential.

■ **Incentives**

Expansion of TEI entrepreneurial activities and increased collaboration is dependent on the active involvement of academic personnel both in undertaking the required research and with early stage commercialisation. It is widely recognised that the TEI, its researchers and external commercialisation partners need to work in close collaboration. Without this involvement it is likely that opportunities will not be maximised.

The incentives for obtaining academic involvement are considered to include:

- Ensuring that teaching and administrative workloads can be arranged to enable individual academics to assist/participate in exploitation of research through commercialisation of IP and knowledge.
- Making available education/training in entrepreneurial skills for academic personnel, so that their understanding of the key issues is enhanced and their participation is encouraged.
- Developing TEI reward/recognition structures that provide a balance between

the involvement of academic personnel in commercialisation of IP and knowledge and their involvement in basic research publications and winning research grants.

- Providing a portfolio of direct (e.g. shares, royalty etc.) and indirect (conference leave, research equipment/support) rewards as financial incentives to participate in commercialisation of research and knowledge.
- Enabling researchers to move between basic research and research commercialisation phases without jeopardising their research reputations and capabilities.

It is inevitable that many academic researchers will face choices in the allocation of their time between pursuing basic research leading to publications and research grants and contributing to more applied research and development activities relating to commercialisation. TEIs need to ensure that they establish a balanced set of incentives to participate in and be rewarded from both phases in the research lifestyle.

■ **Management**

The involvement of any TEI in entrepreneurial activities requires it to have in place management and operational policies and practices that provide the infrastructure for these activities. TEIs will need to adopt best practice guidelines for managing their entrepreneurial activities and collaborative efforts as well as ensuring the protection of IP.

3.2.2 Transitioning to an ideal internal environment

Transitioning to an ideal internal TEI environment required for the successful commercialisation of IP and knowledge requires the application of good practices within a supportive and informed management and governance framework. Such requirements can appear to be deceptively simple to the uninitiated TEI, but may be difficult to implement if a TEI is to achieve an objective of maximising the benefits it obtains either directly, or indirectly, from its commercialisation of IP and knowledge.

This section provides a discussion of a number of the key requirements for a TEI to successfully transition to an ideal internal environment.

■ **Culture and attitude**

It is important that positive, but realistic, support exists for these activities at Council, CEO and management levels. This support will need to include an acceptance that commercialisation of IP is not the panacea for financial issues facing the TEI as the financial benefits are often quite limited. For example, in Australian universities it is estimated that revenue from commercialisation of IP and knowledge averages less than 1% of total revenue and varies from almost nil to 4%. It is also reported that it is not uncommon for American universities to have less than 1% of its total revenue from its commercialisation of IP and knowledge.

Because the value chain for commercialising IP commences with the researcher, it is essential that TEIs seeking to commercialise IP and research establish positive relationships with its researchers. These relationships should include providing the TEI with the opportunity to protect research prior to publication, flexibility for researchers to participate in the commercialisation of IP incentives or rewards for contributing to IP, and opportunities to move between basic and commercialisation phases of research activity.

A key component of successful collaboration is the existence of a TEI environment that promotes collaborative opportunities and the existence of positive personal relationships. Collaboration will not occur by decree, but because of win-win outcomes for all participants and strong personal relationships.

■ **Funding and resourcing**

A prime determinant of commercialisation opportunities is the quantity and quality of fundamental research. TEIs need to maximise the allocation of internal research funds to high quality fundamental research. This may occur through a process of employing a critical number of strong researchers, enabling them to allocate time to research activities or providing an internal fund to support promising fundamental research.

Adequate funding to operate a viable commercialisation unit is also beneficial. A number of reported international examples suggest that a minimum of 4 – 5 FTE staff is desirable for an effective commercialisation unit. Such staff must have extensive relevant experience, expect to command competitive salaries and be supported by a budget that enables travel to major conferences, and to the building of strong external relationships and the funding of high quality legal and patent advice.

■ **Capability**

As indicated above, adequate funding and resourcing is required to establish and operate a commercialisation unit that has a critical mass of people and expertise. Overseas studies reinforce the importance of capability and experience by establishing that the single most important correlation with technology transfer is the length of time that technology transfer office (ie. inferring capability) had been established.

The small size of the majority of New Zealand TEIs and the relative immaturity of such TEIs in undertaking commercialisation will create difficulties in justifying the budget necessary to obtain the required level of capability and experience. Inevitably this will require regional or other collaboration to establish, or obtain access to, a commercialisation unit capable of maximising the benefits from TEI opportunities.

There is also a need for researchers to have an appreciation of the commercialisation processes to ensure that the publish–protect dichotomy is understood and to enable them to participate in achieving successful commercialisation of IP and knowledge.

■ **Organisation**

Councils, Vice Chancellors and CEOs need to ensure that the structure, governance and management of their commercialisation unit adopts best practices. The structure must enable it to operate semi-autonomously from the TEI so that its style of operation and responsiveness matches the expectations of commercialisation partners. Similarly its governance must include individuals with capability and experience in commercial project risk assessment and its management must have the expertise and experience to be credible with the TEI researchers and the commercialisation partners.

■ **Incentives**

A key driver of success in commercialising IP and knowledge will be the positive support from TEI researchers. This support should result from TEIs adopting win-win policies and practices. These policies and practices will include opportunities to actively pursue basic research, participation in the benefits and rewards from successful commercialisation and flexibility to participate in the research commercialisation processes.

3.3 External environment

3.3.1 Characteristics of an ideal external environment

The table in 3.1 identifies that the ideal external environment for maximising the opportunities to commercialise IP and knowledge has five key dimensions. Each dimension has a number of important attributes or characteristics. Both the key dimensions and their characteristics are discussed below.

■ Statutory and policy

The statutory and policy environment will have a strong influence on whether that environment encourages or facilitates the commercialisation of IP and knowledge.

The key characteristics are considered to include:

- The delegation of autonomy for commercial investments to TEIs.
- A Tertiary Education Strategy that recognises the importance of commercialising TEI research, IP and knowledge.
- Government expectations (for CRIs and TEIs) that support collaboration in the area of commercialising IP and knowledge.
- A research funding framework that is consistent and supports collaborative research and commercialisation activity.

An assessment of the current statutory and policy environment suggests that opportunities exist for changes that would be conducive to TEI commercialisation activities.

■ Political

The political environment, in relation to entrepreneurial activity of TEIs, should ensure that realistic and informed views are expressed about such opportunities.

The key characteristics are considered to include:

- Ensuring that the primary rationale for the existence of TEIs, namely a focus on core activities of teaching and research, is not diluted by unrealistic views being expressed about commercialisation opportunities.
- Acceptance of the consequences of undertaking entrepreneurial activities, namely that they involve the risk of failure and potential negative impact on TEI financial position and image.

- Establishing and publicising robust information on relative performance of New Zealand in commercialising TEI research.

The key contribution of TEIs relates to the pursuit of excellence in teaching and research, so that commercialisation opportunities are maximised. Uninformed comments about the extent of such opportunities may be detrimental to TEIs maintaining their focus on teaching and research and risk some loss of capability and resourcing of those core functions.

■ **Business**

A number of international commentators, including analysis undertaken in Australia and New Zealand, establishes that success in the commercialisation of IP requires not only good research but also a business environment that supports the value of research and is prepared to be a partner in risky commercialisation projects. There is a concern that there is a shortage of New Zealand businesses receptors which have those characteristics.

An ideal business environment will include the characteristics of:

- Improved understanding by business of the importance of good science and technology research and its potential benefits for business expansion and growth.
- Increased willingness by business to embark on risky projects, including “early stage” financing of such projects.
- Recognition of the importance of businesses continuing research and commercialisation relationships with TEIs and the establishment of “champions” for those university relationships.
- Acceptance that there is only a limited number of New Zealand business partners available for university research collaboration and commercialisation and this limits the local opportunities for TEIs.
- Understanding of the type of relationship that SMEs (the majority of New Zealand businesses) require with TEIs to participate in research commercialisation.

The relatively specialised nature of TEI research combined with the limited number of New Zealand businesses who are willing to undertake risky research commercialisation opportunities, is likely to require TEIs to utilise overseas licensing, sale or equity participation if their IP and knowledge is to be commercialised. (It should be noted that the Pre-seed Accelerator Fund announced in the 2003 Budget will provide funds for investment in pre-seed Projects.)

■ **Funding**

The availability of funding to strengthen the pipeline from fundamental research to early stage commercialisation is a key component of an ideal external environment, if an increased level of TEI commercialisation activity is to occur.

The key characteristics are considered to include:

- Provide adequate support for enough high quality fundamental TEI research to generate an ongoing strong flow of commercialisation opportunities.
- Reduce fragmentation of research funding and the costs to bid.
- Provide ring-fenced contestable funding for TEIs to establish and foster commercial activities.
- Extend availability of pre-seed funding to facilitate early stage commercialisation at TEIs.
- Operate a tax environment that supports research and development investment by businesses and researchers.

Increasing the level of pre-seed funding will either enable TEIs to advance their research prior to entering into commercialisation arrangement or enable an increased number of New Zealand businesses to participate in commercialising TEI IP and knowledge. However, such an extension of pre-seed funding will not generate increased fundamental research and the priority for TEIs is to achieve that objective. (As noted above, the Pre-Seed Accelerator Fund will provide funding for pre-seed projects in publicly funded research organisations.)

■ **Good practice benchmarks**

The diversity of New Zealand TEIs, combined with the relative immaturity of commercialisation units in the majority of TEIs and specialised requirements of successful commercialisation infrastructure and processes, supports the availability of good practice benchmark information.

This benchmark information may be developed collaboratively or by a lead TEI or other Crown organisation.

3.3.2 Transitioning to an ideal external environment

Ensuring that there is a transition to an ideal external environment is more important for the small number of New Zealand research intensive TEIs which will generate the significant majority of opportunities to commercialise IP and knowledge. It is these TEIs which have the potential to contribute substantial benefits to the economy. However, the external environment which will involve TEIs, Government agencies and the business community is more complex and, as a result, less able to change in the short term, than may occur to the internal environment facing any TEI.

■ Statutory and policy

Changes to the Public Finance Act that would enable TEIs to invest for the purposes of commercialising IP and knowledge, without resorting to case by case approval of the Minister, will facilitate faster TEI decision-making that is expected by commercial and Crown organisations partnering or collaborating with TEIs.

Similarly, the expectations of Government with regard to TEI commercialisation of IP and knowledge need to be clarified. The Tertiary Education Strategy through Strategy One and Six refers to “greater collaboration with the research sector” and “stronger links with those that apply new knowledge or commercialisation of knowledge product”. However, neither of these are accorded an immediate priority in the Statement of Tertiary Education Priorities and are not expected to feature in TEI Charter and Profile development. The essential requirement is for Government to establish and convey to TEIs their expectations about TEIs participating in commercialisation activities. This is considered important because it may influence priorities for the allocation of funds within TEIs and it may change the attitude of TEI governance and management to managing the risks associated with such activities.

In contrast, the Operating Frameworks for CRIs have explicit expectations about the role of CRIs in this context, namely:

- 2001:
 - CRIs should further strengthen links with universities, especially New Zealand universities.
 - CRIs should strengthen links with the private sector.
- 2002: Interconnectivity lies at the heart of a successful innovation system.
- 2003: CRI boards are referred back to the 2001 and 2002 Operating Frameworks and CRIs are encouraged to improve commercialisation ability through partnerships with public and private sector organisations.

The research funding policy framework will need to operate in a manner that provides consistent messages about research collaboration and the interpretation of benefiting New Zealand or the TEI. Concerns exist that inconsistent messages have been provided in the development of CoRES and the PBRF. Some concerns have also been expressed about the New Zealand benefits focus of CRI research and Foundation for Research, Science and Technology (FRST) based funding.

■ **Political**

It is essential that unrealistic expectations about the size and extent of commercialisation opportunities for TEI IP and knowledge do not become accepted wisdom to the point of distracting TEIs away from their core teaching and research. The Sub-group is concerned that primarily TEIs must, through their teaching, create the next generation of researchers and through their research, the next generation of opportunities for commercialisation. Their involvement in commercialisation is considered of second order importance in relation to their core activities and its relative importance to TEI financial viability.

One approach to avoiding unrealistic expectations will be to objectively determine the performance of New Zealand TEIs in generating commercialisation opportunities by undertaking an independent analysis using the structure and format of AUTM (Association of University Technology Managers – USA). This will enable international comparisons to be made.

Finally, increased expectations about TEI entrepreneurial activity must be accompanied by a political acceptance that such activities create additional risks of failure which may have a negative impact on TEI capability to undertake core research and teaching.

■ **Business**

A key ingredient in the commercialisation of IP and knowledge is the establishment and maintenance of networks comprising potential receptor organisations and research organisations. Businesses and TEIs may find such networks as expensive, given the number of commercialisation ideas being generated, the small number of New Zealand receptors and the limited number of risk-taking business organisations in New Zealand. However, it is important that continuing relationships exist and are nurtured to increase trust and confidence.

As TEI research outputs will often be at an early stage of development and given a relative shortage of private sector capacity to fund early stage development, there is a risk for the TEI that any commercial agreement at that early stage will provide very limited returns. For this reason, early stage funding from public sources (such as the Pre-seed Accelerator Fund) may be required to facilitate increased business involvement and improve the returns.

■ **Funding**

The primary role of TEIs has been stated as ensuring that they create the next generation of researchers and the next generation of commercialisation opportunities. For this to occur, a priority exists for increased public funding of fundamental / basic science. The Sub-group has concerns that the acceptance rates for Marsden Fund and other basic research funding is too low and below that of countries such as Australia. Without such funding, the pipeline of commercialisation opportunities will be limited and fall short of expectations of the benefits from commercialising IP and knowledge.

The Sub-group is also concerned that New Zealand has too many separate research organisations chasing too little research money in fragmented funds. A fragmented research funding structure creates high transaction costs for bidders and can contribute to fragmented research activities.

■ **Good practice**

Whilst it is accepted by the Sub-group that diversity will occur amongst TEIs in their commercialisation activities, there are a number of good practices and successful case studies within New Zealand and overseas. TEIs who are relatively inexperienced in commercialisation of IP are expected to benefit from accessing such good practices.

The Sub-group encourages the development and dissemination of good practice case studies.

Annex

- 1. International review of entrepreneurial activities and collaborative initiatives**
- 2. Surveys of New Zealand environment**
 - 2.1 Scope and composition of entrepreneurial activity in New Zealand TEIs
 - 2.2 Barriers to entrepreneurship in TEIs
 - 2.3 Summary of New Zealand policy framework
 - 2.4 Potential benefits of commercialising IP in New Zealand TEIs

Annex 1:

1. International review of entrepreneurial activities and collaborative initiatives

1.1 International models for collaboration - lessons for New Zealand?

It is neither new nor surprising to state that at a global level collaboration is increasingly becoming the “norm”. For example, an analysis of US publications – commencing in 1990 - demonstrated that more than 50% of all papers published were by researchers from multiple institutions.

The single investigator project is basically extinct. The same may now be happening to single-institution research. Research where people collaborate across institutional boundaries is now the rule and not the exception.

There is a vast array of models and schemes operating throughout the world that aim to encourage or enhance collaborative behaviour between TEIs as well as between TEIs and other organisations, especially private sector partners.

The relevance of these models to New Zealand varies, given the unique circumstances and conditions the nation experiences. As a geographically isolated country of only four million people, with an economy still largely dependent on the export of primary produce, any attempt to simply transpose international models on New Zealand would be inappropriate.

It also needs to be reinforced that New Zealand TEIs *can and do* collaborate with each other, with industry partners and with public and private research organisations. Indeed, there is no evidence to suggest that New Zealand TEIs are any worse at engaging in collaborative activities than their overseas counterparts. Furthermore, to suggest that such activity is not occurring in New Zealand and that it requires the application of an overseas model or incentive scheme to “seed” this type of behaviour is nonsense.

Some of the international material discussing the question of entrepreneurial activities and their impact on the core activities of TEIs – teaching and research – was also considered. A brief summary of that material is included in this appendix as well.

1.1.1 International examples of collaboration

This section looks at models that have been established to encourage collaboration at a national level between TEIs, Government and industry. The Australian Co-operative Research Centre experience is discussed, as is the Canadian National Centres of Excellence model with some passing comment on the massive EU Sixth Framework Programme.

Annex 1:

■ **Australian Cooperative Research Centres (CRCs)**

The Co-operative Research Centres (CRC's) programme was launched in 1990. By 1998 when last reviewed (another review is currently in progress) it was stated that “the CRC Programme is widely seen as the most successful mechanism in Australia for linking users to research organisations”.

This programme was launched in response to criticisms levelled at Australian research organisations that ideas and inventions developed in Australia were lost to overseas interests, with little or no benefit returning to Australia and that Australian researchers were isolated from industry. CRCs were established to bring together researchers from CSIRO universities and other Government laboratories and private industry and public agencies in long term collaborative arrangements. These arrangements:

- Create multi-disciplinary, multi-institution research environments focussed on addressing industry and user needs.
- Assist with increasing efficiency and cost effectiveness of research and research training and to make better use of research resources through sharing major facilities and equipment.
- Support research and development and education activities that achieve outcomes of national significance.

Since the inception a total of 84 CRCs have been established with 62 remaining in existence. Total funding from Commonwealth, university, CSIRO and industry sources has been in excess of \$5.9 billion. Most CRCs have at least 30 full-time researchers and average annual budgets in excess of \$7.0 million.

All CRCs must have a university as a core participant and many are based at a university campus. They extend across a wide range of research fields including: manufacturing technology, information and communication technology, agriculture, mining and energy, the environment, and medical and science and technology.

■ **Canadian National Centres of Excellence**

Many national models for collaboration are based on the Canadian National Centres of Excellence model that has been in existence for 12 years. The programme fosters partnerships between university, Government and industry. Three federal funding agencies have combined their efforts to support and oversee the initiative.

The National Centres of Excellence are partnerships among universities, industry, Government and non-Governmental organisations aimed at turning Canadian research and entrepreneurial talent into economic and social benefits for the nation. An integral part of the Canadian federal Government's innovation strategy is that these nation-wide multi-disciplinary and multi-sectoral research partnerships connect excellent research with industrial know-how and strategic investment.

The positive benefits of the Centres of Excellence include:

Annex 1:

- The active involvement of Canadian industry provides training environments and employment opportunities for students.
- Knowledge transfer through 88% of the graduates being successful in finding jobs, 50% of the network graduates being employed by industry and many more being employed by Government.
- Knowledge transfer as the networks have launched 78 spin-off companies representing 10% of all university spin-offs in Canada, and stimulated some \$80 million in outside investments.
- Impacts on the way in which research is conducted. These impacts include differences in research, collaboration, multi-disciplinarily, cross-disciplinarily, student training, partnerships with users, knowledge and technology transfer, intellectual property protection and development of local and national critical mass.

Factors contributing to the success of the programme include:

- World-class scientific leadership.
- Strong administrative support, including having a strong network manager and Board of Directors.
- A strong and active role for partner organisations throughout the network planning and research processes (not just a role in "name only").
- True collaboration among researchers (not "collaborations of convenience"), who represent the best people in the field (not just an "old boy's club").
- Integrated research programme, in which the themes are mutually self-supporting (as opposed to being unlinked, or in which individual projects are not linked), and to which the network researchers are fully committed.
- Multi-disciplinary approach in which the peripheral disciplines are well integrated into the overall network strategy, as opposed to being brought in for appearance's sake.

■ **The EU Sixth Framework Programme**

For sheer size, the EU Sixth Framework Programme (FP6) is mentioned here although its relevance to New Zealand is slight. The programme demonstrates perhaps the advantages other countries enjoy in terms of scale and geographical proximity. It is, for instance, much simpler to encourage multi-national collaboration within the confines of the European Union backed by a vast centralised funding mechanism.

Annex 1:

1.2 Entrepreneurial activity in TEIs

1.2.1 What is needed for entrepreneurial activity in TEIs?

A cross-national study of five highly successful European universities identified five elements for successful entrepreneurial activity in institutions of higher education:

- A strengthened managerial core – institutions are adaptable and have an administrative ability to fuse new managerial values with traditional academic values;
- An enhanced developmental periphery – institutions reach across normal academic-industry boundaries to form mutually beneficial relationships while preserving their educational integrity;
- A diversified funding base – revenue sources are spread across Government, industry and private sources;
- A stimulated academic heartland – every department in the institution must accept and engage in the entrepreneurial process; and
- An entrepreneurial culture – the first four elements combine to create a culture that embraces change and sustains the fundamental values of the institution.

A conference sponsored by the European Commissions Directorate-General for Enterprise identified not surprisingly that “one approach does not fit all”. (reference)

Each TEI needs to look at their particular environment, the entrepreneurial orientation of their university, their region’s existing innovation structures and programmes and its main development priorities. Then they can decide which support structures and programmes make sense in that specific context.

1.2.2 Government-sponsored schemes to encourage TEI knowledge transfer

As is repeatedly stated throughout this report, the Entrepreneurial Sub-group is strongly of the view that commercialisation is not a core function of TEIs. However TEIs do have a critical role to play in enabling knowledge/technology transfer. In recognition of this, a number of countries have developed Government-sponsored schemes to encourage TEI knowledge transfer. Summarised below are examples of United Kingdom and Australian schemes that demonstrate pathways that might merit further consideration for application in New Zealand.

Annex 1:

■ **Higher Education Innovation Fund (UK)**

This fund is worth £140 million over three years to build on universities' potential to act as drivers of growth in the knowledge economy. HEIF provides special funding to enable Higher Education Institutions to respond to the needs of business through both the continuing development of capacity in universities to interact with business and the community and large strategic collaborative projects to strengthen university-business partnerships.

HEIF has supported more than 70 universities in activities such as the employment of specialist staff, establishing business incubators, improving the intellectual property infrastructure, and providing enterprise training for staff.

In its 2002 Spending Review the United Kingdom Government is planning to continue supporting knowledge transfer between universities and business through the HEIF and has decided to combine University Challenge and Science Enterprise Challenge funding into the new HEIF budget. In this way the Government aims to support knowledge transfer in universities and research institutes through a single stream of funding.

As part of their proposals for HEIF funding, universities must consider how they can better engage businesses in knowledge transfer activities as well as being relevant to the needs of local and regional economic development.

■ **University Challenge**

The purpose of University Challenge is to access seed funds in order to assist the successful transformation of good research into good business. It is designed to bridge the funding gap in the provision of finance for bringing research discoveries to a point where their commercial usefulness can be demonstrated and first steps taken to secure their utility. Forty Five million pounds was allocated in the first round of the competition in 1999 and £15 million more recently in October 2001.

Thirty seven institutions (28 universities and 9 Research Council institutes) were involved in the first round of University Challenge with 17 further institutions becoming involved in the second round.

In the first two years of operations 105 new spinouts were created and £26.8 million third party investment was attracted complementing the £16.8 million University Challenge funds committed.

The 2002 Spending Review of the Office of Science and Technology states that University Challenge has been "extremely successful in stimulating activity from a low base and improving the awareness and experience of knowledge transfer between universities."

Annex 1:

■ **Science Enterprise Challenge**

The aim of this initiative is to establish a network of centres in United Kingdom universities, specialising in the teaching and practice of commercialisation and entrepreneurialism in the field of science and technology. Twelve Centres of Excellence were established in United Kingdom universities in the first round of the competition in 1999/2000 with £28.9 million of Government funding. A further £15 million of awards were made on 1 October 2001.

Early measures of activity are encouraging with 5900 science and technology graduates exposed to new enterprise teaching in the first two years and over 850 at postgraduate and professional level. The centres have also been attributed with helping generate 400 new business ideas, over 80 of which have led to early stage businesses.

■ **Public Sector Research Exploitation Fund**

This fund aims to realise the potential of public sector research establishments. Ten million pounds were made available in October 2001 to enable public sector research establishments to exploit their science and technology potential and to access seed funding to support the commercialisation of research.

The 2002 Spending Review suggests that public sector research establishments are beginning to respond positively to commercialisation opportunities. Further funding of £15 million over two years will be provided to support increasing commercialisation among public sector research establishments.

1.2.3 Is commercialisation and entrepreneurship affecting teaching and research?

There is continuing debate on the role and impacts of commercialisation and entrepreneurship on academia. Although commented on elsewhere in this report, some examples of international debate on the issue are included below.

■ **Australian Social Scientists' Survey**

Results from this recent survey on academic freedom suggest:

- Increased workloads arising in part from responding to competitive tenders and developing and marketing courses were reducing independent research time.
- Pressure to attract funding from industry and consulting services was channelling research effort into safe, well defined areas rather than speculative or curiosity-driven ones.
- Fee-based courses, particularly for international and domestic postgraduates, was lowering standards.
- The emphasis on fee-based courses benefited disciplines that were vocational rather than speculative and critical.

Annex 1:

- The emphasis on market demand required more corporate management structures in universities which in turn eroded collegial decision-making structures.

■ **Potential Down Sides of Commercialisation**

Three types of potential risks have been identified by one commentator, namely:

- Colleges and universities expose themselves to business risks – i.e. commercial ventures can lose money.
- Universities are much more conceptually complex than commercial enterprises where evaluation and control is determined by outcomes measured in dollars. In addition, the managerial time demands can be significant and the payoff may not be worth the investment of time.
- The possibility of squandering existing support for the institution’s culture and goals.

Finally, this commentator discusses the conflict between academic tradition of open debate and sharing new knowledge, with the secrecy requirements of private research and development. In becoming more entrepreneurial universities must respect the value of higher education.

1.3 Collaboration between TEIs and industry partners

An area arising from the review of international material that considered by the Sub-group to be of relevance to New Zealand was the enhancement of TEI/Industry collaboration. Some commentary from international sources on this matter is included below.

■ **Views of the Industrial Research Institute, Washington D.C. (IRI)**

A paper written by the executive director of the IRI discusses the requirement for a “strong academic enterprise” as an essential ingredient for the future vitality of science and technology in the United States.

The IRI, an organisation of more than 260 major industrial firms in the United States representing more than 80% of the privately funded R&D effort in the United States, included as part of this paper a Position Statement on Strengthening Industry-University Interactions. Key recommendations from this statement make for a compelling framework on how interactions between universities and industry should be structured.

- Interactions between industry and universities should be strengthened, particularly in science and technology, in accord with their traditional roles. The top priority of universities should be to educate their students. Basic research in universities and interaction with the private sector can support and strengthen this educational priority but knowledge transfer to knowledge should have a lower priority.

Annex 1:

- Exchange programmes between universities and industry should be strongly encouraged as a means to transfer knowledge and to promote understanding of each others roles in building global competitiveness. Examples of such programmes include establishing industry advisory boards for curricula review, research programmes and facilities development, assigning graduate students to industry mentors, using faculty as visiting scientists and/or industry consultants.
- Cooperative programmes between industry and universities should recognise the difference between industry's shortening lead times and the historic pace and scope of university research. For example a six-month lead time in the market can be critical to commercial success. Cooperative programs directed to near-term industrial objectives should recognise these issues.
- Academic research can be made more relevant and useful to industry. This should be achieved through academic research focusing its efforts on the long-term, fundamental needs of the nation in science and engineering, with input on those needs from the private sector, Government and others.
- Partnerships between industry and universities should be encouraged, but not forced. The value to be gained from interaction with the academic research enterprise, namely insights, contacts and early access to new information in science and technology should be the driving force for industry's collaboration.
- Universities should encourage industrial support of academic research through adequate consideration of industry's intellectual property rights. In cases where a company provides a significant share of funding for a university research project it should be assured of intellectual property protection. All sponsored research agreements should also include mutually beneficial licensing agreements and due-diligence clauses.
- Universities should include in their curricula ways to enhance students' awareness of the unique requirements of the industrial environment. There is some concern on how well new graduates perform in industry. This makes the ability of graduates to communicate clearly, to work in cross-functional and cross-cultural teams, to understand how business operates, to take an interdisciplinary approach to problem solving and to complete projects in a timely fashion a priority.

■ **Four key areas in industry-university collaborations:**

One study has identified four key areas in industry-university collaborations, namely:

- Know your organisation, or your boundaries for collaboration i.e. what is the intellectual property policy of the university? Are you (your organisation and you personally) entering this relationship for the right reason?

Annex 1:

- Know the commercial imperatives into which you are entering i.e. how responsive do you need to be to the people you intend to work with? How quickly can you deliver? Do you have a beachhead agreement with the industry partner you intend to work with? Can you reconcile your obligations with the commercial demands of your partner?
- Ensure you contract appropriately, i.e. is the IP regime satisfactory to your university but realistic for the circumstance? Are confidentiality clauses sensible? Is there a suitable exit point for you if required? If the partner is meeting the costs of commercialisation, is this diluting returns to the university or yourself? Have realistic milestones, accompanied with appropriate milestone payments. DO NOT give up the right to publish.
- Be proactive in managing the relationship. Ensure there is a liaison within the partner who is engaged and committed to the success of the project. Deliver on time with what is expected or renegotiated.

Annex 2:

2. Surveys of New Zealand environment

2.1 Introduction

As indicated in the main body of this report, the paucity of data on IP commercialisation by TEIs in New Zealand is a significant barrier to quantifying and commenting on the levels of activity occurring in New Zealand. As part of the collection of “baseline data” to help provide context for the Sub-group’s reports, two surveys were commissioned to:

1. Assess levels of activity on ‘non-core’ income-producing activities involving the commercialisation of intellectual property (IP) at New Zealand TEIs. The survey involved 13 institutions and one contact at each TEI was chosen for their knowledge of commercial and entrepreneurial activity at their TEI.
2. Obtain information on the barriers and perceptions relating to TEIs commercialising IP. The survey was a qualitative study that involved focus groups from TEIs, individuals from CRIs and other research organisations, and representatives from businesses that have or are considering entrepreneurial activities within TEIs.

This annex provides a summary of the findings of both these surveys. It needs to be noted that neither survey is endorsed by or represents the work of the Entrepreneurial Sub-group and should only be considered as a preliminary attempt to collate disparate information on TEI commercialisation activities in New Zealand.

This annex also includes extracts from two other reports:

- A brief summary of the relevant overarching policy statements relevant to the commercialisation of intellectual property.
- An overview of potential benefits of commercialising IP in TEIs.

2.2 Survey One – The scope and composition of entrepreneurial activity in New Zealand TEIs

The interpretation of entrepreneurial activity used in this survey was somewhat wider than that eventually adopted by the Sub-group, as the questions asked focused on:

- Use of TEI’s intellectual property and skilled staff (in a non-core way) to produce new or innovative products or services.
- Leveraging intellectual property.

Annex 2:

- Research funded by commercial organisations, but not research funded by the Foundation for Research, Science and Technology or Government.
- Collaboration or joint projects with commercial partners, between departments within your TEI or with other TEIs.

2.1.1 Key questions and TEI responses

■ Readiness of TEIs to engage in non-core income-producing activities, in terms of infrastructure and environment

Generally the TEIs have infrastructure to support entrepreneurial activity. All consider it to be important, and have tasked a senior manager to develop it. Seventy percent have business plans, can make initial expenditures on entrepreneurial activities without senior management approval and have a formal reward system or appropriate terms of employment.

With one exception each TEI has invested in enough infrastructure to support several projects.

■ Challenges in exploiting intellectual property

There are considerable environmental challenges facing TEIs in exploiting intellectual property:

- Access to venture capital – especially seed funding – and the shortage of potential business partners were of most concern.
- A supportive academic environment, commercialisation support structures, building relationships with commercial businesses and creating spin-off companies were also of concern.

■ Types of non-core income producing activities in the TEIs surveyed?

The surveyed TEIs reported examples of commercialising IP that include:

- Micro co-generation system
- Animal repellents
- Irrigation control package
- ISP business
- Odour diagnostic technology
- Pesticides
- Sports training goggles

Annex 2:

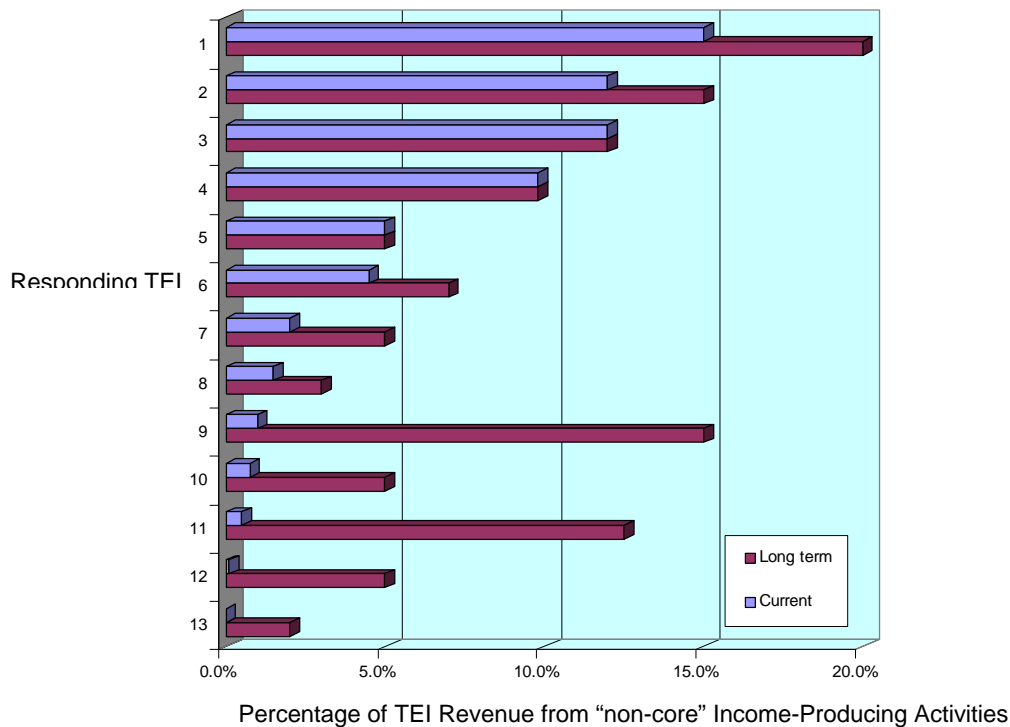
- Technology for fertiliser by-product reduction in soils
- Water testing technology.

In addition, the surveyed TEIs reported an extensive range of other examples of non-core income-producing activities that utilised specialised equipment/technology or “know how” in commercial contracts. These TEIs also reported a wide range of revenue-generating activities relating to business development assistance and courseware development. Because these activities are generally considered outside of the scope of entrepreneurial activities adopted by the Sub-group, they are not reported in detail in this report.

2.1.2 Relative importance of “non-core” income-producing activities

Both in considering the short-term and long-term importance of commercial activities, the TEIs put more emphasis on their areas of strength, with universities having research intellectual property to commercialise and other TEIs emphasising educational material and the relationships they have with business.

Of the 13 TEIs responding, four derived between 10% and 15% of their total income from “non-core” income-producing activities, and the remainder derived 5% or less. All of the responding TEIs expected this type of income to stay steady or increase, from an average of 5% to between 8% and 9% of total income in the long term. These results are summarised in the chart below:



Annex 2:

It should be noted that the above discussion and graph reports all non-core income-producing activities and is not limited to the scope of entrepreneurial activities, i.e. commercialising IP being used by the Sub-group in this report.

■ **Drivers (benefits) and impediments (risks) of entrepreneurial and collaboration activity**

The key drivers (benefits) identified by the TEIs responding to the survey were:

- Additional income to supplement core funding
- Enhanced reputation and profile
- Increased research
- Staff development
- Student training and job opportunities.

The main impediments (risks) reported were:

- Diversion of time and effort from the core purposes of education and research
- Risk to reputation
- Financial risk – including the possible further reduction of Government funding due to apparent entrepreneurial success.

■ **Changes that would increase entrepreneurial and collaboration activity**

The key changes identified by respondents are:

- Easy access to relatively small amounts of pre-venture capital seed funding, which the NZVIF scheme is not adequately providing, although the Entrepreneurial Sub-group appends that VIF is not intended to provide this sort of funding;
- Financial incentives (tax breaks) to encourage businesses to collaborate with TEIs; and
- Central marketing of collaborative opportunities.

In their final comments, four respondents expressed grave concerns over the wisdom of TEIs diverting effort from their core tasks to entrepreneurial activities. A further four were doubtful of whether benefits would be realised and two were enthusiastic. Respondents warned against this activity being a panacea for funding shortfalls. The costs and risks are significant, and funds generated should be viewed as a supplement to, and not a replacement of, core funding.

Annex 2:

2.2 Survey Two - Barriers to entrepreneurship in TEIs

2.2.1 Tertiary Education Institutions – key issues

The results of this survey showed a continuum of formal commercialisation development, from no formal commercial structure or process within the TEI, or within areas of a TEI, through to a highly structured, largely autonomous business liaison office creating a strong research environment.

Barriers to commercialisation within the TEIs were characteristic of the TEIs stage of development and ability in developing formal commercial support processes and structures along this continuum.

■ Internal barriers

In TEIs where business liaison offices have been, or are being, established, barriers have arisen through poor internal communication; unclear points of contact and channels within the TEI; mistrust between academic staff and the TEI hierarchy; disagreement over the reward formula; increased bureaucracy; formula driven processes; management of research by committee; lack of confidence by academic staff in the commercial ability of the support staff to do deals; and a perception the TEI is controlling the commercialisation process to protect and gain rewards from research for the organisation at the expense of the researcher.

These barriers reflect the initial stages of implementing a formal commercialisation policy and structure as well as getting right the change in culture required to move the TEI from teaching, research and publishing to also identifying, developing and commercialising research and TEI.

■ External barriers

In TEIs where a business liaison office is well established and functioning internally to create a good commercial research environment for the academic staff, commercialisation barriers are primarily external and relate to a lack of research funding and opportunity from New Zealand industry. This is due to its small size and the preponderance of low research-and-development-based companies, and a reduction in real revenue from Government for basic research and increasing compliance costs.

All TEIs expressed real concern about the lack of money for basic or ‘blue sky’ research that ultimately drives most intellectual property IP development long term. The respondents indicated there is not a lot of IP with commercial potential currently within New Zealand TEIs and what research is being commercialised today is based on research funded and developed 10 to 15 years ago.

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The view was expressed that the level and quality of research being undertaken by TEIs is steadily diminishing due to falling investment in scientific research by Government not being replaced by business in New Zealand; an inability to attract post-graduate students due to a lack of careers in science; and an aging and contracting scientific community.

Academic staff in TEIs are also coming under increasing work pressure from teaching loads as the TEIs have focused on the equivalent full time student EFTS funding model and that, coupled with the increased time needed to apply for funding and to ensure compliance, their ability to commit to research is being eroded.

In summary, the key issues raised by TEIs were:

- In New Zealand TEIs there is limited seed money or limited grant money for early industry stages. There is a need for quick availability of discretionary money e.g. writing a one-page report to get money.
- It is fundamental to fund and encourage ‘blue sky’ research, as this gives TEIs a pool of ongoing research with commercial work and IP spin-offs.
- The TEIs are now harvesting research started 10 years ago. Long-term research funding of basic research is vital for future IP output.
- New Zealand must recognise basic science is the key for commercial growth.
- The cost of research is going up but Government funding is not keeping pace.
- Money from industry is limited in New Zealand, here money is invested in property, not IP, and there is no appropriate money for commercial development of IP within the TEIs.
- The Marsden Fund should be increased to \$100m for overall basic research in New Zealand.
- The Marsden Fund provides access to academic research money but the success rate of individual TEIs is low.
- The Foundation for Research, Science and Technology provides one mechanism for commercial funding but it is an inefficient source of funding because of the time and effort required to succeed.

2.2.2 Crown Research Institute – key issues

The importance of relationships between TEIs and CRIs was discussed. TEI participants expressed the view that CRIs are cautious, and conservative in building relationships because of their DSIR history. CRIs have a fear of failure and there is strong competition between the CRIs and the TEIs for foundation money.

The key issues identified by CRIs were:

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- Differences in culture, values and funding

This perceived difference is creating barriers to research between CRIs and TEIs and, as a result, is prohibiting the commercialisation of IP in the sector. However, there are examples of TEIs and CRIs working together but these appear to be the result of long-term personal relationships and, if CRIs and TEIs are to work together, opportunities for these relationships to be formed must be encouraged.

- Academic freedom vs commercial imperative

TEIs are guided by academic freedom and do not always appreciate that CRIs have to fully fund their costs (i.e. a commercial imperative). These different perspectives can make it difficult to work together. The CRIs focus on an economic model and take a different approach to research with major funding from the Foundation for Research, Science and Technology, and with commercialisation and engagement in the private sector providing the remaining funding. There is not the same commercial accountability in the TEIs, which makes the relationship difficult. Where it works best is when there is close collaboration on a project.

- Collaboration

Collaboration was considered by CRI interviewees to be difficult as many TEIs are not seen as unified in their development of commercialisation procedures. The scale of the TEIs also means there is normally no dominant culture for the CRIs to work with. In contrast the CRI strategy is to run as a corporate company and get staff “onside”. Individual departments may have close CRI relationships, however, often there is no consistency within or across the TEIs.

- IP development

CRIs also consider that there is not enough money to develop IP (the “valley of death” concept). Funds should come from the private sector, but currently they do not.

CRIs participants noted that there appears to be “quite a lot of IP” in the TEIs, but they are not good at protecting IP in the “publish or perish” environment. CRI interviewees felt that there is a lot of leakage out of TEIs mainly because the researchers do not recognise the commercial value of their work.

Annex 2:

2.2.3 Industry perspectives on TEIs and IP environment in New Zealand

Interviews with venture capitalists and their agents identified that the critical issue is the lack of commercial and marketing skills of the TEIs, which has created slow and inefficient commercialising of research and IP. Those participants identified the main obstacles to IP development and entrepreneurship in New Zealand to be:

- Lack of deal-making skills.
- Most research institutions, including CRIs, and TEIs are weak at IP development.
- Delays in process; too slow to get to market with IP applications.
- Not specific enough with respect to IP applications in the commercial details.
- Lack of commercial understanding.

The Business Liaison Office (BLO) was seen as being key to improving the links between Venture Capitalists (VCs) and TEIs/CRIs. The BLOs should provide clear communication of the quality of the IP being offered and not just the quality of the science. The value of the IP development proposal or deal should be much clearer to the VCs and be understood by the researchers who also need to understand market issues.

Industry participants were critical of the ability of CRI boards and TEI Councils to deal with IP issues. “These are positions of low risk management. The members have little expertise in estimating the value of a potential IP development contract and exhibit diversity in skill levels, leading to confusion.”

TEI business liaison boards and offices often make poor decisions. There is not enough autonomy, trust, or accountability among their staff, and they require ‘deal makers’.

These participants stated that research institutions ideally should go through the following stages for a successful IP development project:

- Step 1:** Develop a proof-of-concept. Remembering that empirical generalisation from proof-of-concept must be backed up by rigorous science.
- Step 2:** Provide IP protection. It was noted that patent attorneys in New Zealand are normally skilled only at judging patent-ability not commercial potential. This is a deficiency that needs to be addressed.
- Step 3:** Keep alive the research and idea.
- Step 4:** Attract venture capital.

Their opinion was that Steps 2 and 3 are often not carried out successfully. Opportunities have been lost whilst replicating experiments for empirical generalisations. Overseas IP developers know they have a strict deadline of 12 months to complete this phase, however, New Zealand developers do not appear to understand this requirement.

Annex 2:

2.3 Summary of New Zealand policy framework

2.3.1 The Overarching policy context

■ Growth and Innovation Framework

“**Growing an Innovative New Zealand**” sets out the framework Government will follow to create an innovative New Zealand capable of achieving and sustaining the growth rates needed to return New Zealand’s per capita income to the top half of the OECD rankings. Within the Growth and Innovation Framework there is an emphasis on developing “a solid research, development and innovation framework” as a key element in the economy. The GIF also discusses the need to give greater emphasis to ensuring that more of New Zealand’s R&D investment leads to economic benefit through the commercialisation of the ideas generated.

■ Tertiary Education Strategy

The Tertiary Education Strategy places an emphasis on the importance of tertiary education research and the role of tertiary institutions (especially universities) in the development and application of new ideas and technologies to generate wealth. Strategy Six of the TES is to “Strengthen Research, Knowledge Creation and Uptake for our Knowledge Society” with the following relevant objectives sitting underneath this strategy to be considered:

- **Objective 31 “Increased global connectedness and mobility” with the statement that for economically focussed programmes, innovations will be commercialised through international networks and be linked to enterprise in New Zealand and offshore.**
- **Objective 34 “Improved knowledge uptake through stronger links with those that apply new knowledge or commercialisation of knowledge products” with a focus on stronger connections with research end-users.**

In addition, the objectives linked to Strategy Six give the expectation that TEIs will be required to:

- Engage in greater collaborative activities across the sector including partnerships with other research organisations such as CRIs
- Direct a significant proportion of future research investment towards particular fields that are aligned with national goals as well as other activities that reflect local and regional needs and specialisations
- Engage in strong accountability and enhanced performance reporting for research activities
- Build their research capabilities and improve the quality of research they are conducting.

Annex 2:

2.3.2 The key agencies involved

The overarching policy framework aims to actively encourage and stimulate the commercialisation of intellectual property by public research organisations including TEIs. The implementation of this policy framework, as it relates to IP commercialisation, is the responsibility of a number of key agencies that have, or are developing, a range of initiatives relevant to this issue. These agencies are:

■ **Policy/Regulatory Agencies:**

- The Ministry of Research, Science and Technology (MoRST)
- The Ministry of Economic Development and the Intellectual Property Office of New Zealand (MED/IPONZ)
- The Ministry of Education/Tertiary Education Commission (in relation to the commercialisation activities of TEIs & PBRF.
- Crown Company Monitoring Advisory Unit (CCMAU) (in relation to the commercialisation activities of Crown Research Institutes).

■ **Delivery/Funding Agencies**

- Industry New Zealand
- The Foundation for Research, Science and Technology New Zealand (FRST – Vote RS&T)
- The Health Research Council (HRC – Vote RS&T).

2.4 Potential benefits of commercialising IP in New Zealand TEIs

New Zealand Institute of Economic Research were engaged by the Sub-group to provide the above review, including consideration of the economic and employment benefits and the increased efficiency in resource allocation.

In their report NZIER note that New Zealand is a small contributor to, and user of, global IP and that almost all New Zealand firms are small by global standards. As a result:

- New Zealand firms may often be adaptors or users of IP developed elsewhere in the world, as a result of importing the technology through goods and services.
- Transaction costs and risks of taking IP to the New Zealand market are high.
- Chances of commercialising New Zealand-developed IP, other than perhaps the primary sector, are likely to be highest if there are strong links to large scale offshore businesses.

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In addition, NZEIR observe that:

- New Zealand TEIs have two important roles in teaching and research and the additional of commercialising IP will need to be viewed as a secondary accomplishment, if only because of pressures on management and funding.
- The skill set for commercialising IP is not consistent with those normally seen within TEIs to undertake their teaching and research roles.