citrus
centre for information technology research

Seeding A Culture Of Innovation And Collaborative Research At The Grassroots Through A Nationally Co-ordinated Centre For Research Excellence

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ABSTRACT

When the government called for proposals for Centres of Research Excellence it was decided that the historic model of academic collaboration that exists within the polytechnic sector could be leveraged to build a nationally resourced but regionally active network of research clusters. Such clusters would collaborate amongst themselves and with industry and community organisations locally in order to do what the polytechnic sector does best, that is to deliver applied research directly into the local economy. This is the vision that lies behind our proposal for the New Zealand Centre for Information Technology Research (CITRUS). It is a proposal that defines excellence as a horizontal, virtual network of co-operation and opportunity driven through an integral innovation framework. Such a model presents a real opportunity to seed both the regional economies as well as research activity in the increasingly research-aware polytechnic sector. CITRUS was unsuccessful in its bid for funding, which went to high-profile, single-issue centres in the established universities, however the feedback we received has been overwhelmingly positive and has praised not only the approach but also the potential of such a project. CITRUS has a number of significant benefits that simply cannot be ignored. It will build on an existing network and culture to enhance polytechnic research with the real potential to deliver tangible benefits to the regional economies. CITRUS is a vision of collaboration, of innovation and of action and as such is a vision that the authors are committed to pursuing.

Keywords: Centre for research excellence, virtual organisation, innovation, collaboration, ICT, applied research.

1. INTRODUCTION

In mid-2001 the New Zealand Government called for proposals for Centres of Research Excellence. The NACCQ and Otago Polytechnic agreed to work together to develop a proposal for a Centre for Information Technology Research, or CITRUS for short, which could become a world-class centre capable of making a significant contribution to New Zealand's economic and social well being through the successful transfer of knowledge and applied research in the field of Information and Communications Technology (ICT). CITRUS would be based at the Otago Polytechnic, which would act as a management and resourcing hub for the virtual network of schools of information technology based in the Polytechnics, Institutes of Technology and Universities that are members of the NACCQ.

The NACCQ sector already plays a critical role in forming the links between academia and industry and has a track record for using innovative research to help develop regional and national economies. With the proposed centre, innovation would come from the integration of new techniques in solving real problems in a timely and cost effective manner and the centre would extend the sector's high performing locally applied ICT research to a national network with national industry connections.

This papers defines what a centre for research excellence is intended to be, discusses the rationale behind why the NACCQ sector is the ideal host for such a centre and then describes the proposed model for CITRUS, demonstrating the benefits of such a centre for New Zealand, industry and the NACCQ sector.

2. DEFINING A CENTRE FOR RESEARCH EXCELLENCE

The Ministry of Education established funding for Centres for Research Excellence (CoRE) in 2001/02 Budget and appointed the Royal Society of New Zealand to oversee and administer the establishment of a number of centres. The Government's intention was that the centres would promote world-class research excellence and New Zealand's social and economic development. The Terms of Reference released by the Ministry of Education list the following indicative characteristics for successful research Centres:

- Excellence
- Contribution to New Zealand's economic and social development
- Knowledge transfer in training.

The Government's intention was for centres to be drawn from a wide range of disciplines and proposals that were collaborative, involved multiple tertiary institutions, demonstrated the potential to be innovative and entrepreneurial and which could show a partnership with industry were encouraged. Funding would be allocated through a bidding process, from the total fund established in the Budget, and shown in Table 1 (Royal Society of New Zealand, 2001).

There has been a prevalent belief, particularly amongst the Universities and the University-biased Royal Society that a Centre for Research Excellence is a single unit specializing in a vertical, highly specialized area of research, for example producing a cure for cancer or the common cold. Such a centre would have very specific, measurable and manageable objectives and a very clear, narrowly defined deliverable. The authors have chosen to challenge this assumption not as being invalid but as being to narrow and have developed a proposal for a CoRE in ICT research as a horizontal project, covering a range of research topics located in geographically dispersed locations but managed, supported and resourced from a central hub. In other words, we have transformed a university way of thinking into a polytechnic way of thinking.

3. FUNDING GOES TO 'ESTABLISHED' UNIVERSITIES

Any polytechnic putting forward a proposal to establish a CoRE was at a disadvantage from the start, the evaluation process was heavily skewed in favour of heavy-weight 'academics', post-doctoral supervision and the recruitment of world-class staff to head up such projects. The structure, the process and the panels were biased in favour of the University sector. The shortlist announced by the Royal Society on February 19th 2002 was no surprise, with the CITRUS bid excluded along with all other Polytechnic bids.

2001/02	$2.000 million
2002/03	$10.225 million
2003/04	$12.475 million
Ongoing	$13.600 million
Capital contingency fund	$20.000 million

Table 1 - CoRE Funding allocations 2001-2004

Of the eight universities, former polytechnic AUT was the only one not to be short-listed. Making matters worse the call for innovative centres that would build New Zealand's economic and social capability was dealt a serious blow by the Royal Society, which has ensured that no ICT projects were selected. All but one of the short-listed proposals is in the traditional University sciences (Middlebrook, 2002). Of the final five centres that were selected in March 2002, three are from Auckland University, one from Massey and one from Victoria. It is hard to conclude anything other than this result is a whitewash and an as expected pat on the back for the old boys club. It is difficult to see how the finalists, despite some excellent individual proposals, are going to meet the demands of the original proposal and, for that matter, advance our regional and national economies.

This does not mean the end for CITRUS. It was always unlikely that this proposal would be funded, not least because it challenged the very assumptions of what a CoRE was. We see this as the beginning of an exploration as to how our vision for a nationally co-ordinated, polytechnic-based Centre of Excellence can come to fruition. The process of researching and writing the proposal for CoRE has if anything strengthened the author's belief in the viability and need for such a project. In the remainder of this paper we will present our vision for CITRUS and demonstrate why this vision has the potential not only to seed the emerging polytechnic research culture but also to deliver real economic benefits to regional New Zealand.

4. THE NACCQ SECTOR IS THE RIGHT PLACE FOR A CENTRE OF EXCELLENCE

The polytechnic sector has a tradition of close partnership with local community, including local businesses, community groups and iwi. This is reflected in the ICT schools, where both students and staff are involved in helping organisations to maximise the potential of ICT in their enterprises. The polytechnics have historically supported the local and regional economies of New Zealand by working directly with small to medium sized enterprises (SMEs). A brief review of statistics (Ministry for Economic Development, 2001) shows that 96 percent of New Zealand's 390,000 business units are classified as small to medium size, employing less than 20 people and 86 percent employ fewer than five staff. This is a sector that directly accounts for 35 percent of New Zealand's economic base yet statistics show that survival for SMEs is far from certain: Only 40-45 percent of SMEs are in existence for more than five years. It is this critical sector of New Zealand business that already benefits directly from research in the polytechnics and it is a core tenet of the CITRUS vision that a new centre of excellence should directly enhance the viability of the SME sector.

The NACCQ sector has the benefit of a huge resource of computing practitioners, ex-developers and managers, with considerable practical project management and innovation delivery skills, which enable the sector to link credibly and pragmatically with its practice communities and bring ideas to practical realisation. In the knowledge economy "the critical means of production is small, grey and weighs around 1.3 kilograms. It is the human brain" (Nordström and Ridderstråle, 2000, p.16) and the PhD is not the only badge of recognition. This means that we are not restricted to the small pool of theoreticians populating the traditional universities, who have difficulty linking with the world of practice and what Schon (1987, p.3) calls "the low swampy ground" of professional practice and the intricacies of actual software development. The very characteristic of the ICT discipline is that it involves applied research and development, therefore practitioners are inherently research capable, if not necessarily in the academic sense.

4.1 WHAT IS POLYTECHNIC RESEARCH?

The author's believe that polytechnic ICT research exhibits the following characteristics:

- Links both the applied and the theoretical.
- Remains allied to the appropriate community, such as IT practitioners, professional nurses, occupational therapists, accountants, food technologists.
- Creates new and suitable vehicles through which research outputs can be reported (for example, the *NZ Journal of Applied Computing and Information Technology*).

- Broadens the research discourse within the discipline by exposing the hitherto invisible world of teaching and learning practice in the sector and making visible what has always been done.
- Continually redefines the criteria, both locally and nationally to reflect the focus and mission of research in the sector, as a unique and distinctive research context, which combines and actively recognises all four of Boyer's forms of scholarship, namely discovery, integration, application and teaching (Boyer, 1997).
- Continually reviews the nature and definitions for consultancy, so that it becomes a valued, recognised and reported dimension of teaching, learning and research in the sector. Much co-operative and project based undergraduate learning could be reported as consultancy along with the supervision element thereof. We need the courage to accept this possibility and the rigour to develop open and defensible criteria for such definitions.
- Collaborates with other researchers within the practitioner and academic communities, in New Zealand and overseas, to leverage the expertise, reputation and funding sources of others. Research does not have to be done alone - in fact the best research is often developed from the work of teams.
- Emphasises the value of practice, and actively looks for ways to develop professional practice, and recognise appropriate forms of such practice as research equivalent. This is explicitly allowed for within the NZQA definition of research (New Zealand Qualifications Authority, 1998), but the work of determining criteria that lie outside the bounds of the scholarship of discovery has yet to be done.
- Acknowledges the unique opportunity the sector has to develop its own breed of vibrant, creative and valued research that contributes in a meaningful way to improving professional practice, life and work in New Zealand society.
- Accesses the resources of industry, the community and students to find ways of adding value to joint endeavour.
- Builds on what the sector does best and leverages the existing reputational resources. The sector has a reputation for producing work ready, adaptable and practical graduates, and for transforming students who enter at various levels within the system into more capable and self-confident learners and prospective employees. Maintaining this reputation by research programmes that support these characteristics, rather than a more academic mission, is vital to the success of the sector. There is a body of goodwill that can also be accessed to support such activity, whether financially, through partnerships or through contacts and lobbying processes for funding or other support.
- Links research, practice and teaching, in such a way that it can be demonstrated that research actually informs teaching and learning and improves professional performance.

5. RATIONALE BEHIND THE NACCQ PROPOSAL

The authors developed a vision for CITRUS as a new centre yet one that was underpinned by and would build on a mature culture of strong cooperation and collaboration that has been built up within the members of the NACCQ over the last fifteen years. The call for proposals for Centre for Research Excellence called for creative solutions that would return real value to New Zealand both economically and socially and the CITRUS proposal is a highly innovative approach that takes existing localised research clusters and industry partnerships, aiming to ignite these through a strongly managed virtual model of supervision, support and incubation. CITRUS is an innovative proposal for an innovative centre, with the focus on grass roots projects co-ordinated nationally and sharing resources, skills and knowledge. Our proposal was to take polytechnics do best and do it better, supporting local research that is applied directly to the needs of business and community in the regions. CITRUS's national centre, which we proposed to base at Otago Polytechnic, would help incubate research projects through to commercial reality, directly contributing to regional growth by building a networked research community that is coordinated nationally but which acts locally. This in turn puts direct benefits back into the member institutions by informing teaching, increasing applied research in ICT and in building growth in New Zealand's regional economies.

Excellence in research is seen in by many as a piece of paper, a list of publications or success in obtaining funding but there is more to excellence than this. For us excellence also includes a commercialisation engine underpinned by skills and

knowledge in a wide array of subject areas. We wanted recognition for the concept of applied technology across, and on top of, a wide range of subject areas. Our own experience tells us that what is valued in the ICT field is the ability to innovate and to integrate technology by solving problems in new and innovative ways. Indeed, these are the skills that lie at the heart of the 'knowledge economy' and the skills that a centre such as CITRUS will promote.

The CITRUS philosophy is based on the principle that academic researchers within the NACCQ sector should be able to operate within an advanced intellectual and applied framework that sees them as capable and informed computing and information technology professionals. We are building on an existing culture of innovative grass roots research that is already aligned with industry and already contributing to the regional economies. The strength of this model lies in the coordination of these activities, the potential to focus and dramatically increase funding in the sector and the ability to increase inter-institutional collaboration. By adding a centralised project office supporting a virtual network of localised research clusters, CITRUS leverages research potential in the sector and will dramatically increase the potential for commercial success and for the dissemination of research findings within the CITRUS network, nationally and internationally.

CITRUS recognises the importance of research in the community but also acknowledges that researchers risk becoming isolated. A cornerstone of our philosophy is the resourcing of the virtual research clusters through the central and regional support structure to ensure active collaboration, cooperation and communication.

Scenario	Problems faced	CITRUS value add
Research team at small regional polytechnic	Lack of time and money to dedicate time to research Lack of resources Lack of support Unable to realise full potential of the project	CITRUS funds polytechnic to provide teaching cover, allowing the project team time to work on their research project CITRUS can link the project team to experienced researchers, subject matter experts and project managers CITRUS able to assist with commercialisation of the research through links with national and regional development agencies, incubators and venture capitalists
Student project developing application for small business	Neither the student nor the client see the full potential of the project Academic staff supervising the project lack project management and commercialisation experience	CITRUS can provide resources to review the project and help to identify generic components and commercial potential CITRUS can support the academic supervisor with training and resources
Individual researchers at different polytechnics are working on similar projects	Duplication of effort Lack of co-ordination Projects too small to realise full potential Resources limited No communication between groups	CITRUS virtual model creates increases awareness of other activities Nationally co-ordinated knowledge base ensures that resources are shared and reduces the risk of duplication. CITRUS can bring together and coordinate multi-centre projects
Researchers are too busy or do not have the funding to present at overseas conferences	Local researchers are not reaching their full potential because they are unable to attend world-class conferences.	CITRUS can fund researchers to attend conferences and use virtual communication model to ensure that what is learnt is shared.

Table 2 - Benefits to the NACCQ research community

The multi-disciplinary co-operation that is required in any team will be improved by the increased appreciation of the burgeoning and diverse field of computing and information technology that will result from significantly increased opportunities for networking, mentoring, training and resources. CITRUS recognises this through the encouragement and support of research teams undertaking cross-disciplinary research. All of this delivers real benefits to the research community, as is shown in Table 2.

6. THE CITRUS MODEL

ICT exhibits a phenomenal rate of change that shows no sign of slowing. It is important to recognise that this complex, changing world is not simply one of business intelligence and intangibles that can be abstractly researched by the traditional academic or managed by the financially focused MBA graduate. Knowledge is held locally, it is captured, evolved and expanded by individuals and leadership in this virtual community is about empowering these knowledge flows and aligning like minds and strategic visions (Nordström & Ridderstråle, 2000). Whilst individual research must be focused, the CITRUS vision needs to be flexible. We must avoid defining ourselves to rigidly since what is cutting edge one year is common practice the next and outdated shortly after. Developing detailed plans for specific subject areas would be cumbersome and inappropriate. CITRUS would establish a programme of providing support across the area of research in applied information technology through a model that is responsive and flexible to change. Drivers for research projects are business and societal needs, the commercial potential of research areas and the potential to inform and innovate applied technology teaching.

CITRUS is a virtual network of active research clusters, some working together, and supported by a central team. Research projects could be in-house or with industry partners but will always be focused on adding real economic and social value into the

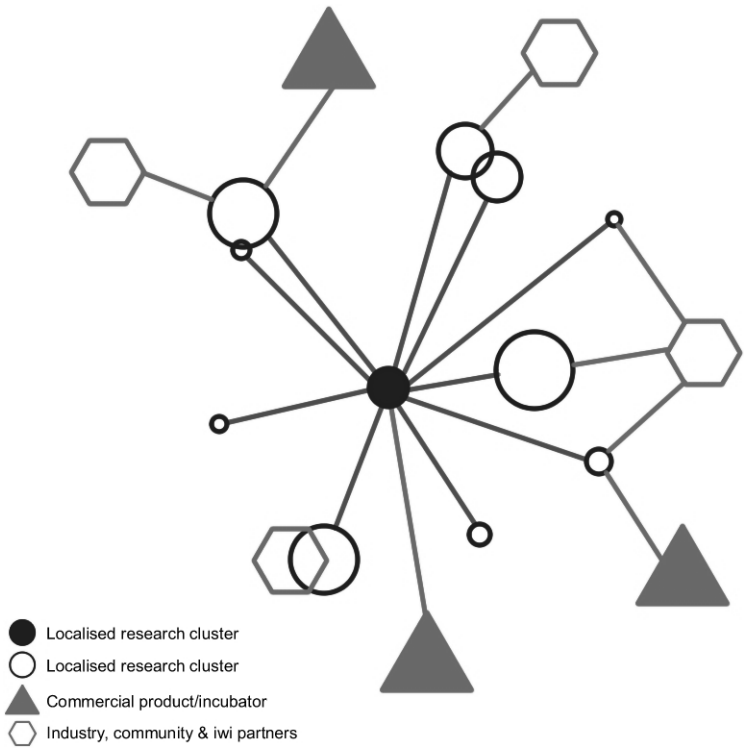

Figure 1 - The CITRUS Model: Hub, clusters and partners

regional economies with particular focus on the SME sector. The centralised structure of CITRUS offers what Senge (1992, p.236) calls as an "innovative, centralised approach", ensuring knowledge transfer can occur through team learning and that disparate research interests can be aligned and be better resourced. It aims to actively promote the commercialisation of research projects through incubation and business development models and by building relationships with key business development organisations nationally and regionally.

By managing a centrally co-ordinated national network with the resource and skills to co-ordinate regionally based and inter-institutional research clusters so CTIRUS:

- Builds a community of ICT researches (across-the-board)
- Increases financial support for research activities (targeted)
- Increases the critical mass of new researchers (new directions)
- Develops and supports research centres and clusters (seeks excellence)
- Develops formal research linkages with other institutions (outreach)
- Leverages localised partnerships with industry, community and Iwi (inclusive).

6.1 HOST FACILITIES

In our proposal, the central CITRUS facility would be located at Otago Polytechnic in Dunedin. Facilities will be leased from Otago Polytechnic as part of the partnership agreement between CITRUS, Otago Polytechnic and the NACCQ. Physical requirements in Dunedin are minimal since the major operations of the centre will be performed in the regional clusters and the structure of the centre is based on the concept of a decentralised virtual organisation using web-based management tools to coordinate.

6.2 REGIONAL CO-ORDINATORS

Highly experience researchers will be used as regional coordinators. They will facilitate research projects and teams and to support teams already in operation. These five full time individuals will most likely be based within a member institution and will directly support the local research co-ordinators.

6.3 LOCAL RESEARCH CO-ORDINATORS

The CITRUS vision is that research sparks ignite at the grass roots. To facilitate this, we intend to fund experienced researchers on a part time (0.2 fte) basis. This person will seed and coordinate research activity in the clusters, identify teaching and resourcing requirements and liase with regional coordinators and the central CITRUS core.

7. BENEFITS

CITRUS brings together current informal and individual research across the polytechnic sector in the same way that the NACCQ has brought together academic development, staff development and collaboration over the last 15 years. As the value and importance of research in the polytechnic sector is becoming increasingly recognised, CITRUS introduces a national collaborative framework that will provide mentorship, networking and support to ensure that polytechnic-based research in ICT is focused and reaching its full potential. In the dynamic field of ICT research, the issue of intellectual property poses difficulties for many researchers who lack the commercial experience and resources, as part of its mandate CITRUS will develop generic policies on intellectual property and will actively work with local research clusters to promote the best result for intellectual property ownership. This leads directly to a significant role of CITRUS, the incubation and commercialisation of research projects based on an approach that:

- Recognises the potential for win-win interactions
- Is empowering for all concerned
- Actively uses principles of project management to initiate and sustain tasks
- Has a very strong integration of teaching and research
- Makes use of networks to add value through collaboration
- Builds on strengths with focus on small to medium enterprises
- Uses IT in building capability across sectors
- Creates a high level of economic and social well-being
- Is systematic in bringing education in tune with the cycle of work

- Partnership with students, partnerships with communities, partnerships with ourselves
- Values knowledge in communities, and works with them.

8. CONCLUSION

CITRUS is what the knowledge economy is all about and so we firmly believe that this is a project with a bright future, despite being unsuccessful in bidding to become one of the first Centres of Research Excellence. This failure to attract funding was expected and it does not dent the enthusiasm for the potential a national centre such as CITRUS has. In writing the CITRUS proposal we have looked at excellence in research worldwide and we have looked at the strengths that the NACCQ sector has. By extending the collaborative model of the NACCQ into the research arena, CITRUS supports not only New Zealand's polytechnics and institutes of technology but also our regional economies to develop new and innovative ICT solutions.

We have intentionally challenged the traditional assumption of a CoRE as a focused, single issue research centre, instead choosing to present a model for a centre in ICT research as a broad project, covering a range of research topics located in geographically dispersed locations but managed, supported and resourced virtually from a central hub. We have intentionally chosen to transform a university way of thinking into a polytechnic way of thinking in the belief that "simply by sailing in a new direction you could enlarge the world" (Curnow, 1997, p.226).

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9. APPENDIX A: FEEDBACK STATEMENT BY ASSESSMENT PANEL

This proposal contains much descriptive material about organizational processes and characteristics, but does not provide essential information needed to measure it against some crucial criteria in the assessment framework.

Section 5.ii, the proposed research programme, does not specify what topics will be researched, let alone what approach to them will be taken, or what new findings might be expected. There is no research programme in ICT described whose excellence can be judged.

Although a number of CV's are included, the research team to be funded is not specified in Section 8.i, so its quality is difficult to assess accurately. A number of those with listed CV's do not have PhD's or significant research experience.

The Director should be an internationally recognized research leader. Assessment of the proposed Director is hampered by the extremely unusual failure to supply a list of publications.

The proposal concedes that the Polytechnic sector is new to re-search and that post- graduate supervision is not a strength of its ICT component. In proposing (p. 15) that the Centre provide training courses for its staff in research techniques, it is in effect acknowledging that it is not in a position to meet the Knowledge Transfer Objective of providing excellent Postgraduate Research Training.

The idea of building a network of research clusters in the Polytechnic sector is an admirable one that deserves encouragement. Such a network would need to become established and develop a credible, research record before it could compete for the kind of support intended to be, provided by the CORE programme.

10. APPENDIX B: REFEREES' OVERALL COMMENTS

The proposal was given to three independent referees to evaluate. Each provided a detail report and evaluation based on the CoRE criteria. These are reproduced below:

10.1 REFEREE 1

"This is a quality proposal and should be funded. People have thought that Centre's of Excellence require a single, geographical location. With the dawn of electronic communication a Centre is not defined or limited by geography, but a quality Centre does require effective leaders who can manage a distributed group as a single organizaton. A Centre with only a single location has an uphill battle with broad-based knowledge transfer. A Centre with a main and some regional locations will be able to focus a greater diversity of resources and being distributed will be more effective in knowledge transfer. The applicants have already managed to do networked IT research throughout New Zealand supported only by their dedication, skills, and boundless energy. The positive results for New Zealand will be enormous if this team is provided with support that will enhance their organization and provide them time to dedicate to these projects.

This is a proven team."

10.2 REFEREE 2

"I believe that this proposal tests the boundaries of the vision for the Centres of Research Excellence Fund, and because of this, evaluation of the proposal has been made somewhat more difficult. Indeed this is acknowledged in the submission [5.i.i].

Let me say at the outset that I found the proposal refreshing and creative. It identifies a real opportunity to leverage the research capability increasingly found in the polytechnic sector in way that would enhance New Zealand's ability to develop as a knowledge society and conceivably contribute to New Zealand's development. There is evidence within the proposal of this already occurring in small but effective ways.

It is also a proposal built on collaboration, strongly between tertiary institutions within the polytechnic sector (and two universities), and to some extent involving local industry and public instrumentalities. There is little evidence in the proposal of relationships and linkages (in a research sense) with other (national or international) research organisations or enterprises. Without these and without a corpus of strong established researchers supported by postdoctoral fellows and doctoral students, it is difficult to see how CITRUS could support and/or generate world class research within a realistic timeframe acceptable to the CoRE fund. And the essence of the CoRE initiative appears to be excellence in research, measured by world standards.

The standing and experience of the researchers nominated in this application is very varied, and, with a few notable exceptions, would not have the national and international standing backed up by a publication record expected of a national centre of research excellence.

The proposal also lacks the necessary detail in its mode, of interaction, strategies for research training and exploitation of research outcomes that I would have expected to see in an application of this sort. Perhaps the very nature of the network approach over such diverse backgrounds necessarily predicates against this, but it is a weakness in the application.

I also have some concerns that the issues associated with managing a distributed research environment have been underestimated (significantly). There are certainly examples of effective distributed research environments (for example the collaborative initiatives that grew out of

the National Science Foundation in the U.S., and certain of the Cooperative Research Centres in Australia). These however are networks based around strong existing research nodes, and even in these the task of managing a coherent program of research can be very challenging.

The proposal seems to be based on developing a research capability in an existing body of people rather than in an area of knowledge, and in applying this within local industry and the community rather than generating new knowledge, peer reviewed in the international research community. The proposal is full of interesting ideas, whether those are consistent with the objectives of this fund us a task for the Assessment Panel. Should this application be unsuccessful, as I suspect it will, I would encourage the proponents to seek other avenues for the funding to realise at least some of the vision of this proposal."

10.3 REFEREE 3

"The CITRUS proposal argues for funding of a network of polytechnics, it is not a proposal for the funding of a specific research group. The proposal does not contain a specific research programme in the area of ICT. The type and topics of the research will be determined by the projects that will be accepted for funding by the CITRUS network. Therefore it is difficult to evaluate on the findings what can or will be achieved by CITRUS. I have based my score on the potential of this proposal.

I suggest that the evaluation board must decide whether a proposal such as CITRUS is applicable to CoRE or whether they want to fund only centre with a clear research agenda and mission. If this is the case CITRUS is not applicable for being funded in the context of CoRE. Nevertheless I believe that the funding of a network as it is proposed by CITRUS is a very good approach to support research and innovation in New Zealand."

concise papers