Andrew Cleland
Chief Executive
PO Box 12 241
Wellington
policy@ipenz.org.nz
www.ipenz.org.nz

Updating the New Economy Research Fund (NERF) Ministerial Direction to the Foundation for Transformational RST (TRST) Implementation

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Our understanding

In the 2008 budget the government provided funding of $24m to promote new industries over the long term in areas such as high-tech manufacturing, ICT, new materials and sophisticated engineering. The paper for consultation outlines proposed changes to the NERF Ministerial Direction and the implementation plan (timeframe and funding stream) for the proposed RfP for the High Tech Platforms TRST.

Executive Summary

IPENZ supports the intention to change the NERF Ministerial Direction to implement the high tech platforms and to simplify wording. However, IPENZ is concerned that the wording needs further amendment to reflect the nature of TRSTs and the appropriate ways to measure research quality when seeking commercial outcomes and recommends the following amendments to the Ministerial Direction:

Paragraph 5, line 3 - after "enterprises" add "or revitalise or transform existing industries"

Paragraph 6, lines 3 and 4 – replace targeted basic research" with "research likely to create know-how or other knowledge of potential commercial value"

Paragraph 10, bullet 2– after "new" add "or revitalised or transformed"

Paragraph 12, bullet 3 – replace "The research will meet international standards of excellence as judged by international peers" with the following:

> - "The research is judged by relevant peers to both have a high likelihood of creating know-how or knowledge of potential economic value and be of high technical quality".

General Comments

IPENZ notes that the high tech platforms that could be funded are sensors, smart materials and virtual reality. It is important to note that these platforms will involve physics, engineering, electronics and embedded systems (electronics that are in other products). These areas are strongly dependent on engineering and thus are different from other areas of science and will not be measured well by academic-style peer review. Attached to this submission as Appendix 1 is a discussion of how science differs from engineering.

Specific Comments

These comments are presented in the order that the relevant content is presented in the consultation paper.

Paragraph 1 notes that there are two proposed changes to the ministerial direction – changes to clarify and simplify wording in the existing direction and changes to implement the High Tech Platforms TRST. IPENZ supports these changes taking place.

Paragraph 5 notes that implementation of the High Tech Platforms TRST will enable the following:

- A change in the overall portfolio balance
- Support for commercialisation
- More consistent approach for research areas over time.

IPENZ supports these objectives and considers that the long term stability of research is important. Similarly, IPENZ considers it is important that there are increased linkages between the research community and industry.

However, we have concerns about the lack of explicit signalling in regard to engineering – we need better balance between biotechnology-oriented research and physical science, **engineering** and ICT. In particular it is vital that the different nature of engineering research from physical science is recognised (see Appendix 1).

Paragraph 7 states that High Tech Platforms TRST will build on existing science strengths and have a focus on economic transformations by seeking to generate platforms for new and emerging industries that will be of significance to New Zealand's future.

In our view this is unduly restrictive – it should also support research platforms that will revitalise or transform existing industries. Renewal of companies is as important to creating a new economy as start-ups are. For example, the morphing of the primary Fisher & Paykel brand from whiteware to medical technologies. There are major logistic advantages in clipping new technologies into existing commercial entities as much important infrastructure, particularly in connections to markets is already there.

IPENZ suggests that if the objective is to "grow globally competitive firms", then at this stage the Ministry should not take a view on whether it is for existing or new companies – this should be decided against the selection criteria.

Paragraph 7 also notes that potential areas for funding under the High Tech Platforms TRST are sensors, smart materials and virtual reality. The 2008 budget announcements described the areas as high-tech manufacturing, ICT, new materials and sophisticated engineering.

The Transformational Research, Science and Technology: High-Tech Platforms report published in July 2007 states that "High tech platforms will help establish and sustain

firms at the forefront of industry sectors such as high-tech manufacturing, ICT, engineering or services…" This paragraph also states the need to build on "science strengths" – in fact there is a need to build on both science and engineering strengths – both should be signalled. They are different.

In **Paragraph 8** it is proposed that "standard" NERF funding is differentiated from TRSTs. IPENZ supports this approach.

In **Paragraph 11** there is a statement that each platform is likely to generate a multiplicity of interactions with different companies over its lifetime. This is possible, but in our view unlikely. To succeed in the international marketplace requires a high degree of focus and the suggestion that wide interaction (which creates risk of too little focus) is a success factor should be removed. For example, Gallagher Industries focuses on key contacts rather than having wider interactions and wants its research partners similarly focussed.

Paragraph 12 states that candidates to become a high tech platform will already be successful teams with funding from a variety of existing sources. We have a problem with this statement, and strong concerns about how success is measured. It must not be on achievement of public sector funding or of peer reviewed output, it must be of fitness for purpose of the research, industrial co-funding and the ability of research personnel to engage with industry. Again, a highly successful team may have only one or two funding sources, for example a major company co-funding the research in parallel to public investment.

Paragraph 12 states that the high tech platform TRST funding will accelerate targeted basic research to develop the underpinning platform technology, through to support for commercialisation of the results of the research. It is important to note that the path from research to commercialisation is not always linear. There are times when research is undertaken, an idea is developed for commercialisation and further action (such as more research) is required before successful commercialisation.

We are also concerned about how the words "targeted basic research" will be interpreted – it would be better to say "scientific or engineering research with potential commercial value".

In **Paragraph 13a** we suggest that the word "engineering" is needed after "physical technologies" in two places.

Paragraph 13 notes that funding could be used to develop technology roadmaps. IPENZ would caution the funding of roadmaps. Roadmaps can be limiting and impede broader thinking. Too many really valuable innovations occur at the fringe and cannot be predicted by roadmaps.

Paragraph 13 suggests that the majority of the funding will go toward 1-2 investments and **Paragraph 14** suggests some criteria for judging potential investments.

IPENZ does not consider that the proposals should be judged on the core team's publication record and international standing. Peer review by other members of the research community is likely to be poorly correlated with the real commercial potential. Provided the work follows sound research methodology, and is novel then the value of academic-style peer review is extremely limited. Potential market volume if the research succeeds is much more important. Accordingly, we do not consider the eligibility criteria in **Paragraph 12 of the Notice of changes to Ministerial Scheme** ("The research will meet international standards of excellence as judged by international peers") appropriate (see below).

Additionally, where research area is new or novel, the results of the research are unlikely to be available for widespread distribution.

Paragraph 15 lists the objectives of the TRST and IPENZ supports these objectives.

Suggested Amendments to Notice of Changes to Ministerial Scheme

Based on the above we recommend the following changes to the Ministerial direction:

Paragraph 5, line 3 - after "enterprises" add "or revitalise or transform existing industries"

Paragraph 6, lines 3 and 4 – replace targeted basic research" with "research likely to create know-how or other knowledge of potential commercial value"

Paragraph 10, bullet 2– after "new" add "or revitalised or transformed"

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CONCLUSION

IPENZ appreciates the opportunity to comment on the consultation paper and is able to provide further clarification if required.

Appendix 1

How does engineering differ from science?

There are a variety of definitions of what the practice of engineering is, from the noble "harnessing the power of nature for the benefit of humanity" to the more practical "how to do useful things using knowledge of systems, materials and processes". Given the diversity of engineering it is probable that there is no single all-encompassing definition, but rather the practice of engineering is characterised by the presence of most or all of the following things:

- engineering is purposeful – it seeks to use knowledge and resources to make interventions in the natural world that meet a present or future need of people
- engineering is creative – it involves creativity to develop or design new or improve existing artefacts, products, processes and services
- engineering seeks efficiency – it is concerned with the wise use of resources
- engineering is predictive of the outcomes it seeks to achieve – it seeks to use mechanistic understanding of both natural and man-induced processes to develop models, that allow reliable predictions to be made of the future performance of any artefact, product, process, system or service to be made
- engineering uses available materials, systems and resources – it uses understanding of the properties of materials, systems and resources to ensure that artefacts, products, processes, systems or services that are created are of sufficient durability that their use can continue for suitable periods of time
- engineering includes risk management – it recognises limitations imposed by incomplete knowledge or understanding of systems, materials and processes and develops means to control or manage the resultant risks to levels acceptable to society at large.

Engineering research

Engineering research seeks to advance the practice of engineering by means such as:

- Discovery of new materials, theoretical models and processes which can enhance the performance, quality, efficiency, cost effectiveness and life of engineering systems
- increasing the quality of models by which predictions are made, thereby improving process understanding
- investigating and defining the properties of new or existing materials, systems and resources so that their use can be more appropriate and reliable to the end-user
- developing improved design methodologies so that the resultant outcome is more efficient or reliable, or poses less risk to its end-users
- improving control and risk management frameworks around particular families of engineering problems

In essence, research in engineering is research to improve the practice of engineering – it gives engineers better ways to do their job.

Basic Research in Engineering

What then is basic research in engineering? Because the nature of engineering is to be purposeful, basic research cannot be defined on the basis that it is research for which no future purpose can be envisioned. Rather it must be defined as that research which informs potential future practical application including:

- research that seeks to build underpinning theoretical and mathematical models that increase understanding of the mechanisms of either natural or man-made processes or systems
- research that seeks to increase understanding of the unique and potentially valuable properties of novel materials or resources

It probably does not include the ongoing refinement of risk management or design methodologies, but it does include developing models or knowledge that might lead to substantive rethinking of the methodologies themselves.

Basic research must be judged in three ways:

- does the theoretical and/or mathematical model provide further understanding of and/or more accurately or more effectively describe the phenomena under study than pre-existing models,
- is the group of materials, systems or processes under study significant in terms of its potential impact, and
- is the work proposed leading edge internationally within the particular field of engineering endeavour?