

Technology Users' Innovation (TUI) research programme

Report to BRANZ

Can building and construction sector innovation be improved?

A review of innovation centres and their implications for New Zealand

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Summary

Can building and construction sector innovation be improved?

A review of innovation centres and their implications for New Zealand

Objectives:

- Report on the role of innovation centres in the building and construction sectors in different countries
- Describe their structure and function
- Compare the governance of building and construction innovation in New Zealand to what is happening overseas.

Method: Internet search for innovation centre websites.

Findings: There are four main functions of innovation centres, only the first being well accomplished in New Zealand:

- Commercialise R&D
- Help inventors
- Promote innovation
- Do research.

There is scope for a dedicated New Zealand innovation centre to provide all these function. Compared to Australia, the New Zealand government provides no internet help for inventors.

Building and construction innovation centres provide nine core functions, but four of these appear not to be well supported in New Zealand. There is a need for a New Zealand Building Innovation Centre (NZBIC) to provide:

- Promotion of design
- Demonstration parks
- Leadership of sector strategy
- Promotion of the use of new technologies, new systems, and new services throughout the building network or system.

Following the example of the Swedish BIC, NZBIC should be a peak organisation which includes all building and construction stakeholders, relevant research centres and government representatives.

The findings point to a broader role for a New Zealand innovation centre and NZBIC to promote innovation generally.

Chapter 1:

Introduction

1.1 Research objectives

At the present time, innovation in the building and construction sector derives from three main sources: (1) endemic innovation among builders and architects, (2) support by sector organisations such as BRANZ, and (3) support for innovation deriving from government policy. Are there better ways to support innovation than those currently in place? The research question motivating the research presented in this report therefore asks if innovation in the building and construction sector can be improved. This is not to imply that current innovation levels or support are problematic but asks if they can be improved. In large part, this question stems from growing recognition of the importance of the building sector in a number of environmental and sustainability issues.

One way to address these questions is to conduct a gap analysis, that is, to assess the state of support for innovation in the New Zealand building and construction sector at the present time and to compare it with what is happening in other countries. Such a comparison can show the strengths and weaknesses of the New Zealand situation and can indicate if improvements in innovation can be achieved. At the least, it can be beneficial to see what is happening in other countries and learn from them even if the conclusion is that no major change is needed. It is especially relevant to make these comparisons to countries known to have stronger economies than New Zealand given that it is generally accepted that the New Zealand economy needs to perform better. One way to achieve this is via innovation in one of the significant sectors of the New Zealand economy.

The situation in New Zealand and other countries can be assessed by focusing on how each country supports building and construction innovation and this requires assessing two things: their innovation governance, that is, the general strategy, policies and regulation of innovation, and more specifically their building and construction innovation. The former is the province of government policy and involves one or more departments or ministries and funding agencies. The latter is the province of building and construction sector organisations charged with promoting innovation, responsibilities not disconnected from innovation governance. In this report the focus is mainly on the building and construction sector level since that is where overall innovation governance has its most direct impact.

The objectives of this research are to (1) report on the role of innovation centres in the building and construction sectors in different countries, (2) describe their structure and function and, (3) compare the governance of building and construction innovation in New Zealand to what is happening overseas. The report therefore will assess the potential support for innovation that the structures and operations of BRANZ and the Department of Building and Housing in New Zealand offer, compared with the structure and operations of their equivalent organisations overseas.

There are not many dedicated building innovation centres presently existing. Therefore attention is also given to innovation centres generally in order to gain a general understanding of their structures and functions and their implications for building and construction innovation centres. The building and construction innovation centres that do exist are given special attention in this report since they are most relevant to the research objectives.

1.2 Method and limitations

The main method used was to conduct an internet search using the key words of 'building innovation centres'¹. The resulting 20 pages of search results were checked to identify relevant web sites, that is, sites that gave evidence of representing an innovation centre. Much of the core text of this report was obtained by direct copying from the websites of the innovation organisations. At times, the text may suffer from such copying, especially where the promotional tone of the website's language could not be moderated. The reader is warned that when reading about the details of an innovation centre, the text is really a slightly modified form of the website text, not the independent assessment of the researcher. While this may be less than ideal it is still an effective way to learn about the key features of innovation centres. Even if the websites suffer from some inaccuracies they still represent the core activities of the innovation centres and it is at this level that our interest lies.

Another problem with this method is that one cannot be sure how comprehensive the sample is. There was no population frame from which the sample was derived. However, it seems reasonable to expect that any active innovation centre playing an important role in its country's innovation would have an up-to-date website, and therefore would have been found in the web search. This approach is a more viable alternative than searching the academic literature since it is unlikely that the activities of building innovation centres would manifest in such a medium. A search using this approach did not find relevant information. Thus, while no proof of the viability of the sample can be provided, it seems likely that the sample obtained is comprehensive. It should be noted that for the purposes of our research objectives it is not necessary to include every innovation centre in the review. Provided that most innovation centres are considered then it is possible to learn from them and achieve the research objectives.

The method does not allow for a comprehensive assessment of each research centre since it was reliant on the website source, and these are of varying depth and detail. Further research would be needed to gain a full understanding of innovation centres. The method is no substitute for a more detailed understanding of the situation in a given country. Such an understanding could be obtained by consulting with specialists in each country, a task well beyond the scope of this study, or by direct contact or visits, also beyond the scope and budget of the present study.

Another limitation to this method is that it requires building innovation centres to use the word 'innovation' prominently. In some cases, the principal building and construction organisation does not do this and so may not have been found in the search. This was the case for BRANZ. Further, some innovation centres may use their native language and this may have limited the number of innovation centres found.

The author deliberately did not study BRANZ at the outset of the review but instead focused on innovation centres overseas and then in New Zealand. Once the overseas innovation centres were documented it then became necessary to learn more about building and construction organisations in New Zealand, and the BRANZ and Department of Building and Housing websites provided sufficient information. Therefore, the author has a limited knowledge of these organisations and his characterisation of them cannot be seen as definitive. Fuller appraisals would require more attention and the use of sources other than the website. This is not considered necessary for the present report since it would shift the perspective away from learning about what is happening in other countries.

¹ The search engine used was Google.

A final comment is that the review was undertaken as part of the Technology Users' Research Programme, which focuses on inventors, and therefore the review paid attention to the role of inventors in innovation. The conclusion develops this point when it shows how inventors are assisted in Australia compared to New Zealand.

1.3 Interpretive approach

The initial approach taken to interpret the search data was to characterise each innovation centre in terms of its structure, conduct and performance. Structure relates to the way the centre is set up and includes reference to governance such as the boards used to govern its activities. Conduct refers to the goal the centre has and includes consideration of how it achieves its goals, and performance refers to an assessment of how well these goals are achieved. This latter aspect is often not included in the website sources and remains incompletely documented in this report. However, the structure and conduct data are sufficiently detailed to provide a good base from which to draw useful conclusions.

1.4 What is an innovation centre?

Innovation centres share some similarities with research centres in that both are involved in innovation. This review does not include research centres because this would make the task too cumbersome. What innovation centres have in distinction is a greater focus on innovation.

Organisations interested in innovation may take many forms but most commonly occur as innovation centres or Science and Technology Parks (STP), often associated with a university. Innovation centres have four main functions: commercialise R&D, help inventors, promote innovation, and do research. Innovation centres and STPs are an established part of the innovation system for most developed economies. They play an important role in regional economic development, technology transfer, commercialisation of university research, promoting R&D by firms, and facilitating the development of knowledge-based industry clusters. Successful innovation centres and STPs, integrated with national and regional economic development policy, are often located adjacent to a leading university with a critical mass of research capability and can facilitate commercialisation and incubation services. It appears that innovation centres are more common in Europe while STPs are more common in the USA.

Some innovation centres are in reality a broad coalition of research organizations. For example, the Danish Innovation Institute (DII) is a not-for-profit Research & Technology Development Group employing 550 scientist and engineers, and containing nine individual institutes, each with a specific technological specialism and competence. There is a focus on 'mechatronic products' expected to play a pivotal role in determining and improving economic performance and the quality of life. The majority of research is in five key sectors (health, energy, production, communications, consumer goods) with researchers covering the full breadth of scientific disciplines from applied mathematicians and physicists, to materials engineers and chemists.

Other innovation centres are mission oriented. Recently, architect William McDonough and chemist Dr. Michael Braungart launched their Green Products Innovation Institute (GPII), Inc., an addition to their Cradle to Cradle Movement® (C2C). This new non-profit organization is focused on being a valuable resource for all consumers, and ultimately, will help people achieve a higher level of environmentally-safe and healthy products. The driving force behind the movement is that through the innovation of "redesigning products and ingredients to become nutrients, and enabling old products to become the raw material for new goods and services" in a cycle of reusing elements that will eliminate waste.

The Institute will establish a system for evaluating products, based on the guidelines established by a team of members in the environmental community, government, industry, and academia. One of the first moves of the Institute will be to provide a safer alternative chemicals list to replace toxic chemicals. It is the hope that this list will generate innovation within the industry and eventually “lead to safer products and bring us closer to a global Cradle to Cradle® economy. Using the C2C framework, the GPII is set to transform how companies design, manufacture and use chemicals, fostering innovation and job growth in a new green chemistry sector.”

Another example of a mission-oriented centre is the Low Carbon Innovation Centre (LCIC). It is the commercial hub for all of the University of East Anglia’s (UEA) carbon-related activities. The centre opened in October 2008 bringing two existing brands, the Carbon Reduction Programme (CRed) and Carbon Connections under one umbrella while expanding the consultancy wing. Linked intrinsically to the globally-renowned School of Environmental Sciences at UEA, LCIC draws upon over 30 years of climate change research which acts as the basis for exhaustive carbon footprinting processes, life-cycle analysis and the creation of online pledge systems. Some of the services offered by LCIC include analysis of organisational carbon footprint, product life-cycle assessment, and energy surveys. LCIC is also responsible for co-ordinating the construction of the Combined Heat and Power biomass gasifier plant at UEA. This plant is due to open in 2010 and will reduce the university’s carbon emissions by over 30 per cent on 1990 levels. It will operate at 84 per cent efficiency, thought to be the UK’s most efficient power plant.

Science and Technology Parks (STPs) offer a slightly different model compared to innovation centres by giving more emphasis to commercial development. Wikipedia describes a ‘science park or science and technology park’ as an area with a collection of buildings dedicated to scientific research on a business footing. There are many synonyms for STP such as science park, research park, technology park, technopolis and biomedical park. The appropriate term typically depends on the type of science and research in which the park’s entities engage, but many of these STPs are named according to which term gives the park the best profitability and naming advantages. Often, science parks are associated with or operated by institutions of higher education (colleges and universities).

These parks differ from typical high-technology business districts in that STPs are more organized, planned, and managed. They differ from science centres in being concerned with future developments in science and technology. Typically, businesses and organizations in the parks focus on product advancement and innovation as opposed to industrial parks that focus on manufacturing and business parks that focus on administration. Besides providing a building area, these parks offer a number of shared resources, such as uninterruptible power supply, telecommunications hubs, reception and security, management offices, restaurants, bank offices, convention center, parking, internal transportation, entertainment and sports facilities, etc. In this way, the park offers considerable advantages to hosted companies, by reducing overhead costs with these facilities.

Science and technology parks are encouraged by local governments in order to attract new companies, and to expand their tax base and employment opportunities to citizens. Land and other taxes are usually waived or reduced for a number of years, in order to attract new companies. Some examples from the US include the USA Technology & Research Park, launched in April 2002, which is a major economic development initiative of the University of South Alabama. The Park links university resources with the business community in a single location that expands educational opportunities for students, provides new research relationships for faculty, and offers fresh growth prospects for businesses. Another example is the Meadowville Technology Park (MTP), a 526 hectare industrial development located in Chesterfield County in the Richmond, Virginia metropolitan area. The MTP offers an attractive site for a wide range of businesses and it is especially well suited to serve water-intensive users such as pharmaceutical and semiconductor manufacturers.

Finally, there are private innovation centres established by businesses to emphasise innovation, presumably more so than what is the regular level of business innovation. For example, Cereal Partners Worldwide (CPW) is building a new innovation centre for breakfast cereals in Switzerland at a cost of €33m. The Nestle and General Mills owned business is building the centre in Orbe, Switzerland, where Nestle already has a significant research base. The innovation centre will work on breakfast cereals that provide consumer benefits, such as improved nutritional content, as well as freshness, taste, and texture. Another example is Accenture which has opened an Innovation Centre at Oracle's U.K. headquarters in Reading to accelerate the development, delivery, and commercialization of innovative business solutions based on Oracle technology. Another example, in London, is the IBM Innovation Centre at South Bank. London is a local portal to resources at the IBM Innovation Centre in Hursley near Winchester and to other centres worldwide. This centre allows business to build their skills and to discover how to integrate solutions with the IBM technology portfolio. A final example from the US is Batelle, a private, not-for-profit research centre with a varied portfolio of activities including energy, defence, and laboratories.

None of the innovation centres mentioned in this outline is a good match to a building innovation centre. The closest match are the mission-oriented ones because they are not so broad in their focus nor do they have a regional economic development function, characteristics they share with building innovation centres. Good examples of building innovation centres exist and these will be highlighted in this report. In general, building innovation centres seek to promote innovation in the building and construction sector and do have a commitment to economic development but via building activity generally rather than in a particular region. On these points, building innovation centres are similar to innovation centres but they may not be linked to a particular place or to a university.

1.5 Conclusion

Having specified the research objectives and approach taken it is appropriate now to consider the substantive results. The next chapter reviews innovation centres and the subsequent chapter develops the implications of these results for New Zealand.

Chapter 2: Innovation Centres

2.1 Introduction

This chapter presents a descriptive account of innovation centres. The order of presentation reflects our location and set of interests, and so begins with New Zealand, moves to Australia, considers the UK then North America before concluding with other European countries, grouped as Scandinavian and other.

Each country is presented as a section of the chapter and for each country the material includes, where possible, the policy setting, innovation centres generally, building innovation centres, and a country conclusion which includes a summary table. The policy setting briefly describes the innovation governance for each country, and the government department or ministries that relate to or focus on innovation. This is done to put the innovation centres in perspective, that is, to show how they relate to government policy and in acknowledgement that in many cases government policy has a direct bearing on innovation centres generally and on building and construction innovation centres in particular.

2.2 New Zealand innovation centres

Policy setting

New Zealand innovation policy is in a state of flux at the present time. The Ministry of Research, Science and Technology (MoRST) (responsible for science policy) and the Foundation of Research, Science and Technology (FoRST) (responsible for administering research funding) are being combined into a proposed Ministry of Science and Innovation. However, the situation up to the present time can be characterised as follows.

Key Policy Documents:

- MoRST's Igniting Potential document which summarises the main challenges and identifies current priorities and includes the CRI Taskforce report findings.
- OECD Review of Innovation Policy in New Zealand (2007).

Decision-making Bodies:

- Ministry of Research, Science and Technology (Primary role)-responsible for high-level research policies and strategies. FRST manages most of the funding.
- Ministry of Economic Development (Primary role)
- Ministry of Education (Primary role)
- New Zealand Trade and Enterprise (primary role)
- Ministry of Agriculture and Forestry (Secondary role)
- Ministry of Fisheries (Secondary role)

- Tertiary Education Commission (Encouraging and Supporting Innovation (E&SI) scheme).

Implementing Bodies:

- Foundation for Research, Science and Technology
- Health Research Council
- Royal Society of New Zealand (Marsden Fund, James Cook Fellowships, Teacher Fellows, Science and Technology Promotion Fund, International Science and Technology Linkages Fund, Talented Young New Zealanders)
- New Zealand Trade & Enterprise (funds a lot of business sector R&D)
- NZ Venture Investment Fund
- Tertiary Education Commission

Multi-level Governance:

- Some governance at the local level (e.g., The Canterbury Development Corporation (CDC)- provides business development services. The CDC's technology initiative works to promote Christchurch as a knowledge-based city.
- NZ Trade and Enterprise funds Regional Programmes (the central government works with regional governments in deployment) – Regional Polytechnic Development Fund, Regional Partnerships Programme, Cluster Programmes.

Innovation Centres

The **New Zealand Innovation Centre (NZIC)** was developed jointly by the government, the University of Auckland and Auckland City Council to help research and development (R&D) intensive companies grow and succeed by providing a meeting point between these companies and R&D expertise. The NZIC was the first in what would become a series of innovation centres throughout New Zealand. In developing the model, significant input was obtained from representatives of Technopolis, a Finnish STP company, which specialises in planning and developing STPs, and is regarded as having one of the most successful models internationally. They operate 13 STPs in Finland, with regional centres specialising in different sectors.

The centre is located near to the university's Tamaki Campus, includes office space, research labs and equipment, as well as networking facilities and amenities, and research, incubation and commercialisation services. By attracting and clustering together innovation-led companies and research expertise facilities in an innovation 'ecosystem' of firms and supporting organisations, the NZIC aims to become an internationally-recognised centre of research and innovation.

The main target tenants are medium-sized firms with 10-100 employees, which are high-tech and fast growing. Target clients are involved in sectors such as aerospace and transport, building and construction, food and beverage (including packaging), health and medical technologies, marine, and other heavy industry, including energy and infrastructure. Tenants are also likely to include a combination of a few major firms, Crown Research Institutes, and on-site service providers such as government agencies and professional service firms. The NZIC also hosts some start-up firms, from company or research organisation spin-outs, as a result of the innovation generated from the increased collaboration between firms, and between firms and research institutions.

By 2015 the aim is to serve about 50-100 firms in the NZIC itself, and many more in a broader Innovation Precinct. This Precinct will include a 'research hub' which will be a site for research centres, laboratories and specialist facilities, based on the University of Auckland campus in a nearby site. The Precinct also provides scope in the surrounding area for related companies that will not meet the entry criteria to the NZIC of growth potential and R&D intensity, but do want to be near to value chain partners. NZIC helps companies bridge the gaps between concepts, production and markets, with specialist knowledge in developing the high value solutions now demanded by global clients.

The Government has approved funding support for master planning and establishment work for the Centre, to contribute to the construction of the Centre and associated research hub, and to support operating expenses for the first eight years. The Auckland City Council is undertaking to provide five hectares of land, for the Centre and will assist with the development of the broader Tamaki Innovation Precinct that the NZIC will sit within. The University of Auckland is also undertaking to provide five hectares of land from their Tamaki campus that will be used for a 'research hub' to support the NZIC.

This partnership will form an independent, commercially-driven company, with a structure that can adapt and respond to the changing requirements of businesses and stakeholders. NZIC will be governed by a board of independent directors, primarily from the private sector and representing the interests of shareholders.

In Christchurch the University of Canterbury houses the NZi3, a national ICT innovation centre. The Institute is a 'hothouse' of strategic ICT research and aims to be a globally-recognised innovation centre that transforms ideas from the lab, across the innovation gap, into industry. As an entrepreneurially-focused, applied research institute, NZi3 offers a unique fusion of the best of New Zealand's ICT academic expertise with industry-driven research. The key focus of NZi3 is overlaying academic research strengths with industry-based themes, with each theme having an industry-led project leader. This is the business model for the highly successful MIT Media Lab and has been accordingly embodied in the governance and management models for NZi3. This is also the business model for the well-known and highly successful HIT Lab NZ. The initial industry-linked research themes for NZi3 include human Interface technology, wireless Communications, Software engineering, geospatial technology, assistive technology, bioengineering, nanotechnology, and the UC Supercomputer.

Also in Christchurch is **Power House Ventures** (formerly Canterbury Innovation) which combines the functions of company incubation and venture capital in one organisation to nurture hi-tech entrepreneurs with expertise in technology commercialisation, capital and other needs. Tenants get and office, one gig of broadband per month, and as much advice as they want. It has branches at the University of Canterbury and at Lincoln University.

The **New Zealand Centre for Social Innovation** has an emphasis on social innovation. Social innovation is defined as "the design and implementation of better ways of meeting social needs". It is a wide field – from new models of child-care to micro-finance, from new ways of delivering healthcare to the home to new web-based energy co-ops. Attention is given to "better ways" of doing things via transformational improvements, not incremental gains. A shared commitment to dramatically improved outcomes is what drives the process. The Centre creates a space for innovation, where Government, business and community partners can come together to focus on some of the most pressing social needs, and a home where social innovators can collaborate, share and find support. The Centre is an independent charitable trust which will be supported by corporate, philanthropic and government partners.

The Centre for Social Innovation works at three different levels. First there is the 'Deep dive' where each year the Centre for Social Innovation targets a few priority social needs that are currently unmet in New Zealand. It brings together a consortium of stakeholders including government agencies, users, community organisations, businesses and other innovators. The centre brings together the idea, the funding to test it out, and the organisation to take it forward. Second, there is support for social entrepreneurs in the community, government and private sectors, with a focus on building on and supporting existing networks. Their flagship programme is the Social Innovation Camp – a programme bringing together social entrepreneurs with web developers to create new web-based initiatives meeting social needs. Third, there is exchange where insights, methods and lessons are shared, so that the centre serves as a hub for people engaged in social innovation in New Zealand, and as a node in an international social innovation exchange.

The **Waikato Innovation Park** seeks to help companies make connections that would yield commercial outcomes. It is being promoted in partnership with James and Wells Intellectual Property and is building on the earlier formed AgBio New Zealand Cluster initiated in Hamilton in 2002 with funding from New Zealand Trade and Enterprise. Recent and planned events include a panel discussion on the topic of 'Partnering to compete: realistic or idealistic?', and Ag Bio speed dating event, and free discussions about IP.

Recently set up is **Innovating New Zealand**, a collaborative national network involving New Zealand's foremost Institutes of Technologies providing a range of services to industry. The project has been funded by the Tertiary Education Commission through its Supporting and Encouraging Innovation Fund, part of a new funding system to support an investment approach to funding tertiary education, which aims to develop "a collaborative and co-operative tertiary system that contributes to New Zealand's national goals by stimulating technology and knowledge transfer from tertiary education organisations to industry". At a macro-economic level, innovation is seen as a key driver in increasing New Zealand's long-term economic performance and international competitiveness. At a company level innovation leads to improvements in a company's performance — whether measured by turnover, profitability, productivity, or the number of people it employs. Innovation drives new products and services as well as improvements to a company's operational efficiency and organisational capabilities. Technology transfer is the process by which tertiary educational organisations can share their skills, knowledge and technology so that companies can innovate.

Innovating New Zealand connects businesses to expertise within polytechnics providing consultancy, training, services and research to assist in all areas of innovation — from rapid prototyping, staff training to organisational design and leadership training. Currently Innovating New Zealand comprises a consortium of six institutes of technology based in the metropolitan centres across New Zealand. In 2011 the network will be extended to polytechnics in the regional centres. Participating institutions include:

- Christchurch Polytechnic Institute of Technology
- Manukau Institute of Technology
- Otago Polytechnic
- Unitec
- Waikato Institution of Technology
- Wellington Institute of Technology

Some New Zealand innovation centres are overseas, for promotional purposes e.g., the **Wood Innovation Centre in Shanghai**, opened in 2006 by New Zealand Trade and Enterprise, with the support of six leading New Zealand wood companies - Red Stag Timber, Carter Holt Harvey Wood Products, Pan Pac Forest Products, Weyerhaeuser New Zealand, TDC Sawmills, and Gunn's New Zealand who have jointly formed New Zealand Wood Innovations Asia Incorporated. The Centre has already attracted a lot of attention amongst Shanghai's wood and building industry with a substantial number having visited the Centre before it officially opened. The Centre provides an opportunity for China and New Zealand to work closely together to use New Zealand Pine in innovative ways to meet China's needs, and will be a springboard for further relationship building between the two countries. New Zealand Pine has been used in China for many years, and has recently been approved for use in building and construction, and, if the response to the opening is anything to go by, the Shanghai building industry is keen to learn more on how they can use New Zealand Pine.

New Zealand building and construction

BRANZ is an independent and impartial research, testing, consulting and information company providing services and resources for the building industry. Their two main areas of activity are to research and investigate the construction and design of buildings that impact the built environment in New Zealand, and to enable the transfer of knowledge from the research community into the commercial building and construction industry. BRANZ has as its core purpose the goal of improving people's lives through research and to inform, educate and motivate those who shape the built environment. BRANZ services include building technology appraisals, testing and consulting, and provision of a library. Their research includes the topics of materials performance, urban form, moisture in buildings, maintaining and improving existing buildings, productivity, informing sustainability choices, and defining performance and practice. The building and construction industry's Building Research Levy supports a broad range of industry-funded projects including technology transfer, Good Practice Guides; Build magazine, technical bulletins, and other communications.

The Department of Building and Housing has a vision of a building and housing market that delivers good quality homes and buildings for New Zealanders that contribute to strong communities and a prosperous economy. They provide information and guidance on building law and compliance, services including weathertight homes, and advice for tenants and landlords. . In addition, the department is also the regulator for the building industry. It administers the New Zealand Building Code, and has powers to ban products or systems, and can make binding determinations on the suitability of construction details. The code effectively set the targets that buildings are evaluated against. Further, it provides a range of building and housing-related information, trends and statistics collected by the Department of Building and Housing, other government agencies, and organisations such as the Real Estate Institute of New Zealand and Quotable Value Limited. They provide consulting functions and publications

Conclusion New Zealand

Table 1 summarises the findings for New Zealand. The policy setting in New Zealand emphasises economic growth via innovation with a variety of funding agencies and programmes. In recent years, one consequence of this policy setting is the establishment of a number of innovation centres with a general goal of commercialising R&D. The strategy is to provide buildings, property or land, along with business support and advice, to achieve synergies among the mix of scientists and business people which presumably were not so well supported before the innovation centre was available. None of these innovation centres has a sectoral focus, although they do choose specialty areas of the economy which they see has most potential, and often innovation at this level is supported by research in different locations. For building and construction, BRANZ and DBH appear to be

progressive and together provide many functions relevant to building. Among these functions, promotion of innovation is a common goal but is more implied rather than overt. This observation raises the question as to whether the promotion of innovation could be strengthened. The emphasis on innovation among university, polytechnics and others relating to commercialisation of R&D sets precedence for the role of innovation in economic development which also suggests that the building and construction sector organisations could give more emphasis to innovation.

Table 1: Summary for New Zealand

Name and location	Goal	Structure and funding	Conduct or functions
New Zealand Innovation Centre Auckland	Support R&D growth Serve up to 100 firms	Linked to University of Auckland Government funding Council provided land	Provide office space Research labs Commercialisation services Networking
NZi3 Christchurch	Become a globally recognised innovation centre	Transform ideas from the lab to industry	Industry led project leader
Power House Ventures Christchurch	Nurture hi-tech entrepreneurs		Provide both incubation and venture capital
New Zealand Centre for Social Innovation	Improve the design and implementation of meeting social needs	Independent charitable trust with corporate, philanthropic and government partners	Integrate stakeholders to support social innovations
Waikato Innovation Park Hamilton	Commercialise R&D	Partnership between James and Wells IP and NZTE	
Innovating New Zealand New Zealand wide	Stimulate technology and knowledge transfer from tertiary education organisations to industry	TEC Supporting and Encouraging Innovation Fund	Connect businesses to expertise in polytechnics Consultancy, services, research, leadership
Wood Innovation Centre Shanghai	Promote the use of New Zealand pine in China	NZTE Six leading companies	Exhibition centre
BRANZ	Research construction and design Transfer knowledge to the building sector	Levy funding Industry funding	Research Testing Consulting Information
Department of Building and Housing (DBH)	Delivery of good quality homes	Government funding	Building law and compliance Weathertight homes Advice for tenants and landlords Information and statistics Consulting

2.3 Australian innovation centres

Policy setting

Key Policy Documents:

- Venturous Australia: Building Strength in Innovation-produced during the National Innovation System Review
- Collaborating to a Purpose: Review of the Cooperative Research Centres Program

- Building Innovative Capability: Review of the Australian Textile, Clothing and Footwear Industries
- Final Report of the Review of Australia's Automotive Industry
- Final Report of the Pharmaceutical Industry Strategy Group
- Final Report of the Review of Australian Higher Education
- Building Australia's Research Capacity document
- Innovation Nation (2008)

Decision-making Bodies:

- Department of Innovation, Industry, Science and Research (when creating this department the government united policy responsibility for a major portion of the national system of innovation into a single portfolio).
- Department of Education, Employment and Workplace Relations

Implementing Bodies:

- Commonwealth, State and Territory Advisory Council on Innovation-helps with inter-governmental coordination
- Coordination Committee on Innovation-inter-agency coordination
- Australian Research Council
- National Health and Medical Research Council
- PM's Science, Engineering and Innovation Council/Chief Scientist for Australia-advises the government.

Multi-level Governance:

There are counterparts to the Australian Central Government at the state and territory levels that work to improve innovation at those levels

Innovation centres

In Australia, the **Enterprise Connect** collaboration led by the University of Technology in Sydney (UTS) will host the **Creative Industries Innovation Centre** including a consortium that unites higher education and industry across Australia. The Creative Industries Innovation Centre will make marketing and communications knowledge available to smaller firms through business reviews, tailored advisory services, publications, seminars and workshops. The Creative Industries Innovation Centre will provide core services similar to those offered across the network, as well as specialist services tailored to the creative industries. While it is headquartered at UTS, the centre will serve firms around the country through a national network of business advisors, through the other Enterprise Connect centres, and through the network of partners UTS has brought together.

A major organisation dedicated to promoting innovation is **Australian Innovation**. It claims it is widely known as a key source for up-to-date information on Australian Innovation and entrepreneurship. Their mission statement is based on using these and other initiatives to increase public awareness of the importance of innovation and entrepreneurship through an emphasis on the three pillars of future economic growth – excellence in research, development and commercialisation. The centre is supported by a wide range of organisations, including a number of state governments, the Business Council, and some companies.

Australian Innovation has five key objectives:

- Demonstrate the value of research, development and commercialisation
- Profile Australia's intellectual capital.
- Reinforce the innovation and entrepreneurial process, from idea to market.
- Facilitate networking between innovators and investors.
- Collaborate nationally and with each Australian state & territory.

Australian Innovation organises an annual festival to support and promote the best of Australian innovation and entrepreneurship. Since its conception the Australian Innovation Festival has increased in size and range with virtually every major town and city throughout Australia included; along with a global spread of supporting international business and educational councils and associations. The Festival is a not-for-profit initiative which aims to inspire a culture of innovation in all Australians, by reinforcing the rich, innovative history and an entrepreneurial spirit, which is comparable to the best in the world. This year's festival runs from the 26th April (World IP Day) to the end of May 2010 in all Australian States and Territories. This year's Festival theme "Building Sustainable Businesses" highlights the importance of innovation during this period of regeneration from last year's global economic uncertainty. Many people equate the term "innovation" with having a long term R&D perspective, but of limited relevance to immediate business needs. More than ever, organisations need to "innovate" to meet the challenge of increased competition and ever changing consumer and market needs. "Innovation" is not just the latest in technology and scientific advancement; it is also about generating new ideas and their take-up. Innovation applies to incremental, ongoing changes to existing processes, systems and products; as well as taking advantage of future, over the horizon opportunities. This festival has national importance because Australians increasingly realise that innovation is the lifeblood of today's companies and the key to national economic success. Those that fail to innovate are at best standing still, while those receptive to new ideas, realistic to challenges and prepared to make things happen will be successful.

The **Industry Development Centre (Hunter) Ltd (IDC)** is a not-for-profit organisation established in 1992 by the Australian Federal Government. Today IDC remains Australia's leading innovation development services firm, delivering a suite of specialised commercialisation products and services to help inventors and innovative small businesses evaluate, develop, protect and commercialise new ideas. Each year IDC provides help to more than 1000 innovators from across Australia. **Innovation & Technology Australia** is the innovation-dedicated website of the Industry Development Centre.

IDC recommends a step-by-step process for developing ideas and provides real and cost-effective solutions designed to minimise risk along the commercialisation pathway, as well as provide clients with the best chance for success. With its comprehensive range of innovation development products and services, experienced staff and strong networks with government, industry, business, research and education providers, IDC is well-positioned to assist innovators take their ideas from concept to commercialisation.

The Industry Development Centre (Hunter) Ltd (IDC) offers a suite of specialised commercialisation products and services designed to help inventors and innovative small businesses commercialise new ideas. From free initial advice and support to comprehensive reports and negotiating licensing deals, IDC is able to assist. IDC's commercialisation products and services are delivered nationwide and each year assist more than 1000 inventors and innovative small businesses from across Australia.

IDC's range of commercialisation products and services are delivered in four main areas. First, to inform by providing an innovator's guide an advisory service and commercial advice; second, to protect by providing confidentiality agreements and other legal forms; third, to evaluate; and last, to commercialise.

The **Australian Innovation Research Centre (AIRC)** researches key issues in innovation performance and economic development. One of their primary aims is to link their research to issues in public policy and business development. AIRC accomplishes this via policy advice to state and federal governments in Australia, policy work with overseas governments and agencies, an entrepreneurship program, a teaching program on innovation policy and a strategic innovation forum. AIRC communicates results via publications, seminars and workshops.

The AIRC focuses on the links between innovation, productivity, and economic growth. This focus involves two broad and distinct streams of work. First, science-based innovation involves participation in emerging sectors such as biotechnology or nanotechnology. The challenge is to link research and business opportunities and to ensure that appropriate levels of venture capital and business support are available. Second, innovation in established industries, products and processes involves consistent technological upgrading of existing activities. This kind of innovation is characteristic of the so-called low-tech activities on which both the Tasmanian and the Australian economies rest. A theme of AIRC's work is that the innovation and growth prospects of such industries are often underestimated. These industries require the deployment of major knowledge resources linked to the science and technology infrastructure of universities and research institutes.

The AIRC uses an approach based on Innovation Studies. Innovation Studies is a problem-oriented field that explores the origins, nature and effects of technological and organisational change. Innovation Studies focuses on the structure and operations of learning, including science and formal R&D, as well as learning in companies, universities and research institutes. Although persistent innovation is one of the few genuinely defining features of modern society, innovation research on a significant scale began only very recently. From the mid-1970s, an increasing number of researchers - usually within small research institutes attached to universities in Europe or to business schools in the USA - turned their attention to innovation. Innovation Studies is now a large field in both Europe and the USA.

What has been achieved and what research challenges remain? Innovation Studies has been approached from a cross-disciplinary perspective by researchers with backgrounds in economics, engineering, management, sociology and history. Much research has been empirical, exploring the characteristics of innovation using case studies and statistical analyses. The main robust conclusions that can be drawn so far from this extensive body of work are that:

- Economic growth and competitiveness rest ultimately on innovation performance.
- Innovation outcomes are highly uncertain, with great complexity and variety in investment patterns among firms and industries.
- Innovation very often relies on collaboration and interactive learning among organisations.
- Local clusters are important, and reflect national and regional patterns of industrial and technological specialisation.
- Innovation involves a strong science-technology interaction.
- Innovation is 'systemic' - it involves interaction between firms and institutions, policies and infrastructures.

Research in this field has challenged earlier assumptions, in particular the idea that innovations come about primarily as a result of scientific research. Today, innovation is seen as an extremely differentiated and heterogeneous activity that assumes different forms and involves a range of activities. However, major intellectual and policy issues concerning innovation remain unresolved. AIRC research seeks to explore the dimensions and significance of such issues.

In Victoria, there is INNOVIC, a not for profit organisation assisting over 1,800 innovators each year, helping to turn new ideas, inventions and innovations into viable products and new businesses. It offers a wide range of services, free seminars and innovation resources to help get invention or innovation through all stages of commercialisation. INNOVIC also runs Next Big Thing Award™, an international competition to find, showcase and award leading-edge new inventions, innovations and ideas with the potential to become the 'next big thing'. Their i-link service links innovators, inventors and start up businesses to INNOVIC's wide network of business associates. Among their services INNOVIC helps with commercialisation including sales, marketing and distribution assistance or help in getting to the right people. Their patent search service can help you to find out if an idea has already been patented or if it infringes an existing patent. Their website development service offers affordable, professional and modern websites that are search engine friendly. Their grant matching service helps connect inventors to the hundreds of grants available for start-ups and small businesses.

Australia building and construction

The **CRC for Construction Innovation** was a national research, development and implementation centre focused on the needs of the property, design, construction and facility management sectors. Operating from 2001 to 2009 and headquartered at Queensland University of Technology as an unincorporated joint venture under the Australian Government's Cooperative Research Program, Construction Innovation developed key technologies, tools and management systems to improve the effectiveness of the construction industry. More than 350 individuals participated and an impressive alliance of 27 leading partner organisations was involved in and supported the activities of Construction Innovation.

As the CRC for Construction Innovation closed on 31 December 2009, the organisation was assessed as making achievements in enhancing the research culture in the built environment industry. Construction Innovation successfully engaged with a cross section of organisations in the supply chain of the built environment industry, resulting in a much broader impact than that received only by the organisations which were participants of the CRC.

The participants and the broader stakeholder group of industry associations have formed a strong network of collaborators and are keen to maintain this foundation of research collaboration. There is support for a **Sustainable Built Environment National Research Centre** which will extend the research themes established: environmental sustainability, safety, productivity improvement through procurement, and digital modelling. This new centre commenced in April 2010.

The industry publications include:

- Brochures
- Project Reports/Refereed conference papers/etc
- Clients Driving Construction Innovation (selected conference papers)
- Construction 2020 - A Vision for Australia's Property and Construction Industry (main report and executive summary)

There are general brochures:

- Achievements 2001-08
- Achievements 2001-08
- Innovate 08 [Mar08]
- Research solutions for the property, design, construction and facilities management industry [Mar07]
- Building our Future [Oct06]
- Strategic Plan 2005-2008 Executive Summary [Apr05].

There are industry publications:

- National Guidelines for Digital Modelling
- National Guidelines for Digital Modelling: Case Studies
- Guide to Leading Practice for Dispute Avoidance and Resolution: An overview
- Guide to Leading Practice for Dispute Avoidance and Resolution
- Safety Effectiveness Indicators Project Workbook.

The **Tasmanian Wood Design Centre** strives to:

- Sustain the wood design industry in Tasmania
- Inspire Tasmania and the world with an understanding of the potency of design
- Create an identity for Tasmania as a place of excellence in the world.

The **Design Centre** is the Tasmanian representative of the Australian Craft and Design Centres (ACDC). ACDC (formerly ADCO, formerly COA) is a national network of craft and design organisations which exists in order to:

- Advocate and lobby for the craft and design sector
- Foster collaborative relationships between craft and design institutions and service organisations nationwide
- Market craft and design exhibitions to the regional gallery network
- Observe and comment on the state of the craft and design sector as needed.

The **CRC for Wood Innovations** is included because of its close relationship with building and construction. The centre completed its seven year program of research and commercialisation on June 30th 2008. Its objectives were to:

1. To develop new technologies that solve industry problems relating to the processing of hardwood and softwood primarily by researching and developing wood modification through microwave processing. Individual projects involve:
 - Rapid drying of hardwoods;
 - Treatment of wood with preservatives and resins;
 - Moisture levelling of hardwoods and softwoods; and
 - Stress relaxation of timber.

2. To develop innovative engineered wood products that are competitive in the international marketplace by the development of the microwave-modified, resin-impregnated wood ('Vintorg') that:
 - Provides new, high strength, dimensionally stable, durable products suitable for high value uses in the internationally competitive furniture, joinery and flooring markets
 - Significantly extends the processing potential of low-grade material, including pine heartwood and low density plantation-grown eucalypts.
3. To develop innovative techniques for the manufacture of high quality and high performance value-added wood products by:
 - Developing and applying a novel concept in the surface engineering of polymers to enhance the adhesion of surface coatings and resins on wood;
 - Undertaking fundamental studies on bonding high density hardwoods to establish the optimum manufacturing conditions and raw material requirements needed for long-term retention of bondability;
 - Investigating the innovative uses of microwave-modified wood in the manufacture of various timber components for furniture, joinery, flooring and windows, utilising industrial design principles;
 - Developing innovative techniques for the manufacture of bent wood components, including the use of microwave technology;
 - Developing optimal long-term performance criteria for wood products through the simulation of various environmental conditions that they may encounter during transport, storage and use; and
 - Investigating the application of process optimisation, development of high efficiency production lines and 'in-built control systems' in the manufacture of high value wood products.
4. To improve the utility of wood waste (for example, sawdust) through wood pyrolysis and:
 - Develop higher value products, such as furfural alcohol, that can be used to improve the durability of wood and as substitutes for costly oil imports; and
 - Develop substitute resins and preservatives that are less toxic and improve the durability of wood in exterior situations.
5. To provide national leadership in research, innovation, education and training that can be accessed by all sectors of the forest and furnishing industries, and increase the level of technical expertise, innovation and enterprising management required by the Australian timber industry.

Conclusion Australia

Table 2 summarises the findings for Australia. Australia's policy setting emphasises recent reviews and innovation. The Department of Innovation, Industry, Science and Research is focused on innovation and there are a variety of funding agencies. There appears to be a good mix of dedicated innovation centres including two that are focused on the core business of helping inventors commercialise. Another one is focused on promotion and awareness and conducts an annual festival. The fourth focuses on innovation research. There is a dedicated building innovation centre

plus wood and design-related innovation centres, including one which emphasises building materials. Australia is of sufficient size to support this number of general and building innovation centres but it covers all aspects of innovation and its overall governance has resulted in a group of innovation centres which span the full range of needs (hands on help for commercialisation of R&D, promotion, and research), and building innovation centres which address the needs of the sector and the need for materials research.

Table 2: Summary Australia

Name and location	Goal	Structure and funding	Conduct or functions
Innovation Development Centre (IDC)	Help inventors commercialise	Federal funding Not for profit	Inform Protect Evaluate Commercialise
Australian Innovation (AI)	Excellence in research, development and commercialisation	State governments Business Council Some companies	Reinforce innovation Facilitate networking between innovators and investors Run the Aust. Innovation Festival
Australian Innovation Research Centre (AIRC) Tasmania	Research on innovation performance and link to public policy and business development	'Innovation Studies' approach	Policy advice to governments Entrepreneur programme Teaching innovation policy Publications, seminars, workshops
INNOVIC	Assist inventors to commercialise		Provide comprehensive assistance
Sustainable Built Environment National Research Centre	Env. sustainability Safety Productivity improvement	Government funded	Digital modelling Industry publications
Tasmanian Wood Design Centre	Support wood design Tasmanian excellence		
Design Centre	Advocate for the craft and design sector		Design exhibitions
CRC for Wood Innovations	Leadership and innovation in the forest and furnishing (timber) industries Develop new technologies		New wood products New manufacturing Utilise wood waste

2.4 United Kingdom innovation centres

Policy setting

Without reviewing UK innovation governance in full I note only the policy relating to innovation centres. In the UK earlier this year, Business Secretary Lord Mandelson announced Government support for the development of a network of technology and innovation centres following the recommendations of a report by technology entrepreneur Hermann Hauser, commissioned to conduct a review into how the UK could learn from other countries' innovation networks. The elite

group of centres will help commercialise the output of the UK's world leading research and will drive economic growth in potential high-growth sectors that will emerge from commercialising technologies. Promising technologies include: stem cells and regenerative medicine; future internet technologies; plastic electronics; software and technologies addressing renewable energy and climate change; satellite communications; fuel cells; advanced manufacturing; and composite materials. The policy of supporting innovation centres appears to have been in place for some time, resulting in the UK having a number of innovation centres as the following examples illustrate.

Innovation centres

A new research hub set to launch in East Anglia in England, as work nears completion on the £5 million innovation and incubation building at the Norwich Research Park (NRP). The **NRP Innovation Centre** will offer over 30 office and laboratory units and has been fitted out in a totally refurbished and customised 4,215 sq m three-storey building. The centre offers facilities for start up and expanding science businesses. It includes 3,000 scientists working within a radius of one kilometre, and a number of institutes including the John Innes Centre, Institute of Food Research, the Sainsbury Laboratory, the Genome Analysis Centre and the University of East Anglia.

The Eco Innovation Centre (EIC) Peterborough is part of a network of Innovation Centres spread across the East of England. The EIC has been established to offer specialised support to the fast-growing Environment Goods & Services (EGS) sector both in Peterborough and across the East of England. Specifically, it aims to provide flexible space to grow businesses, support innovation, enterprise and entrepreneurship, and enable networking between businesses and other innovative and technological organisations. Anchor Tenants include the Centre for Sustainable Engineering (CSEng), the UK Centre for Economic and Environmental Development (UKCEED) as well as Renewables East. CSEng operates the facility, providing specialist advice in the form of surgeries and connecting clients to existing support networks locally, regionally, nationally and internationally. Advice ranges from how to set up a business to sources of financing, guidance for patenting ideas, sanity-checks for commercial applications and routes to market.

Bangor University (Wales) this year has established a world-class **Arts and Innovation Centre** in a £35+million iconic new building in the heart of the city. Located in a vibrant bilingual community with a rich cultural heritage, the Pontio ('bridging' in Welsh) Centre will promote innovation by bridging arts, science and technology. It will also provide a dynamic impetus to the performing arts and to the regeneration of the region.

The **Daresbury Innovation Centre** is rapidly becoming a magnet for businesses, whether as a location for hi-tech SMEs, a high quality setting for events or simply as a meeting point offering high-value networking opportunities, it provides a complete breakthrough in business interaction. It features a designed, state-of-the-art building, situated in the heart of the Daresbury Science & Innovation Campus, specifically equipped for science and technology-based businesses. Since it opened in 2005, the centre has become home to nearly 100 companies, with strong representation from the biomedical, digital/ICT and engineering sectors. It has also brought in a key strategic business unit from IBM, attracted to Daresbury by the presence of the HPCx supercomputer at the world-renowned Daresbury Laboratory.

The University of Wolverhampton has an **e-Innovation Centre** which is characterised by its innovative approach to business accommodation and support. The e-Innovation Centre (e-IC) on the University's Telford Campus provides start-up and growing businesses with state-of-the-art business accommodation in a new and modern building with hi-tech support from a team of consultants. The centre is part-funded by Advantage West Midlands and the European Regional Development Fund to encourage businesses to integrate new ideas and technologies into their working practices. The e-

IC's innovative, stylish Launch Pad Unit is designed for individuals who want to develop their embryo business ideas without incurring vast expense. There is shared, furnished workspace, support with the latest technologies and meeting facilities are offered in a stimulating and supportive environment. Companies can tap into the multitude of skills on offer by the team of consultants based within the e-IC.

The **Cork Business and Innovation Centre (BIC)** is hosted in the National Software Campus (NSC). The NSC Campus is a landmark development in the context of Ireland and the EU. The project is a privately led venture via a public private partnership. The NSC offers world class third generation offices and broadband Infrastructure. The fundamental thrust is to create a global footprint for knowledge based ventures through using innovative networking technologies. The master plan is for a large area of intelligent wired buildings in an innovative crescent or arc facing south and west. This incorporates Block One (the flagship central services facility) and The Campus including linked buildings and multistorey car park. Block One, the anchor facility of 54,000 sq ft, is now complete and is part occupied by tenants such as Horizon Technology Group and the Cork BIC. A key element of the success of an Incubation Centre is the value-add it brings to its tenants. With this in mind the manager works on the identification of "Client" needs and arranges support / development programs including:

- Training Programs
- Informational Seminars
- Networking Opportunities
- Access to professional services - such as help in preparing Business Plans, consultancy on certain issues etc.
- Awareness of Business Development Issues
- Social Events.

In addition to these, all of the resources of the Cork BIC will be available to the Innovation Centre, placing a wealth of business and industry experience at the hands of the start-up companies. Services include Business planning and marketing assistance. Guidance in formulating a business plan is the cornerstone of a BIC's venture consulting service. A promoter's plan is developed with the Centre's professional staff, supported by an outside team of specialists. Skills such as technology research, labour relations, financial control, IT, patenting and legal responsibilities will be made available as needed.

The University of Sheffield's **Kroto Innovation Centre (KIC)** intends to be a centre for world-class research in emerging technologies is helping to attract start-ups and established businesses from around the world. In the last six months of 2008, the University of Sheffield's two technology incubators secured six new tenants; three of these were overseas companies. The University of Sheffield provides a supportive environment for companies to innovate and grow. The Sheffield Bioincubator secured a US-based medical technology company, a Canadian stem-cell company and a new microelectronics start-up from Portugal developing medical devices. The University's other incubator, the Kroto Innovation Centre (KIC), is also "going global" with Soft Landing agreements with Singapore, Taiwan and the most recent with the US Market Access Centre in California. The KIC is also currently at the heart of negotiations with several potential inward investors, which include existing businesses in Germany and Japan, and start-ups from Singapore and Portugal.

NESTA is **the National Endowment for Science, Technology and the Arts**, an independent body with a mission to make the UK more innovative. NESTA invests in early-stage companies, informs policy,

and delivers practical programmes that inspire others to solve the big challenges of the future. NESTA works in partnerships with innovators, policymakers, community organisations, educators, and other investors. It brings the best ideas, new flows of capital, and talented people together, and encourage others to develop them further. Their Public Services Innovation Lab is trialling some of the most innovative solutions and bringing them to scale across the country's public services.

NESTA is a venture capitalist with a privileged position at the heart of the UK Investment scene. They have a £50million evergreen fund to work with teams and portfolio companies to build a close, supportive relationship over a number of years. NESTA co-invested with virtually every major UK-based venture fund and have made investments in five funds giving an exceptional reach in to sources of further funding and the wider expertise of the venture capital community. Their goal is to build great companies via close supportive relationship over a number of years.

NESTA operates a four stage investment process:

- Stage 1: People submit an Executive Summary/Business plan. If the plan meets NESTA's investment criteria, it may ask for further information and/or a business plan. After this a decision is made about a meeting the applicant.
- Stage 2: Assessing the proposal. This will take place over several meetings and will involve analysing any additional information, discussing the terms of any potential investment, and consulting with other potential investors and shareholders.
- Stage 3: Initial due diligence and approval process. A team of experts will assess the business and will write an investment case to be presented to NESTA's Investment Committee.
- Stage 4: Final due diligence and legal contracts. The investment will be complete by signing all of the necessary contracts. NESTA sometimes offer a convertible loan structure.

UK building and construction

The **BRE Innovation Park** claims it is a world-leading and ground-breaking demonstration development designed to give a glimpse of how the future delivery of sustainable buildings and communities can be achieved not only in the UK but around the world. It features seven² of the world's most sustainable houses (built to the Code for Sustainable Homes), a health centre of the future, and over 300 different construction innovations and emerging technologies as well as a state of the art community landscape design. Collectively these projects demonstrate diverse and innovative approaches to sustainable design and construction. They each share the common goal of having a low impact on the environment but a high impact on the quality of life of building and community occupants and CO₂ emissions reduction.

The buildings and key features on the Park currently include:

- Visitors' Centre - provides convenient access to full information on all of the buildings and products on the Innovation Park, while also showcasing a range of new designs and technologies.
- Barratt Green House - the first house on the Innovation Park to be built by a mainstream house builder, the Green House achieves Level 6 of the Code for Sustainable Homes
- ecoTech Organics House - demonstrates a flexible system of sustainable homes that can be both mass produced and designed to suit individual circumstances.

² There is some evidence that not all seven buildings are still on display.

- Hanson EcoHouse - constructed using traditional building materials, precisely assembled to conform to the best principles of innovative methods of construction.
- Kingspan Lighthouse - this super insulated, airtight house, designed to encourage a more sustainable lifestyle, has achieved Level 6 of the Code for Sustainable Homes.
- Natural House - demonstrates a simple, low-tech and easy to build alternative for volume house builders seeking to meet increasingly stringent low carbon targets for new homes.
- Osborne House - shows that high quality, sustainable housing can be delivered affordably and in volume.
- Renewable House - illustrates how renewable building materials, such as hemp, wood and wool, provide excellent options for constructing low carbon, practical and affordable modern housing.
- Stewart Milne Sigma Home - has been test run by a family to obtain a 'real' perspective on living in a home constructed for sustainability using the latest technologies.
- Willmott Dixon Healthcare Campus - points to a new age of healthcare that helps people to manage their conditions more independently by using both health clinics and their home.
- Landscape - demonstrates the role of landscape design, not only in creating great places to live, but also in providing energy, waste and water management.
- Energy monitoring - gas and electricity consumption is being monitored with smart meters in six of the Innovation Park houses.
- Cub House - designed by property developer Charlie Greig and manufactured in the UK by FutureForm, this ultra-modern and highly sustainable modular home is suitable for both social and private housing applications.

Constructing Excellence is the single organisation charged with driving the change agenda in UK construction. It exists to improve industry performance in order to produce a better built environment. It functions across sector, across supply chain, and is a member-led organisation operating for the good of industry and its stakeholders. Their vision is for the UK construction industry to realise maximum value to all clients, end users and stakeholders and exceed their expectations through the consistent delivery of world-class products and services. Their mission is to deliver improved industry performance resulting in a demonstrably better built environment.

The background to Construction Excellence lies in the mid-nineties when widespread recognition arose of the need for the construction industry to improve the service it provided to its clients while also ensuring future viability for the wide range of organisations that operated in the industry. In response to Sir Michael Latham's 1994 report 'Constructing the Team' and Sir John Egan's 1998 report 'Rethinking Construction' a number of cross-industry bodies were formed to drive change.

These included:

- Reading Construction Forum
- Design Build Foundation
- Construction Best Practice Programme
- Movement for Innovation
- Local Government Task Force
- Rethinking Construction
- Constructing Excellence
- Construction Clients' Group

In order to streamline the effort involved, all the above cross-industry bodies were united as Constructing Excellence in 2003 to form a powerful, influential voice for improvement in the built environment sector.

Excellence in construction means:

- Creating individual, community and national prosperity (wealth) through the provision of products and services;
- Creating opportunities for living, learning, recreation and development that will advance the interests of the community at large;
- Exceeding all community expectations for products and services offered and creating added value;
- Achieving expected margins and ensuring value is delivered;
- Earning community respect for aesthetic, safety and environmental standards;
- Having integrated teams delivering world class constructed products, buildings, facilities and infrastructure incorporating quality components, systems and products;
- Respecting its people and the wider community;
- Exporting a range of products and services to other industries.

The activities of Constructing Excellence include a think tank which seeks to strategically set the agenda for industry improvement through the collation of empirical evidence on what works and what does not. The evidence base for change is derived from three core activities of innovation and research, demonstration projects, and providing KPIs and benchmarking. This evidence base is then utilised to try and influence change in the sector through a further three core activities: networks, guidance and training, and leadership and influence. Its activity is concentrated through two membership forums: Constructing Excellence membership and the Construction Clients' Group.

Constructing Excellence will hold its fourth series of Awards in 2010. Since the inaugural series of Awards in 2007, the Constructing Excellence Awards have become one of the leading built environment awards in the UK. The Awards are unique both in terms of coverage and format. The Awards have now grown to include nine regional awards ceremonies encompassing ten regions of the UK. The series of Awards culminates in a National final which this year will take place in London on 18 November 2010.

A newspaper report in 2002 claimed that the future of the building technologies industry in the West Midlands received a boost with the signing of a contract worth more than £750,000 to establish a Regional Centre for Knowledge and Innovation in Building Technologies. At present, a web search does not find this research centre, so it may not have developed as planned or it may have evolved and been assigned a different name. The centre was to be co-funded by regional development agency Advantage West Midlands and the Department of Trade and Industry, and developed in collaboration with Business Link Staffordshire. The centre, located at CERAM (a global expert in materials testing, analysis and consultancy, providing customised solutions that can help to measurably improve performance and profitability through safer, regulatory-compliant and better-engineered products) is based on the highly successful Building Technology division at CERAM, which provides consultancy, product development and large-scale structural testing services to the construction sector. The centre will provide the construction industry with fast and easy access to information services on all building technologies via an online smart software service. The centre will also support innovation in building technologies by subsidising product development for small to

medium sized enterprises and assist networking in specialist areas such as prefabricated construction.

UK and Sweden sustainable construction

Set up by the Swedish and UK Governments, the joint **UK-Sweden Initiative on Sustainable Construction** is an initiative to encourage sustainable construction, management and renovation. The building and property sector is responsible for a very high proportion of environmental impacts sustained in both the UK and Sweden. Environmental improvements within this sector are therefore important in the ongoing work towards achieving a sustainable society. It is hoped that this initiative will help to foster new joint UK-Swedish projects related to the use of environmental technologies in sustainable construction and refurbishment. Best practice includes reducing carbon emissions (energy efficiency, embodied energy, renewable energy sources), minimise pollution, introduce life cycle costing, and using resources effectively (waste management, water management, appropriate use of materials).

Specifically, the aims and objectives of the joint UK-Sweden Initiative on Sustainable Construction are to:

- Bring together current UK-Sweden activities linked to building construction and refurbishment as examples of the benefits of shared best practice
- Facilitate dialogue between stakeholders at all levels – from policy makers and regulators to investors, architects and tradesmen – to share skills
- Disseminate best practice examples and the results of joint UK-Sweden projects, both successes and failures, to ensure that lessons are learnt and mistakes not repeated.

The rationale for the UK-Sweden Initiative on Sustainable Construction lies with the energy consumed in constructing, occupying and operating buildings which accounts for about half of all the UK's carbon dioxide emissions, contributing to climate change, consuming non-renewable resources and adding to pollution. In Sweden, energy for heating purposes makes up about 40 per cent of the total energy use and buildings (apartments, offices etc) are responsible for about 20 per cent of total carbon dioxide emissions.

Waste from construction and demolition materials and soil is 90 Metric tonnes annually in the UK. The industry produces annually three times the waste produced by all UK households combined. Making buildings and construction more environmentally sustainable can make a massive contribution to meeting environmental challenges. This includes a huge number of existing buildings that need to be refurbished and renovated, with improvements to energy efficiency and appropriate ventilation.

Sustainable building is also about building places where sustainable communities can thrive - well-planned places where people want to live and work, which meet the diverse needs of existing and future residents, are sensitive to their environment, and contribute to a high quality of life.

Conclusion United Kingdom

There has been a push for commercially-oriented innovation centres in the UK and many examples can be found. The innovation centres documented in this report show themes of emphasis to the commercialisation of innovation achieved by the provision of well-designed facilities (via refurbished buildings or newly designed buildings), support and networking, and business support and advice. There is a focus on regional development but at the same time with global links, and links to universities although not in every case. For the building and construction sector there is a building innovation park which demonstrates high-performing alternative buildings, and a peak organisation

dedicated to promoting construction excellence for the sector by doing research, demonstrations, providing KPIs and running the Construction Excellence Award.

Table 3: Summary for the UK

Name and location	Goal	Structure and funding	Conduct or functions
Norwich Research Park (NRP)	Incubating science businesses	Network of research centres University of East Anglia	Provide facilities for start up and expanding businesses Refurbished and customised building
Eco Innovation Centre Peterborough	Support fast growing, environmental goods and services sector	Network of research centres	Space for businesses, innovation, enterprise, entrepreneurship, networking Surgeries, linking clients to supports Advice
Daresbury Innovation Centre	Business networking		New building Biomedical, digital/ICT, engineering
e-Innovation Centre (e-IC) Wolverhampton	Encourage businesses to integrate new ideas and technologies into the workplace	Part funded by Advantage West Midlands & European Regional Development Fund University of Wolverhampton	Business accommodation and support New building Hi-tech consultants
Cork Business and Innovation Centre (BIC)	Create a global footprint for knowledge-based ventures using innovative networking facilities	National Software Campus Public/private partnership	Incubation centre Third generation offices Broadband Training programmes, information seminars, networking, access to professional services on business development
Kroto Innovation Centre (KIC) Sheffield	Centre for world-class research on emerging technologies	University of Sheffield	Attract start up and established businesses Global focus
National Endowment for Science, Technology and the Arts London	Venture capital Promote innovation	Endowment National lottery funds Tax-free status	Invest in early stage companies Inform policy Practical programmes to meet future challenges
BRE Innovation Park	Sustainable buildings and communities		Demonstration building innovation
Constructing Excellence	Industry performance Agenda for industry		Think tank. Innovation Demonstration, KPIs, awards

2.5 North America

Policy setting

The task of assessing the policy setting for the US and Canada has not been completed due to the difficulty in summarising diverse policies in two large countries. As noted in the introduction, the

common manifestation of innovation centres in North America is in the form of innovation parks. What follows in this section is all that was found using Google but in reality it is only a cursory glance at innovation centres in North America and in no way reflects the situation fully.

Innovation centres

Battelle is a general, privately-funded research centre concerned with innovation. In their view, innovative businesses see the future and make it better. Battelle invests in initiatives that will deliver a safer, healthier, and more productive future. They have national laboratories managed or co-managed for the U.S. Department of Energy. Battelle is governed by a self-perpetuating Board of Directors and is a charitable trust, exempt from federal taxation, organized as a non-profit corporation under the laws of the State of Ohio. It has a number of areas of interest. Regarding energy, it is seeking to diversify sources of energy, ensure reliability of the energy system, and maximize productivity for economic advantage. From leading major government and industrial initiatives like FutureGen and coal conversion to developing commercially viable fuel cells and energy storage “beyond batteries,” Battelle’s science and technology base and dedicated leadership are meant to forge a powerful future. Regarding health and life sciences it is tapping assets in proteomics, advanced computational biology, and medical device development to take life sciences to the next level. Regarding national security and defence, it provides homeland security solutions, detection and protection against weapons of mass destruction, and emergency preparedness/response and protection of critical infrastructure. Other areas include laboratory management and community education.

An interesting example of university activity in business and innovation development is illustrated by Washington State University and its help for inventors to protecting their technology, and in the licensing of technologies to existing companies and start ups. The **Washington State University Research Foundation** ("WSURF"), in close coordination with the WSU **Office of Intellectual Property Administration** ("OIPA"), protects and commercializes intellectual property produced by Washington State University ("WSU") and its employees. They provide a website which gives information relating to their services and has downloadable forms for reporting inventions.

The term ‘intellectual property’ refers to any product of the human mind, such as an idea, invention, unique name, business method, or an industrial process, etc. that has commercial value. Intellectual property can be protected in many different ways but generally these forms of protection include patents, copyrights, or trade secrets. The entire process of protecting an invention can be complex and litigious. OIPA/WSURF utilizes the expertise of experienced licensing professionals both within and outside the office and various reputable attorneys to manage intellectual property in an efficient and competent manner. Protecting an invention is a multi-step process. The first step is for OIPA to make the appropriate preliminary decisions. Once OIPA has received an invention disclosure form, it evaluates the technology for commercial potential and determines whether legal protection can and should be obtained for the intellectual property. In addition to the novelty/patentability of the invention, OIPA generally bases this decision on several factors, such as the commercial value of the intellectual property, the costs of legal protection, the likelihood that commercially valuable protection can be obtained, and the ability to enforce protection.

Once OIPA has determined that legal protection is justified, it takes the appropriate steps to obtain protection. If OIPA determines that obtaining protection is not justified, and the invention development was federally funded, then OIPA offers the rights to the invention to the federal agency that funded its development. The federal agency may then choose to protect the invention or return the invention to the inventor. If the invention was not federally funded, then OIPA may return the invention directly to the inventor. OIPA manages protection of the intellectual property after legal rights to protect it have been granted or secured, and it assigns the technology to WSURF

once a commercial partner is identified. WSURF licenses the technology and manages the license and the income derived therefrom.

The **Canadian Innovation Centre (CIC)** has an important role in deploying Canada's innovation strategy. The CIC helps Canadian companies exploit new technologies to generate wealth and sustain Canada's competitiveness. It has a process for guiding innovators and their innovations to the market. It is based on sound market research and original market insight. The Centre helps organizations turn their innovations into market-ready products and services. To date, they have done 40,000 business case studies and recommendations, which have helped countless products and services, become market-ready. Their processes have been validated by external researchers, and by the most important group of all - businesses whose rapid growth has been achieved by CIC recommendations. As a not-for-profit organization, it is especially attuned to the needs of the SME community.

Beginning with the establishment of the University of Waterloo's Inventor's Assistance Program in 1976, and in conjunction with increasing recognition of the value of supporting Canadian innovation and entrepreneurship, the Canadian Innovation Centre was founded in 1981 as an independent, not-for-profit corporation. Since then over 20,000 Canadian inventors and innovating companies have worked with the Centre; over 13,000 new product ideas have been assessed; and thousands of products have been successfully guided to the market. The CIC helps individual inventors and entrepreneurs crystallize their ideas and commercialize the resulting products. It also works with innovations coming out of existing enterprises.

The Canadian Innovation Centre provides a number of functions including:

- Validating product or business concepts
- Creating a high performance business model
- Optimising intellectual property strategy
- Pursuing venture or non-equity financing
- Developing market-entry approach
- Accessing government programs
- Determining and enhance business valuation.

The CIC supports business growth by providing a Ready Set Grow webinar series which can help tap into the experience of successful entrepreneurs and business leaders. These free webinars are intended as a resource for the leaders of young Canadian technology companies. Each monthly webinar features successful entrepreneurs and leading subject matter experts providing practical guidance on the challenges facing these companies as they strive to grow. The webinars are live and feature real-time interaction with the audience via polls, chat and Q&A sessions. Their web page has a footer explaining one of their goals as 'Guiding innovation to be market ready'.

The most important issue the CIC addresses is which of all the possible questions should be answered first and what is the best order to answer the remaining ones. Linked with this is a plan to spend as little money as possible in the early stage and more as confidence is gained that the direction taken is the right one. There is no one size fits all solution, and there are many ways to minimize the expense, without reducing the effectiveness of the path chosen.

The CIC runs a National Business Plan Competition for university and college teams. Winners are selected in each region and fly to Vancouver for a final round. There they pitch their ideas to a panel of investors and winners receive cash prizes. It also runs a Technology Entrepreneur Masterclass, an open-source on-line graduate level course in Technology Entrepreneurship. The course, comprising

26 on line sessions, is based on a graduate level course in technology entrepreneurship and helps innovators understand the requirements of developing a technology business.

In 2010 it was reported in the local newspaper that a deal is almost done to build the province's **Wood Innovation Resource Centre** on the site of the Prince George Hotel. The building is expected to be constructed almost entirely out of wood, at unprecedented heights for a wooden building, and house operations by UNBC, UBC, CNC and Emily Carr.

North America building and construction

The **Oregon Wood Innovation Center** provides a number of services:

- Facilities & Equipment Anatomy and Wood Quality – laboratories for wood fibre characterization and wood identification; equipment including microscopes and an X-ray densitometer
- Biodeterioration, Wood Protection and Product Durability – pressure cylinder for wood preservation; laboratories for assessing insect and decay resistance
- Chemistry – Laboratories for development, testing, and troubleshooting of adhesives; research and testing of plant materials for value-added chemical products
- Composite Materials – equipment including presses (hot and cold), glue spreader, refiner, digester, blender, former, and wood-plastic extruder.
- Computer-Aided Manufacturing – facilities for optical scanning, process modelling, simulation and optimization of wood processing enterprises
- Wood Drying – a 100 BF kiln for measuring volatile organic compound (VOC) emissions and 2000 BF dry kiln for research in lumber drying
- Timber Engineering & Structural Design – equipment for assessing strength properties of wood-based materials; scale varies from small specimens up to large members such as beams and full-scale wall systems
- Other facilities include environmental conditioning chambers (hot-dry, hot-wet, cold room, standards room) and state-of-the-art classrooms for on-site or distance education programs.

The products and services include:

- Publications - these include wood technology, operations research, quality and process control, marketing & business management, and lesser-known species utilization (primarily western juniper).
- New product development - by testing products for physical and mechanical properties (density, strength, shrinkage, etc.) and with market assessments.
- Technical assistance – the extension faculty assist with technical questions on a variety of topics related to wood products manufacturing and marketing.
- Short courses & workshops - on business management, wood adhesion, plywood manufacturing, quality control, and dry kiln operation.
- Short-term research - students conduct senior projects to help companies solve pressing problems; students are also available for summer internships.
- Longer-term research - work with companies on longer-term research via sponsored research with faculty and graduate students.

- **Brokering/ "Market Connections"** - The most frequent requests are related to who buys and who sells various types of wood products and industry-related services in Oregon. The on-line Oregon Forest Industry Directory is designed to answer just those sorts of questions.

Conclusion North America

This cursory review of North American innovation centres illustrates a strong commercial orientation. The example from Washington State University shows a rigorous approach to developing IP with a clearly thought out strategy to achieve protection of IP where possible. The Canadian Innovation Center targets assistance to inventors in order to commercialise new technologies. Its approach is comprehensive, including hands-on assistance, education, and promotion, including the use of web tools. For building and construction, the review reports few organisations. The Oregon Wood Innovation Centre focuses on technical R&D issues and education.

Table 4: Summary for North America

Name and location	Goal	Structure and funding	Conduct or functions
Batelle	Invest in innovations	Charitable trust Private funding	National security Laboratories Energy Health and life sciences
Washington State University Research Foundation and the WSU Office of Intellectual Property Administration	Protect and commercialise intellectual property produced by WSU and its employees	Part of Washington State University	Provides expertise of licensing professionals Protect inventions Evaluates, determines if legal protection can be obtained, manages the licence and income derived
Oregon Wood Innovation Center	Wood related services Publications New products Technical assistance Research Market connections		
Canadian Innovation Centre (CIC) Waterloo	Guide innovators to the market	Not-for-profit organisation University of Waterloo	Market research Help inventors crystallise their ideas Business concepts and model IP Financing Market Access government programmes Ready Set Grow webinar series

2.6 Scandinavian innovation centres

This section will cover each Scandinavian country but starts with innovation centres which span them all. The **Nordic Innovation Centre** is important for innovation generally and has many functions beyond building and construction but it also plays a large role in this. The Nordic Innovation Centre initiates and finances projects that stimulate innovation. It works with industry, authorities, and research centres. Their role is also to disseminate knowledge about innovation and spread the results of the projects with a goal of increasing innovation and competitiveness of Nordic industry through enhancing innovation work and collaboration across borders. The Nordic Innovation Centre is governed by the Nordic Council of Ministers and is co-located with other Nordic organizations in

Oslo. The total project portfolio of the Nordic Innovation Centre consists of approximately 120 ongoing projects and networks. Together with several hundred completed projects of great value to Nordic businesses, these projects involve the Centre in nearly all strategically important Nordic areas.

Focus areas include the following:

- Innovation representations in Asia
- Technology Foresight
- MMI - Measured and Managed Innovation
- New Nordic Food
- Healthy choices
- Functional food
- Food Safety
- Tourism
- Sustainable renovation
- Seed & Venture Capital
- Creative Industries
- Environmental Technology
- Innovation Policy
- Micro- and NanoTechnology (MINT)
- Innovative construction

Recent building projects include:

- ***Integrated Design and Manufacturing of Welded Structures.***
The more than 20 research partners have, based on findings on earlier Nordic projects; worked together to improve the design, fabrication and cost effectiveness of advanced welded structures. The results of the project will provide practical guidance of immediate value to industry and exploitation will concentrate on the provision of information in a user-friendly form that is readily applicable.
- ***Solar thermal components adapted to common building standards (SCAS).***
New improved solar products and solar heating systems have been evaluated in the project. The products and systems are very attractive compared to existing ones. It is expected that the new solar heating systems soon will be brought onto the market and that the documentation of the thermal performance and the energy savings of the systems in practice will be extremely important for the industry.

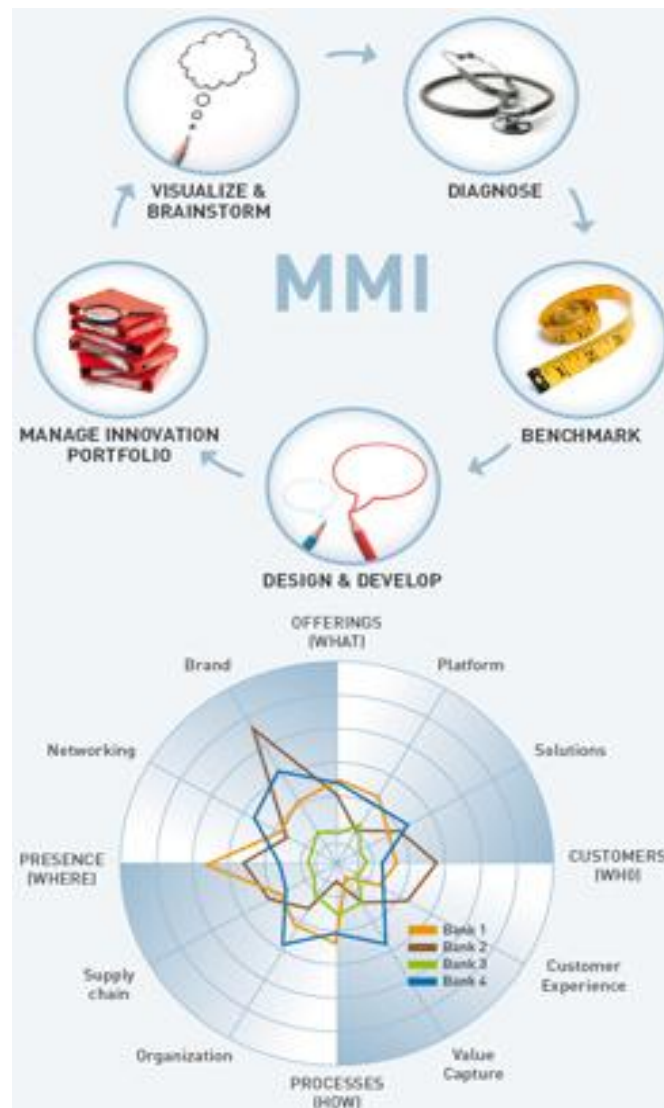
As an example of a recent activity in the building and construction sector, the Nordic Innovation Centre has recently invited Nordic companies, organizations and research institutes to participate in a European call on Sustainable Renovation. The call is held in collaboration with nine partners within the ERA-net - Eracobuild. The purpose of this call is to generate joint research and innovation activities within sustainable renovation of the existing built environment. The call provides opportunities for researchers, industries and other organisations to take part in multilateral cooperation in the field of sustainable renovation.

The ERA-net – Eracobuild - is a network of national R&D programmes focusing on construction and sustainable built environments and aims to develop synergies between national programmes by sharing strategies and establishing joint programmes and projects. Eracobuild has so far defined two thematic frameworks for transnational cooperation: “Sustainable Renovation” and “Value Driven Processes”.

The overall goal with the Eracobuild Sustainable Renovation program is to support research and innovation for balanced and sustainable development within the built environment and sustainable economic growth of society. The research area Sustainable Renovation covers a wide scope of technological, environmental, social, cultural, economic and institutional aspects. The proposals should take the users’ need as a starting point and when possible take a life-cycle-perspective on sustainable renovation.

Outputs from the NIC include more than 600 Technical Reports. Most of these reports may be downloaded as pdf-files free of charge. The areas of testing include: Building• Acoustics• Chemistry• Consumer• Electronics• Environment• Fire• Materials• Mechanics• Non-destructive testing• Polymers• Heating, Ventilation, Air Conditioning / VVS.

For the NIC innovation is more than product development; it is about creating new value. This is essential for growth and profitability in all business sectors. In order to survive and remain competitive, companies must constantly innovate to introduce new products, services, processes, or business models which generate new value. The Measured and Managed Innovation Programme (MMI) introduces a strategic approach to innovation management, which will help Nordic companies measure and focus their innovation efforts in order to increase their return on innovation and become more competitive. The programme is developed by the Nordic Innovation Centre, in cooperation with the national innovation agencies in the Nordic region: Tekes, Vinnova, Danish Enterprise and Construction Authority, Danish Agency for Science, Technology and Innovation, Trade Council Denmark, Innovation Center Iceland (IMPRA), Innovation Norway and the Norwegian Research Council. The programme is carried out during the period of 2010 – 2012, with participation from 100 Nordic companies. The MMI process wheel and the Innovation Radar are shown below.



Source: Nordic Innovation Centre.

2.6.1 Sweden

Policy setting

Key Policy Documents:

- In the Government Bill "Competing on the basis of quality - tuition fees for foreign students" (Govt. Bill 2009/10) the Government proposes that higher education be free of charge for Swedish citizens and citizens of an EU/EEA state.
- In the research bill "A Boost to Research and Innovation" the government dedicated €165b to 24 strategic research areas.

Decision-making Bodies:

- The Ministry of Education and Research, and the Ministry of Enterprise, Energy and Communication.
- The Research Policy Council (RPC), the Innovation Policy Council (IPC), and the Institute for Growth Policy Studies (ITPS).

Implementing Bodies:

- Swedish Research Council (VR), funded by the Ministry of Education and Research.
- There are also six major national semi-public foundations such as the Swedish Foundation for Strategic Research (SSF), which supports research in science and engineering.
- Research of an applied nature is supported by the Swedish Governmental Agency for Innovation Systems (VINNOVA), established in 2001.

Multi-level governance:

- Research policy is decided on the national level but in the latest government bill on regional policy, "Regional growth – for jobs and welfare" and "A policy for growth and vitality in the whole country" (2002), the coordination of research and regional policy was stressed, regarding development of clusters and regional innovation systems. Linking regional growth initiatives with national research and innovation policy includes improving the dialogue with regional actors and national authorities.

VINNOVA (The Swedish Governmental Agency for Innovation Systems) is the state authority that aims to promote growth and prosperity throughout Sweden, and to contribute to Sweden's development as a leading growth country. One particular area of responsibility comprises innovations linked to research and development. Their tasks are to fund the needs-driven research required by a competitive business and industrial sector and a flourishing society, and to strengthen the networks that are such a necessary part of this work.

The Government has assigned VINNOVA to:

- Contribute making Sweden a leading research nation in which research of high scientific quality is conducted.
- Promote sustainable growth and increased employment by acting to increase competitiveness and the emergence and expansion of successful companies.

- Support research and development work of the highest quality in areas such as engineering, transport, communications and working life in order to promote renewal and sustainable growth.
- Stimulate Swedish participation in European and international R&D collaboration and in the exchange of experience in the field of innovation.

Innovation centres

The **Herbert Felix Institute** in Eslöv was started a few years ago to highlight the role and importance of immigrants for Sweden's development. The innovation centre will support entrepreneurship among immigrants. A pilot study has now been completed which describes how an innovation and competency centre within the institute can be organised to meet the needs of 'new Swedes' for counselling and support in their entrepreneurial ventures. The project/pilot study has received SEK250,000 in the form of a grant from the European Regional Development Fund. The objective is to stimulate more people with a foreign background to start and run their own company. The pilot study suggests several different stages, actions and efforts which the future innovation centre will offer entrepreneurs who have a foreign background. Establishing cooperation with local operators and tying them to the centre is an important measure. It would mean that many operators with different skills within entrepreneurship would be represented in the same place. A proposal for the development of the centre is that a personal coach will be on hand when an entrepreneur has decided to go ahead with the development of his/her business idea. The next stage of the pilot study describes the establishment of a coaching programme, which will provide companies with the possibility of in-depth knowledge of entrepreneurship, to be able to discuss different roads to take in the continued development of the company and to create networks in a future business operation.

Sweden appears to not have many innovation centres, putting aside its involvement with the Nordic Innovation Centre, but it does have a dedicated building innovation centre.

BIC (Building Innovation Centre), the Swedish Construction Sector Innovation Centre

Overview

BIC's mission is to develop the construction sector in collaboration with the BIC members. This objective is attained through creating conditions for and carrying out innovation processes by targeting end customer values, sustainable growth and profitability. BIC targets the end customers of the construction sector to achieve its goals. These are individuals, companies, organisations, as well as society in a broad sense.

BIC's method is to link together the ideas and enthusiasm of end users, researchers and stakeholders. The resulting co-operation includes the formulation of strategy, the establishment of procedures for collaboration, the conduct of innovation projects, and communication within the networks that are created. BIC supports research, development and implementation of new technologies, new systems and new services, starting at the design desk, through construction and facility management, to sustainable rehabilitation. Buildings as well as civil engineering structures are covered. These efforts are carried out with strong links to related efforts within the European Union and the global arena.

Innovation and change

Change involves interplay between government, businesses and the research community. BIC membership spans authorities, owners, facility managers, designers, contractors, suppliers and the research society. The aim is to secure competence is available for the innovation systems within the

sector, and that incentives exist for investing in innovation processes. BIC coordinates joint sector programmes, including planning, finance negotiation and management of the execution.

New products, processes, services and systems that have staying power on a competitive market are seen as the means for development for the construction sector. BIC applies a comprehensive approach that includes basic as well as applied research, development and implementation in the form of pilot projects, information, demonstration, education, standardisation, guidance documents, and recommendations.

Activities and functions

BIC promotes useful applications of research by initiating and organizing programmes and projects, improving the construction sector's development climate, and involving and informing members.

Among its important functions are:

- Make innovation possible. This achieved by creating a better climate for conducting innovation projects profitably by (1) applying a functional-requirement approach to construction and facility management, (2) balancing risks and rewards, and (3) discussing purchasing, regulations, standards, etc. with government and the construction sector.
- Create and support projects. This is achieved by co-operating with the Swedish Research Council (Formas) to facilitate and carry out projects which yield innovations, by formulating priorities and ensuring relevance, by developing a basis for decision-making, and by following up innovation projects in co-operation with researchers and other interests. The annual budget for innovation projects related to the work of BIC is ca. SEK 8 million.
- Have global reach. This is achieved by developing international networks, and by monitoring research developments and innovations. BIC influences the European agenda for research and innovation. BIC co-operates with Formas on the ERABUILD project, and provide a national platform for development of the European construction.
- Strategic planning. Together with members, BIC identifies and prioritizes short- and long-term development goals. It sets an agenda for research and innovation in terms of specific projects, and co-operates on strategy with Formas and international construction interests.
- Create strong research centres. BIC operates the competence centre for Swedish Road Administration together with leading Swedish research centres and representatives of the bridge and tunnel branch. It formulates and conveys viewpoints regarding plans of the Swedish Road Administration.
- Support lean thinking. BIC informs about and supports application of lean thinking within the construction sector. It provides a hub for the recently started network, LeanForumBygg.
- Support electronic commerce. BIC contributes to industry effectiveness through development of standards for electronic commerce. Assumes responsibility for administration of a Swedish network for e-commerce in the construction sector.
- General coordination. BIC presents and discusses, informs, gathers viewpoints, and creates forums for discussion in workshops and seminars. It also supports initiatives for increased use of information and communication technology (ICT) and acts as an administrative centre for the industry group, ICT 2008, which continues the work of a previous national programme on ICT in the construction sector.
- Inform membership. BIC sends monthly newsletters to members, publishes a web site with member access to documentation and with details on internal and external activities.

Examples of current innovation projects

- **Indoors environment and health**
Improved comfort and reduced risk of illness in multi-family buildings are the objectives of three joint projects (ca. SEK 12 million). The projects include the development of medical-physiological evaluation methods, surveys of user behaviour, and the development of healthy, environmentally-friendly buildings. Collaborators include Uppsala University, Municipality of Stockholm, Swedish Energy Agency and several other partners. Funding provided by White, JM and others.
- **Environmental classification**
Three projects on the development of methodology for environmental classification are being conducted in close co-operation with Bygga Bo. Total budget is SEK 18 million. Research partners include one department of Chalmers Institute of Technology and two departments of the Royal Institute of Technology. Also participating are many other interests, most of which are members of Bygga Bo; they include Svenska Bostäder, Vasakronan, NCC, Skanska and Swedisol.
- **Product modelling**
In order to assist in the decision-making process, visualization with the help of three-dimensional models is being studied and implemented in a project with a budget of ca. SEK 2.5 million. The research is being conducted at the Centre for IT in Construction at Luleå University of Technology. Funding is provided by the Swedish Construction Industry Development Fund, together with the Nordic Construction Company which is also responsible for implementation.
- **Industrialized construction**
A high degree of prefabrication, interchangeable and easily dismantled components, improved energy performance, efficient supply systems, moisture protection and low production costs are all being studied in a project involving the use of hollow core slabs. The research is being conducted by the Royal Institute of Technology, and the other participating interests include Strängbetong. Total budget is ca. SEK 4 million

Specific Research Programmes

Formas - the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning - and BIC cooperate in several activities connected to generation of new knowledge through research and utilisation of new knowledge through innovation. A research strategy has been jointly developed and a program activity has been installed. The approach of the joint programme connects to the joint research strategy and is to a great extent based on experience obtained from previous key areas within Formas, primarily *Construction client with the customer in focus*, *IT 2002*, and *Electricity use in the built environment*, as well as the programme *Competitive building*.

Projects in the Formas-BIC program require 50 per cent co-funding from sector actors, a special plan for implementation efforts, and an appointed co-project leader for implementation.

The Formas-BIC programme *Sustainable buildings* is the Swedish participant in the ERABUILD project. It is divided into the following sub areas:

- Material economizing, including environmental impact, user requirements, technology and methods for environmental adjustment. Assessment methods.
- Indoor comfort and energy economizing including health, behaviour, new materials, new technology, system approach, incitements etc.

- Processes including management systems for environment, organisation and quality, Industrial construction. Knowledge management.
- ICT for sustainability. Efficient and interoperable processes. ICT as innovation support.
- The role of the developer, including systematic formulation and handling of goals and functional requirements, responsibilities for environmental and quality functions. Formulation, responsibilities and handling of goals and quality functions, handling of risks. Dialogue with end users.

2.6.2 Norway innovation centres

Policy setting

Key Policy Documents:

- White Paper No 7 (2008-2009), An Innovative and Sustainable Norway;
- White Paper No 30 (2008-2009) Climate for Research;
- White Paper No 36 (2008-2009) Public Procurement;
- White Paper No 25 (2008-2009) Local Growth and Hope for the Future: The rural and regional policy of the Norwegian Government;
- Cross political agreement on climate policy 17.01.08.

Decision-making Bodies:

- the Ministry of Trade and Industry (Nærings- og handelsdepartementet, NHD); Coordination of sector innovation policies is the responsibility of the Ministry of Trade and Industry.
- the Ministry of Education and Research (Kunnskapsdepartementet, KD);
- Ministry of Local Government and Regional Development (Kommunal- og regionaldepartementet, KRD), responsible for innovation policies at the regional level;
- also essential parts of the responsibility of several other ministries.

Implementing Bodies:

- Three agencies have the main responsibility for implementing national innovation and industry-oriented R&D policies:
 - (a) the Research Council of Norway (RCN);
 - (b) Innovation Norway (IN) with business-oriented policy instruments and a network of offices covering all Norwegian counties and more than 30 foreign countries
 - (c) and the Industrial Development Corporation of Norway (SIVA): a network organisation which offers an infrastructure for entrepreneurship and innovation nationwide. It contributes to the development of strong regional and local industrial environments as co-owner of virtually all the science and research parks, incubators and business parks in the country

Multi-level governance:

- Norway is a unitary state divided into 19 county administrations (Fylke). The county councils together with the municipalities form the regional governance system in Norway. Initiatives have been taken by some county authorities to develop research and innovation policies of their own.

- In late October 2008 the government presented a proposal for regional administrative reform to be made effective from 2010. Among the proposals are to set up new regional research funds. The counties will also be responsible for selecting board members to university colleges in the region.

Innovation Norway promotes nationwide industrial development profitable to both the business economy and Norway's national economy, and helps release the potential of different districts and regions by contributing towards innovation, internationalisation and promotion. The new state-owned company employs more than 700 people. Innovation Norway has offices in all the Norwegian counties and in more than 30 countries world wide. The head office is located in Oslo. Their core group of clients are Norwegian companies, predominantly SMEs. As of 1 January 2004 the new state owned company Innovation Norway has replaced the following four organisations: The Norwegian Tourist Board, the Norwegian Trade Council, the Norwegian Industrial and Regional Development Fund, SND and the Government Consultative Office for Inventors, SVO.

Innovation centres

The policy settings have resulted in the establishment of many **Centres for Research-based Innovation** which emphasizes Norway's long-term prioritizing of R&D for the business sector. In 2006, a total of 14 centres were established. The main objective for the Centres for Research-based Innovation is to enhance the capability of the business sector to innovate by focusing on long-term research based on forging close alliances between research-intensive enterprises and prominent research groups. (In the long run this basic research will also benefit small and middle-sized enterprises that lack their own research departments.) The total budget for the 14 CRIs will amount to NOK 2 billion over the next eight years. The contribution from the Research Council of Norway is NOK 1 billion. The host institution and its partners contribute NOK 500 million each.

The **Polar Star Innovation Center** in Murmansk offers floorage and offices in a modern infrastructure for Norwegian-Russian economic (trade and industrial) cooperation in the region. Available premises are offered to new tenants through reservations in advance. The Innovation centre's priority is to rent office premises to Norwegian companies and organizations within future-oriented businesses. Innovation centre also offers office premises to Russian companies that have industrial cooperation with Norwegian companies. Innovation centre arranges important common management functions for users of innovation centre. Innovation centre has approximately 100 car parking for its tenants. In 2008 the Innovation centre has established an Incubator for Norwegian and Russian companies and individuals that wish to create future oriented working places through creativity and innovation.

Norway building and construction

A **Nordic guide to workplace design (DEKAR)** provides a guide that focuses on the use of innovative office design as an instrument for creativity and knowledge sharing, and explores the territory between architecture, facilities management, knowledge management, and organizational change.

- ***Multisensors and other new technology for improved indoor environment in buildings***

The importance of indoor air quality (IAQ) in buildings is indisputable. Numerous studies have documented that IAQ significantly impacts occupants' comfort, health and productivity and it is estimated that potential savings and productivity gains from providing users with a "good" IAQ are enormous.

- ***Demand controlled ventilation systems for energy efficiency***

The indoor environment is of fundamental importance to comfort, health, and productivity. However, the technical systems required for ventilation and climatization of buildings use almost 40 per cent of the total energy supplied in Scandinavia. Therefore, research must provide

solutions that simultaneously improve human health, comfort, productivity and energy efficiency. One possibility is enhanced control of air-conditioning and ventilation rates in relation to the actual needs of people.

The **Concrete Innovation Centre (COIN)** is located at the Norwegian University of Science and Technology and has a vision to become the leading European institution in concrete innovation. Advanced materials, efficient construction techniques and new design concepts are developed in combination with more environmentally-friendly material production. The Research Centre Director is Tor Arne Hammer, SINTEF Building and Infrastructure. There are no permanent staff but at any time approximately six researchers and six PhD students working on projects related to the Centre. The centre budget is NOK 210 million, and the funding is from 2007 to 2014. There are a number of formal partners including: NTNU, Norcem, Unicon, maxit, Rescon Mapei, Borregaard, Elkem, Aker Kværner, Veidekke, and the Norwegian Directorate of Public Roads.

Norway's involvement in oil since 1969 has boosted Norwegian concrete research. The knowledge from the construction of oil platforms took concrete from being an ordinary industrial product to an advanced high-tech material. Now, the concrete industry sees innovative opportunities once more.

Over the next eight years, researchers at SINTEF and NTNU will make it possible to create functional concrete buildings with longer life and smarter constructions than anything on the market – in addition, they are more environmentally friendly. The secret lies in the researchers' knowledge about the composition of the material itself and how it affects the final product. Innovative concrete products include: strong lightweight concrete, alternative reinforcement, systems that warn when reinforcing deteriorates, alternative materials (including recycled materials), self-compressing concrete, sandwich elements, multi-functional concrete buildings (heating, cooling, self cleaning), and ornamental surfaces.

2.6.3 Denmark

Policy setting

Key Policy Documents:

- DASTI (2007): Danish Council for Technology and Innovation's Action Plan for more innovation and effective knowledge dissemination Innovation Denmark 2007-2010.
- DASTI (2009): The National Programme for Research Infrastructure.
- Danish Government (2008): Denmark's National Reform Programme 2008;
- The Ministry of Science, Technology and Innovation (2008), 'RESEARCH2015 – A Basis for Prioritisation of strategic Research'.
- Danish Government (2009): a Business-oriented Innovation Strategy;
- DCTI (2008), Strategy for Enforced Innovation in the Public Sector;
- DCTI (2008), Strategy for the International Innovation Activities of the Enterprises;
- DCTI (2008), Innovation Strategy for the Service Industry;
- DCTI (2008), Innovation Denmark 2008.

Decision-making Bodies: Over the past few years, governance bodies, levels of responsibilities, and public sector organisation have been reformed. There is coordination among the different organisations involved in policymaking related to innovation and inter-ministerial committees.

- The Ministry for Science, Technology and Innovation has the main decision-making and coordinating role regarding innovation policy.
- The Ministry for Economic and Business Affairs is concerned with innovation issues in the traditional industrial sector, with the emphasis on supporting entrepreneurship, cluster policies and intellectual property rights (IPR) issues.
- The Danish Council for Research Policy gives advice at the highest government level.

Implementing Bodies: In most cases, the ministries involved in policy formulation also have the responsibility for the implementation.

- The Danish Council for Technology and Innovation, as well as all research councils fall under the responsibility of the Ministry for Science, Technology and Innovation.
- The Danish Enterprise and Construction Authority (DEACA) falls under the Ministry for Economic and Business Affairs.

Multi-level governance:

- There is no formal regional government authority in Denmark (except in the health sector). However, the regional innovation system has gained a much stronger position on the innovation policy agenda, as a consequence of the structural reform in 2006.
- The Danish Enterprise and Construction Authority, DEACA, has the responsibility for a number of regional development initiatives, also in relation to EU Regional Funding. So-called 'regional growth forums' have recently been established (with participation of up to 20 representatives from central stakeholders) responsible for the strategic planning, monitoring and development of initiatives. The growth forums are not themselves implementing units. The initiatives which the growth forums wish to launch must therefore be implemented by others, for example municipalities, independent institutions or other independent legal entities. The regions receive a block grant and the projects are co-financed e.g. by EU structural funds, local enterprises and governments and knowledge institutions.
- At supra-national level, besides the EU, the cooperation between Nordic countries, e.g., the Nordic Council plays a role for innovation and R&D.

Innovation centres

The **Danish Technological Institute** is a self-owned and non-profit institution. It sees that innovation is about developing and translating new ideas into a visible value on the market or for a user group. Innovation creation requires quite an effort in many areas. The focus is on creating and developing ideas through creativity and rethinking. Their point of departure is the users and the employees throughout the entire process. To this end they develop, apply and disseminate research and technologically-based knowledge for the Danish and international business sectors. They participate in development projects which are of use to society in close collaboration with leading research and educational institutions both in Denmark and abroad. In addition, they carry out consultancy and standardisation services, which contribute to a dynamic and harmonious development of society. Finally they strengthen the Danish labour force's competences together with educational institutions and through the Institute's courses, certification and lectures.

Our important task of the Danish Technological Institute is to ensure that new knowledge and technology can quickly be converted into value for customers in the form of new or improved products, materials, processes, methods and organisational structures. It works together with new

and existing companies, either individually or in groups, on ways to enhance technological and management restructuring and efficiency, across a broad range of industries as well as in leading edge sectors. The centre focuses on:

- Innovation and competitiveness
- Training and management
- Sustainable exploitation of resources
- Cost-effectiveness in company and society.
- Offering help to generate a good idea that creates value for others,
- By inspiring you by user-driven innovation by means of identification of new user needs; acknowledged/not acknowledged
- Obtaining even more innovative solutions through tailored innovation processes ranging from idea to the finished product or concept
- Inspiring employee-driven innovation and obtain tools to increase the use of employee innovation potential.

The Danish Technological Institute will throughout the whole strategy period continue to increase its interaction with Denmark's small and medium-sized companies. And the Institute will to an even greater extent contribute to enhancing the conditions for companies' research, development and innovation in a global context. Their ambition is to play a central role in meeting the challenges by:

- Increasing companies' ability to adopt new knowledge
- Increasing companies' productivity on both domestic and international markets
- Increasing companies' exploitation of information and communication technology for the development of intelligent products and services
- Encourage companies to adopt new, efficient and sustainable energy and environmental technologies
- Encourage companies to apply nano- and micro-technology in processes and products.

2.6.4 Finland

Policy setting

Current priorities:

- Broadening the basis of companies involved in R&D
- Further reforms of private research organisations
- Creation of critical masses of research cluster
- Gearing research towards the response to societal challenges
- Encouraging new forms and user-driven innovation
- Promoting entrepreneurship, strengthening internationalization of the system.

Key decision-making bodies:

- The Research and Innovation Council (RIC), formerly the Science and Technology Policy Council of Finland, led by the Prime Minister, plays a key role in policy design for STI and in coordination of the various actors.
- The key ministries concerned with research and innovation policy are the Ministry of Education (MoE) and the Ministry of Employment and the Economy (MEE).

The key implementing bodies:

- Tekes, which falls under the Ministry of Employment and the Economy, is the Finnish Funding Agency for Technology and Innovation.
- The Academy of Finland which falls under the Ministry of Education and Science is responsible for the financing and strategy formulation of the basic research, research training and science policy.
- Other agencies involved in implementation are: Finnvera, Finnish Industry Investment, Finpro, Sitra, Employment and Economic Development Centres (T&E Centres), and the Foundation for Finnish Inventions.

Multi-level governance:

- At international level of governance level the cooperation with other Nordic countries is intense. Recently also the cooperation with Baltic Sea regions has increased. Below national level, regions play a very limited role in terms of governance of innovation policy. Decentralised policy structures include regional offices and innovation clusters.
- Finnvera, a state-owned company, providing risk financing services, has 16 regional offices, and there are 15 T&E Centres across the country.

Tekes – the Finnish Funding Agency for Technology and Innovation is the most important publicly funded expert organisation for financing research, development and innovation in Finland. It supports wide-ranging innovation activities in research communities, industry and service sectors. Tekes promotes a broad-based view on innovation: besides funding technological breakthroughs, Tekes emphasises the significance of service-related, design, business, and social innovations. Tekes works with the top innovative companies and research units in Finland. Every year, Tekes finances some 1,500 business research and development projects, and almost 600 public research projects at universities, research institutes and polytechnics. Research, development and innovation funding is targeted to projects that create in the long-term the greatest benefits for the economy and society. Tekes does not derive any financial profit from its activities, nor claim any intellectual proprietary rights.

Conclusion Scandinavia

Table 5 summarises the findings for Scandinavia. For Scandinavia, the Nordic Innovation Centre is an interesting example of a multi-country innovation centre with an explicit function of promoting innovation generally and in promoting building and construction innovation. It has specific building projects and coordinates EU funding for multi-nation building and construction research. Its approach includes a practical but theoretically informed MMI programme which it developed but now shares across the Scandinavian innovation agencies.

In Sweden, innovation governance is well established with generous support to tertiary education, two ministries, three advisor bodies, and a number of implementing bodies including Vinnova which is charged with promoting growth and prosperity though out Sweden. This reflects the policy of using R&D to promote regional development. There appears to be few innovation centres per sec but for the building and construction sector there is the large and influential BIC. This is a peak organisation which seeks to advance the sector by focusing on innovation which embraces customers, sustainable growth, and profitability. It has a wide variety of functions and conducts numerous innovation research projects.

In Norway, innovation governance includes a focus on regional development, and is carried out by three ministries and three implementing bodies, including Innovation Norway. The latter was

formed as a state-owned company which combined four other national organisations. It promotes industry development by supporting innovation, internationalisation, and promotion. There are many centres for research-based innovation although these are not described in detail in this report. In Denmark, there are many relatively recent policy documents, many of which focus explicitly on innovation. There are two relevant ministries, a council for research policy, and a council for technology and innovation. The main innovation centres is the Danish Technology Institute and there is no readily obvious building and construction innovation centre. In Finland, the recent policy documents do emphasise user driven innovation. There are two ministries, a Research and Innovation Council, and a number of implementing bodies.

Table 5: Summary for Scandinavia

Name and location	Goal	Structure and funding	Conduct or functions
Nordic Innovation Centre Oslo, Norway	Initiates projects that stimulate innovation Disseminate knowledge about innovation Increase competitiveness of Nordic industry	Governed by the Nordic Council of Ministers 120 ongoing projects and networks	Works with industries, authorities and research centres Enhancing innovation work and collaboration across borders Creating new value Measure and managed innovation
Herbert Felix Institute Eslov, Sweden	Highlight the role and importance of immigrants	Grant from the European Regional Development Fund Pilot study	Support entrepreneurship among immigrants Counselling and support for entrepreneurship
BIC Sweden	Develop the construction sector Peak organisation	Association incorporating public authorities, clients, owners, designers, contractors, suppliers and research units Co-operates with Formas and with the Swedish Road Administration on projects which yield innovations	R&D Implementation of new technologies New systems and new services Support innovation
Polar Star Innovation Centre Murmansk	Support future oriented businesses		Rent office premises Arranges important management functions Incubator
DEKA Norway	Guide to design		Integrates architecture, facilities management, and organisational change
COIN Norway	Leading Europe in concrete innovation	Partnerships with private companies State funding	Research on concrete
Danish Technical Institute Taastrup, Århus, Odense, Kolding, Hirtshals, Jyllinge, Roskilde, Göteborg, Stockholm, Upplands Väsby, Karlskrona, Warszawa	Ensure new knowledge and technology are converted into value	Private non-profit institution Approved by the Danish Ministry of Science, Technology and Innovation	Develop, apply and disseminate research and technology-based knowledge for the business sector Consultancy Innovation, training,
Tekes Finland	Funds R&D and innovation	Government funding	Works with top companies and research centres

2.7 Other European innovation centres

2.7.1 Austria

The **Wood Innovation Centre** at Zeltweg, also referred to as HIZ, has the following mission statement: 'A closed, optimised value chain in a small space - target-orientated towards a commonly pursued vision'. The region surrounding HIZ offers perfect conditions for wood businesses. For many centuries, local people have maintained their strong ties to the material wood, which can actually be considered as integral part of the Upper Styrian culture. On the other hand, people have also developed an industrial sense which promotes innovation power and entrepreneurship. This combination of tradition, innovation and vision form a fruitful basis for a well-functioning wood network and wood as raw material holds an enormous potential.

The goal of the HIZ Wood Innovation Centre is to offer wood businesses space for modern production facilities, new fields of application and high-tech research and development activities at a fair price. It supports the establishment of new business with comprehensive cluster management services thus making the HIZ Wood Innovation Centre a professional basis for creating synergies in the wood processing sector. Their goal is to support and promote these synergies so that all can benefit from the enormous future potential of the raw material wood.

The centre also includes the ECW – Engineering Centre Wood. This provides the space and infrastructure for implementing and further developing product innovations. Be it the development of products, facilities, processes or procedures, the construction of prototypes, test configurations or tests regarding the series-production readiness – as a strong link between R&D organisations, the ECW offers the space and know-how necessary for innovation development for companies as well as your customers and partners. The ECW forms part of a network concerning the forestry and timber industries which developed over many years. The advantages at the ECW include state-of-the-art infrastructure, an engineering hall, office and workshop facilities, and technical infrastructure etc. (including ideal transport). It provides a strong network, extensive service package, and affordable innovations.

2.7.2 Slovenia

The Banja Luka Innovation Centre (ICBL) opened recently to serve all those who have entrepreneurial ideas with potential to become profitable businesses. The facility on an area of more than 1,000 square metres of the former Ruda Cavajec Institute was inaugurated by Republika Srpska's PM Milorad Dodik, who said this was the "First innovation centre on this scale". ICBL is the first combined business centre for the development of innovative business solutions, an investment by the government of Slovenia and Norway worth BAM 1.3 million of which the Norwegians contributed 60 per cent.

2.7.3 Estonia

The Technology and Innovation Centre at Tallinn University of Technology is a bridge between the university and enterprise. The aim of the programme is to develop collaborations between entrepreneurs and scientists. The Technology and Innovation Centre is the business and marketing unit of Tallinn University of Technology and the collaboration coordinator with Estonian and foreign partners. The mission of the Technology and Innovation Centre is to create university of enterprising people. The activities of the Technology and Innovation Centre are as follows:

- Provide the flexible solutions in technology development for enterprises
- Find the best solutions to create and develop the technologies
- Collaborate with the technology and competence centres
- Create and develop the spin-offs

- Create high potential high-tech companies and increases their value
- Develop the supporting cooperation network for R&D and innovation
- Find the investors for technological companies.

2.7.4 Slovakia

The Slovak Innovation Centre is an innovative knowledge park shared by universities and regional businesses that will be set up in the Prešov region in Slovakia with support from the EEA Grants, based on a model originally developed by and for the Møre and Romsdal County in Norway. Norway has through the EEA Grants awarded the Prešov Self-Governing Region more than €0.5 million from its €1.6 million project, which will bring together the region's private sector and academic world and allow for commercially interesting research ideas to blossom into full-fledged business ideas. The planned knowledge park will be named the Innovation Partnership Centre (IPC). The IPC will be based on Molde Knowledge Park, the brainchild of Møre and Romsdal County, which was established in 2002 to fill the gap between the academic world and private sector. "A knowledge park can be a regional engine for business development", Molde Knowledge Park Director Frank G. Lien said, adding that connecting the knowledge from research centres with business development and private-sector competence creates a foundation for regional innovation and growth.

2.7.5 Portugal

In 2008, Logica launched the Spark Innovation Centre in Lisbon, Portugal. The centre is the first of many that will be situated around the globe, demonstrating innovative solutions from Logica. The centre in Portugal, focused on energy and utilities, comprises a set of vanguard technology demonstrations for the electricity, water, and gas industries. The solutions combine competences in Advanced Metering Infrastructure and Intelligent Grids, wind-farms management systems, Geographical Information Systems, Asset Management and Metering & Billing solutions (SAP-ISU and UBS, a vertical solution based on Oracle technology). For the event Logica has invited first class local university representatives and more than 20 college professors and selected students from all over country.

The Innovation Centre has been created with three main goals, to:

- Promote Logica's technology and know-how for electricity, water and gas industries.
- Allow local and international clients, partners and universities to experiment with this technology developed in Portugal.
- Integrate in the same physical room a series of showcases which demonstrate integrated Logica's vision and offer for current and future utilities challenges.

2.7.6 France

Technology innovation is claimed to permeate everything done at the Accenture European Technology Park (AETP) in Sophia Antipolis, France. The European Technology Park is the centre of excellence for envisioning, building, designing and delivering Accenture's cutting-edge technology capabilities and solutions. This innovation plays a central role in helping Accenture's clients become high-performance businesses and governments. The technology consultants work in locations throughout Europe. They generally travel extensively and are exposed to a range of clients in multiple industries. In addition to people from Accenture Technology Consulting and Technology Architecture, the European Technology Park has people working for Accenture Technology Labs, the technology research and development (R&D) organisation within Accenture.

Conclusion Other European Countries

Table 6 summarises the findings for the other European countries. These countries, briefly considered, include Austria, Slovenia, Estonia, Slovakia, Portugal and France. Three of these

countries are emerging economies which appear to be following European trends and establishing innovation centres, often with the help of EU funding. The other larger European countries appear not to have many innovation centres although this observation must be very tentative because it is likely that the Google search may not have detected the key words presented in foreign languages. In Austria, there is a wood innovation centre with functions similar to others of that type.

Table 6: Summary for other European countries

Name and location	Goal	Structure and funding	Conduct or functions
Wood Innovation Centre, Austria	Optimised wood innovation value chain	Includes the Engineering Wood Centre	Space for modern production facilities New fields of application High-tech R&D at a fair price Establishment of new business Cluster management services
Banja Luka Innovation Centre (ICBL), Slovenia	Commercialise R&D	Government support from RS and Norway	Provide facility
Technology and Innovation Centre Tallinn, Estonia	Support enterprising university people	Tallinn University	Support collaboration between entrepreneurs and scientists Create spin offs and high tech companies Find investors
Proposed Slovak Innovation Centre & Innovation Partnership Centre Presov region	Regional innovation and growth Commercialise R&D	EEA grants via Norway	Link private sector and academic world Turn interesting research ideas into business ideas
Spark Innovation Centre Lisbon, Portugal	Promote Logica's technology for the electricity, water and gas industries	Logica (a UK-based global IT and management consultancy company specialising in systems integration)	Facilitate local and international clients, partners and universities to experiment with the technologies
Accenture European Technology Park (AETP) Sophia Antipolis (Southwest France)	Help Accenture's clients become high performance businesses and governments	Accenture (a global management consulting, technology services, and outsourcing company)	Technology consultants

2.8 Multi-country organisations and innovation centres

A number of innovation centres are the product of activities involving more than one country. Typically, they derive from one innovation centre moving into another country in order to achieve more effective international connections. Some are more of a think tank in nature, but clearly involved innovation. There is also a European organisation that represents all the Business and Innovation Centres.

The **European Business & Innovation Centre Network (EBN)** was set up in 1984 as a joint initiative of the European Commission, European industry leaders and the first pioneering Business and Innovation Centres. The EBN claims that it is now the leading non-governmental, pan-European network bringing together over 200 Business and Innovation Centres (BICs), and similar organisations such as incubators, innovation and entrepreneurship centres across the enlarged Europe. The network is therefore an umbrella organisation bringing together over 200 BICs from all

around Europe and beyond. It provides help and support to these BICs by acting as an interface with other organisations including the European Commission (which officially recognises EBN), by providing expertise in numerous areas including funding, and by stimulating the sharing of best practices.

The EBN sees benefits in joining deriving from:

- **Recognition:** Fully accredited members are entitled to use the BIC logo, a registered trademark of the European Commission which is recognised as a standard for quality in innovation, incubation and entrepreneurship all over Europe and worldwide.
- **Technical support:** Customised technical support is available to assist new members in reaching the status of full BIC accreditation. Assistance in developing or updating BIC services is available as required by existing members.
- **Quality assessment and benchmarking:** Full BIC members participate in an annual quality survey the results of which allow both EBN and the BICs to benchmark their performance against their peers through the EBN Quality Observatory and benchmarking tools.
- **Representation:** EBN is engaged actively in policy support and EU recognition on behalf of their members. In particular EBN aims to continually position the BICs as a reference point for innovation, incubation and entrepreneurship both at regional level and as part of the European EBN network.
- **Access to a European Network (BIC2BIC networking):** Through the EBN community, BICs have access to a specialized network of like-minded organizations that are focused on innovation, incubation and business development at regional level. Through tools such as the Members' Directory and the EBN calendar of training, information and events, active networking between members is encouraged and reinforced.
- **Access to Thematic & Sectorial Networks (B2B networking):** Following the successful collaboration between EBN and ESA in 2002 resulting in the creation of ESINET a thematic platform for the transfer of knowledge and technologies in the field of space, at the request of members, further sector-specific networks of members were established in 2008 in the sectors of maritime, agro-food and clean technologies. One of the objectives of these networks is to support technological or commercial partnerships between innovative SMEs Europe-wide.
- **EBN also actively supports "theme-specific" networks in themes such as female entrepreneurship, clustering, regeneration, seed-financing etc.**
- **Specialised Training:** A series of technical training seminars is organised for members each year covering topics from BIC fundamentals for new members to developing and exploiting project opportunities for established BICs.
- **Calendar of Events:** The highlight of the annual event calendar is the EBN Annual Congress which usually takes place in June each year. In addition to this event, EBN organises and supports a specific calendar of events in partnership with local members. These events provide opportunities to meet with experts/practitioners in business incubation and innovation, and to exchange best practice and new market opportunities.
- **Project opportunities:** EBN publishes a regular 'Tender Watch' document highlighting all European funding opportunities of particular relevance to BICs. EBN can provide assistance to members in the construction of consortia to respond to these calls or in certain specific cases can lead the development of EU proposals involving several members. EBN also provides a pan-European dissemination platform to promote new best practices identified by BICs within the context of project or other activities.

- **Keep informed:** Through communication tools such as the EBN website, the EBN newsletter and periodic 'Flash News Bulletins', members are kept informed about the latest developments in the BIC network and in the wider EU policy field. Access to benchmarking tools, policy papers and up to date publications is assured through the project website.

Innovation centres can be found in a number of countries. For example, **CSEM UAE** is a joint venture company between the Government of Ras Al Khaimah and the Swiss Research Center CSEM SA. The company has been operating since September 2005. It is located in the industrial area of Al Jazeera Al Hamra near Ras Al Khaimah City. CSEM has a long and successful tradition in the field of applied research in Switzerland. Areas of interest are Systems Engineering, Microelectronics, Photonics, Microrobotics and Nanotechnology. Renowned for the quality of its research, it has established a strong partnership with world leaders in industry. It is also collaborating with top research institutions and universities. CSEM UAE is working on the development of technologies, and projects in renewable energy, solar cooling, and environmental applications (water etc.)

The Innovation Center Denmark (ICDK) is represented in three hot-spots of the global economy: Silicon Valley, Shanghai and Munich. The staff at Innovation Center Denmark, provide advice and consultancy within the fields of research, development, innovation, and higher education. Innovation Center Denmark aims to contribute to strengthening Danish research and innovation by gaining access to foreign knowledge, technology, networks, capital and markets as well as providing Danish researchers and enterprises with advisory services regarding internationalization of their research and innovation activities. Furthermore, Innovation Center Denmark aims to link Danish universities, knowledge environments, researchers, etc. with leading foreign cooperation partners for the purpose of enhancing the quality of Danish research and innovation. Innovation Center Denmark seeks, moreover, to import knowledge to Denmark by attracting knowledge-intensive investments from foreign enterprises. It also aims to improve the knowledge of Denmark as a knowledge-based society by marketing Danish research and innovation. By functioning as a "show case" for Danish research institutions and enterprises, Innovation Center Denmark is spearheading the promotion of Danish research and business core competences through targeted efforts within Life Science, ICT and Clean Technology. Finally, Innovation Center Denmark also houses **Invest in Denmark**. The overall political goal of Invest in Denmark is to maintain and attract foreign direct investments to Denmark, thereby strengthening the globalization of Danish business and increasing the level of competence and knowledge. Apart from attracting investments to Denmark, the agency is a relevant and highly evident source of information to foreign companies and institutions eager to know about the advantages of doing business in Denmark and collaborating with Danish companies and organizations.

The **Innovation Center Denmark** is located in **Silicon Valley** and helps facilitate access to Silicon Valley. Their expertise in working with start ups, innovative businesses, and extensive local network is combined with services to meet the needs of interested companies. ICDK's Business Innovation Services are for new start ups looking for initial feedback and inspiration; start ups or companies looking to enter the US market or raise capital in Silicon Valley, established companies scouting for technologies or inspiration for innovation, or organizations and companies seeking to arrange innovation inspiration trips for members, clients etc. Their focus is on Information and Communication Technology, Clean Tech and Life Sciences. Innovation Center Denmark offers a number of services designed specifically to meet the needs of high growth knowledge companies at various stages of their life cycle. Their business model is to facilitate market access through networks and to provide an Advisory Board, which includes local partners and a network of seasoned, successful individuals with a soft spot for Denmark.

The **Innovation Center Denmark** located in **Shanghai** is a joint initiative between the Trade Council of Denmark in the Ministry of Foreign Affairs (MFA) and the Danish Agency for Science, Technology and Innovation (DASTI) in the Ministry of Science, Technology and Innovation (MSTI). The establishment of the innovation centres in strategically selected regions makes it possible to take advantage of the MSTI's knowledge of leading clusters of research and innovation and the MFA's global network of missions in key markets for the benefit of Danish research, innovation and business environments. Building on two institutional pillars (MFA & MSTI), ICDK caters to innovation needs for Danish companies and universities, as well as Chinese companies and future counterparts. ICDK uses a highly qualified staff and market specific knowledge primarily within the areas of Life Science, Information Communication Technology (ICT) and Clean Technology to provide value creating consultancy services for their clients.

Innovation Center Denmark located in **Munich** ensures that Denmark recognizes the importance of international co-operation in the field of science and technology for economic and social development, and is able to take advantage of the opportunities provided by globalization. The Innovation Center works to strengthen the innovation, knowledge and competitiveness of Denmark by facilitating and creating networks and partnerships for Danish knowledge institutions and companies with leading German, Swiss and Austrian research and innovation environments.

The **Romanian-Norwegian Maritime Project (RONOMAR)** is a project funded under the Norwegian Cooperation Program for Economic Growth and Sustainable Development in Romania. One of the main goals of the project is to establish a sustainable and locally managed Innovation Centre in Constanta, in order to create new businesses and jobs in the maritime sector. Although focusing on the maritime industry, RONOMAR Innovation Centre is looking at all maritime related and supportive sectors. The centre will also offer support to any innovative, knowledge based idea, with high economical and social potential, even not directly related to the maritime sector. Logistics, marine sector, environmental technologies, renewable energies would also be areas of interest.

Another goal of RONOMAR Innovation Centre is to become a contact point and play a hub function for the maritime sectors in Romania and Norway.

For achieving these goals, the Innovation Centre will:

- Mobilize cooperation between authorities, academia (education and research), commercial businesses and international networks;
- Act as a qualified and reliable partner for development of entrepreneurs and new businesses;
- Promote commercialization of research and development.

The Innovation Centre will provide these services:

- Centrally located business premises
- Administrative and technical services
- Access to international partners
- Access to financing
- Business development services
- Development of business plans
- Managerial and entrepreneurial training
- Monitoring/ coaching
- Marketing/ networking.

In achieving its goals, RONOMAR Innovation Centre will benefit from the extensive Norwegian expertise in stimulating and supporting innovation and entrepreneurship, through know-how transfer from the Norwegian partners Ålesund Kunnskapsark AS (AAKP) and SIVATECH. RONOMAR Innovation Centre will also try and get advantage from the European and national policies aimed at stimulating innovation and entrepreneurship through dedicated programs and institutions.

FinNode USA is Finland's liaison to innovators and trend-setters in America. They are fellow facilitators who seek to cross-pollinate ideas and networks between the two countries. FinNode works with America's leading thinkers to share ideas and stimulate economic well-being for all. They claim to be the gateway to the Finnish innovation ecosystem.

The Finnish–Russian Innovation Centre is located in St. Petersburg. It seeks to develop Innovative Way to Russian Market. It includes the FinNode Russia Group -Lappeenranta Group –Technopolis. Their roles include invest in services, recruiting, education and R&D, projects and lobbying, innovation promotion, and innovation commercialization.

The German Innovation Centre (GIC) invites clients to a place in the major world markets. Operating out of the rapidly growing city of Dubai, GIC allows you to not only the placement of your company, your products and services in the heart of the booming Gulf region but also in other comparable markets in the world. The German Innovation Centre has made promoting the brand 'Made in Germany' written on its flag. With its international management and the good and long experience is the GIC to connect your ideal partner who is able to view your product and service philosophy with intercultural differences and to mediate the work with you to select strategies to your future customers and partners.

In a similar fashion but focused on the arts, the Malaysia Design Innovation Centre (MDI) links directly with German industry to accelerate innovation and marketing efforts by both countries. The plan is to build on Germany's reputation to add to strength to Malaysia's creativity and innovation in the region. Organised jointly by Limkokwing University College of Creative Technology, Goethe-Institute, and the Institute of Foreign Relations (IFA), the exhibition features 82 framed works by the artist between the period 1965-1992. Tan Sri Lim and the Ambassador also discussed the possibility of setting up the Malaysian-German Innovation Council in Cyberjaya, which would play a vital role of bringing together innovation between the two countries.

Finally, there are think tank organisations which can be seen as innovation centres. For example, Global Innovation Network (GIN) is a low profile business think tank that, since 1997, has been helping high profile organisations to think about the future. Based in London and Sydney, it specialises in providing new approaches to strategic planning and innovation. They claim that they explore and invent the future, create new horizons by providing access to a unique network of 'innocent experts' - provocative thinkers from a wide range of disciplines including business, academia, government, media, law, finance, science, technology and design. Their view is that some ideas sometimes grow better when transplanted into another brain and that fresh thinking often comes from.

GIN's approach is intensely practical and based on the use of four rigorous thinking tools. First, they use a process called farsight to scan the environment for weak signals and other indicators of change. These can be anything from new products and technologies to new customer attitudes and behaviour. Next, they conduct observational research to explore how ordinary people interact with products or organisations (the most interesting attitudes and actions are often subconscious, or people do not volunteer such information in traditional research groups because they do not think it

is important). This research is conducted by obsessively curious psychologists and anthropologists and is usually recorded. Third, they have conversations with people to debate what's happening at the cutting edge of industries and markets (zeitgeist groups). This knowledge is used to explore new growth opportunities or to ensure that organisations do not become the victims of change. Finally, they run workshops and retreats (in some extraordinary places) with members of the network (the 'brains') to amplify some of these insights and generate fresh thinking. These tools can be used individually or in combination and can be applied to anything from product development to scenario planning. They also complement well alongside the processes used by large consulting firms.

Conclusion multi-country innovation centres

The section on multi-country organisations and innovation centres is included to illustrate the international connections developed by some innovation centres. In Europe, there is a network which facilitates innovation centre activity at a European-wide level. Beyond that, there are innovation centres based on one country but operating in a number of other countries. Denmark does this very effectively in order to promote connections to foreign knowledge, technology, networks, capital and markets. This promotes Danish innovation both at home and abroad. Finland and Germany also are engaged in multi-country innovation centres. There are also think tanks which engage in innovation.

2.9 Social innovation

Among the innovation centres found are some with a focus specifically on social innovation.

The Centre for Social Innovation (ZSI) in Austria is an independent scientific institution, asserting leadership in Europe to advance social innovation and to foster an open and solidly united society. Their mission is to bridge knowledge generation and knowledge application processes by socio-scientific research, education, advisory and networking services to reduce the gap between social needs and potentials of the knowledge-based information society. They see co-operation as a social process. The Centre for Social Innovation is a multifunctional socio-scientific research institute, providing an interface across scientific disciplines and sectors, aspiring highest quality of the nexus between research and utilisation of knowledge. Thus many ZSI-projects reveal features of trans-disciplinarity.

The Centre for Social Innovation is a registered charitable organisation working for the public good. As a non-profit organisation, the ZSI depends on revenues from its current business and on subsidies granted for its scientific work in order to finance its activities and necessary infrastructure. Diversification of services, a broad spectrum of expertise as well as membership in national and international consortia, associations and co-operation agreements safeguard the independence of the institute and its level of employment. For many years the ZSI has been financially supported by the Austrian Ministry of Science and Research.

Social innovation is based on proposals on how to meet social challenges. To become innovative, an idea which addresses existing or newly emerging social issues must not only be new but it should meet the expectations of stakeholders involved. Their needs are to be dealt with in a more appropriate way than by other existing services, products, or procedures. If in such a process a social idea evolves into a social innovation, it first of all helps to improve remedy challenges in the society which may be new, did not yet receive adequate treatment, or perhaps not even any response. Beyond dealing with a concrete social issue, social innovations in general contribute to adaptations and further development of many forms of governance.

Started in 2000, the Stamford Graduate School of business has a Centre for Social Innovation. Its mission is to break down boundaries and promote the mutual exchange of ideas and values across

sectors and disciplines and between theory and practice. The centre provides a bridge between academia and practice. Their purpose is to build and strengthen the capacity of individuals and organizations to develop innovative solutions to social problems. Social innovations include a novel solution to a social problem that is more effective, efficient, sustainable, or just than present solutions and for which the value created accrues primarily to society as a whole rather than to private individuals. Social Innovation focuses attention on the ideas and solutions that create social value—as well as the processes through which they are generated, not just the individuals and organizations.

Their vision is a networked community of leaders actively building a more just, sustainable, and prosperous world. The centre raises awareness about the principles, methods, and potential impact of social innovations. By bringing new knowledge to bear on social issues, they contribute innovative ways of achieving impact. Through an education programs they build the skills, both conceptual and practical, that enable individuals to successfully move social innovations forward. The centre offers programs for MBA students, alumni, faculty, and field practitioners. It provides academic research and ongoing evaluation which are essential to understanding what works and what does not in this new era of social innovation. There are case studies, the Stanford Social Innovation Review, a quarterly magazine presenting the best in research and practice-based knowledge, social innovation conversations, and a podcast channel bringing the voices of the people at the forefront of creating social change in the world.

The centre brings together the best people, organisations, and ideas from the worlds of nonprofits, business, and government. Their participants: lead corporate efforts to improve ethical and sustainable practices, manage nonprofits through strategic growth, launch social enterprises that bring life-changing solutions such as loans to small businesses, and provide safe lighting to the world's poorest places.

Recent examples of social innovation include:

- Charter Schools: publicly funded primary or secondary schools that operate free from some of the regulations that typically apply to public schools. Administrators, teachers, and parents thus have the opportunity to develop innovative teaching methods.
- Emissions Trading: a pollution control program that uses economic incentives to reduce emissions. A cap is set on the total amount of a certain pollutant that can be emitted, and permits to pollute are issued to all participating businesses. Those with higher emissions can buy credits from businesses that have reduced their emissions. Over time the cap is reduced.
- Fair Trade: an organized movement that establishes high trade standards for coffee, chocolate, sugar, and other products. By certifying traders who pay producers a living wage and meet other social and environmental standards, the Fair Trade movement improves farmers' lives and promotes environmental sustainability.

The **Centre for Social Innovation** is a dynamic space in downtown Toronto, Canada. Their mission is to spark and support new ideas that are tackling contemporary social, environmental, economic and cultural challenges. The Centre for Social Innovation is a social enterprise with a mission to catalyze social innovation in its home base of Toronto and around the globe. New innovations are seen as the key to turning these challenges into opportunities to improve communities and the planet. Their simple working definition of social innovation refers to new ideas that resolve existing social, cultural, economic and environmental challenges for the benefit of people and the planet. A true social innovation is systems-changing – it permanently alters the perceptions, behaviours and structures that previously gave rise to these challenges. Further, a social innovation is an idea that works for the public good.

Social innovations come from individuals, groups or organizations, and can take place in the for-profit, non-profit and public sectors. Increasingly, they are happening in the spaces between these three sectors as differing approaches collide to spark new ways of thinking about the challenges everyone faces. The Centre for Social Innovation operates in the spaces between sectors and among individuals, projects and organizations. It creates new spaces to foster social innovation by bringing together a mix of people, services, strategies and ideas.

The Centre personnel believe that the marketplace has tremendous potential for positive social impact. They also believe that the traditional divide between the non-profit and for-profit sectors hinders innovation. When this divide is dissolved there are opportunities for projects and organizations that blend the best of both worlds.

Social Enterprise Ontario (SEO) is a burgeoning network to connect social entrepreneurs, social enterprise staff, business leaders and social enterprise advocates and enthusiasts. The idea is to share and learn from each other and improve the likelihood of success; stay abreast of what is happening in the social enterprise space in Ontario; and, work to ensure and create an enabling environment for social enterprise in Ontario.

Green Enterprise Ontario brings social purpose and green businesses together to promote a sustainable and healthy local economy. GEO leverages the extraordinary power of the marketplace and begins harnessing that energy toward the benefit of people and planet. Enterprising Non-profits

Conclusion social innovation centres

Social innovation centres are not numerous. Only one was found in Europe and four were found in North America. In general, these social innovation centres emphasise the importance of including social issues and their resolution in the process of achieving innovation targets, often with an environment theme. These social innovation centres serve to remind us that innovation for whatever purpose – most emphasise commercialisation of R&D – includes a social component which should be part of the innovation process.

2.10 Chapter conclusion

This chapter has given an account of innovation centres around the world. The emphasis has been on European innovation centres and attention has been given to both innovation centres in general, including social innovation centres, and to building innovation centres. The concluding chapter draws together the implications of the findings by giving attention to the structure and functions of innovation centres and considering these from a New Zealand perspective.

Chapter 3:

Conclusion – Implications for New Zealand

3.1 Introduction

The research question motivating the research presented in this report asks if the level of innovation in the building and construction sector can be improved. Therefore, the objectives of this research were to (1) report on the role of innovation centres in the building and construction sectors in different countries, (2) describe their structure and function (3) compare the governance of building and construction innovation in New Zealand to what is happening overseas. The review did not find many dedicated building innovation centres, and therefore reported innovation centres generally in order to gain a general understanding of their structures and functions and their implications for building innovation centres.

The review now provides a basis to learn from innovation centres generally and consider the implications of this learning for New Zealand, and to learn from building innovation centres and consider the implications of these for the building and construction sector in New Zealand. In doing this, the conclusion compares the functions of leading building innovation centres with the functions provided by BRANZ, in effect a gap analysis.

3.2 Implications for innovation centres generally

The foregoing review shows that innovation centres have the following core functions:

- **Commercialise R&D**
- **Help inventors** commercialise
- **Promote** invention and innovation generally by way of policy and by awareness, general promotion with competitions and festivals, or by combining functions of a number of other national organisations (such as Tourist Board and the Trade Council) under one innovation organisation
- Conduct **research** on innovation
- Provide funding which supports innovation (e.g., Tekes in Finland).

The last item, provision of funding, is perhaps somewhat idiosyncratic and reflects funding arrangements in some countries. It is possible for funding for research relating to innovation to come from funding agencies other than the innovation centre. With this proviso, we are left with four main functions of innovation centres: commercialise R&D, help inventors, promote innovation, and do research on innovation.

Some countries manage to provide all of these four main functions in the organisations it has. For example, Australia has a good mix of innovation centres which in total provide these functions. In New Zealand, there are many innovation centres focussed on commercialisation of R&D but these appear to lack provision of assistance to inventors, do not have a primary role of promoting innovation generally, nor of doing research on innovation per se. Each of these issues is considered in turn.

3.2.1 Help for inventors

Help for inventors is not specifically provided by any New Zealand government department or agency. It may be the case that what is provided for business development generally by various agencies is accessed by inventors but this is likely to be more by accident rather than design. The recently-formed Innovation New Zealand, funded by TEC, may appear to be relevant to inventors but it targets its services to existing businesses, not inventors with potential to establish a business. The same is true of the ICEHOUSE which describes itself as a business growth centre that works with a range of SMEs and has a vision to turn entrepreneurial companies into international successes.

It is likely that an inventor seeking some assistance with the invention process would try to find an internet source. Overseas providers of such services make this assumption and information about assistance to inventors is usually provided by their websites. The following exercise compares accessibility of help for inventors in New Zealand and Australia. An internet search using Google and the keywords 'invention help New Zealand' (first two pages only) led to:

1. The Inventors Trust, a private organisation which sponsors discussion forums, advice, evaluations and mentoring to support inventors in the early stages of the development of their projects.
2. A private company pdf on protecting your invention
3. 'Kiwi Ingenuity' which was founded by John Poppleton to promote inventors and inventions in New Zealand. It aims to provide a service whereby they find the right knowledge, connect inventors with inventors for brainstorming, problem solving and encouragement and connect inventors to professionals that have the capacity to prototype and manufacture the product
4. The intellectual property office of New Zealand.

In Australia, the same search using 'invention help Australia' led to:

1. InventHelp®, an American company with offices in Melbourne, Sydney, and Brisbane.
2. Inventors HQ Australia Pty Ltd which helps turn a bright idea into a new product and then into a new start-up business. They offer solutions for inventors and investors at any stage of the commercialisation process.
3. INNOVIC, see earlier, a state-funded, inventor-oriented agency in Victoria
4. Industry Development Centre (Hunter) Ltd (IDC) and The National Invention Centre (NIC), a subsidiary of the IDC, see earlier, a state-funded inventor-oriented agency
5. Great Ideas free invention development advice
6. A link to the patent office
7. Inventors Assistance Australia, an organization in Perth, Western Australia focused on helping Inventors from original idea through to full commercial success. They claim to have the experience, know-how and contacts – working with associations and innovation centers – plus investors, manufacturers, and service providers to help you get your product to market quicker, with greater financial returns.

The Australian results include both private and government organisations offering to assist inventors. The New Zealand sites include only private sources of help.

These rudimentary results show that while commercialisation of R&D is a high priority in New Zealand, with many innovation centres set up to achieve this, this policy is only responding to the

potential for commercialising from formal research organisations such as universities and CRIs. It is not taking up the opportunity of supporting inventors.

3.2.2 Promotion of innovation

New Zealand innovation is promoted but mainly through those innovation centres which have as their main focus the commercialisation of R&D. Pursuing this goal clearly involves promotion. But there are more general promotion functions that overseas innovation centres illustrate. For example, innovation centres can have as their main goal the promotion of innovation, with a mission to generate greater awareness of the role, importance, and character of innovation. In doing this, such innovation centres can have an influence on culture, that is, the general views held about innovation, and in having such an influence can be a force for change. A dedicated innovation centre in New Zealand would have a website promoting innovation and related activities. In large part its audience would be the general public as well as inventors. In seeking to have an influence beyond just inventors, such innovation promotion would help to inform and influence New Zealand's innovation culture. Thus, it could advance the idea of not just the importance of innovation for the country's future but how it could be encouraged. In addition, it could promote innovation by way of competitions. To date in New Zealand such competitions have been part of other activities (e.g., the National Field Days) or organisations (e.g., Registered Master Builders Federation House of the Year building awards).

In addition to general promotion, a New Zealand innovation centre could help inventors directly, as discussed in the section above. In Canada, the Canadian Innovation Center (CIC) at the University of Waterloo helps inventors get their ideas to market. It includes webinars - seminars designed to impart relevant information. The Australian examples referred to above all make a strong pitch to inventors.

Our research on technology users' innovation (TUI) shows that most inventors feel their isolation and that they need greater recognition. For example, many have difficulty communicating with people in their networks, some of whom are not technically literate. General promotion of innovation may help in this regard by valorising what inventors do and giving them more credibility and acceptability in their innovation networks. Further, our research suggests that there needs to be some cultural changes to encourage not just invention per se but the careful nurturing of the social network in which the inventor operates, giving particular recognition to bonding, bridging, and organisational capital. In the longer term, general promotion of the quantity and the quality of invention would contribute to increased recognition and trust of TUIs. Our research also shows that successful inventors are the ones who manage well the networks of finance, government policies, manufacturing activities, business links, and IP. The New Zealand innovation centre website would need to encourage them to manage these networks well.

A weakness in the 'importance of websites argument' made above is the assumption that inventors who are motivated to seek help will do so from this source. It may be the case that they do not want to get help and, if so, then no amount of website provision will address this need. Two considerations are relevant here. First, our TUI research of successful and unsuccessful cases (a total of 43) of commercialisation of inventions shows that over one half of the inventors have their own website or otherwise indicate that they are internet savvy. Second, for those inventors not inclined to the internet, the outcome of innovation promotion would be greater awareness of the New Zealand innovation centre website and this may encourage them to seek assistance. Providing good services to inventors would be the best advertising in this regard, for inventors themselves are well connected and would play an important role in further promoting the website particularly if it provided relevant and useful advice. In any event, the challenge is to present the website in ways that appeal to inventors and is maximally useful to them.

3.2.3 Research on innovation

There has been research on innovation in New Zealand but to date it has not been located in a specific innovation centre. It has been done by a wide range of organisations, including universities or CRIs, and by private organisations or individuals. In principle, there are no major shortcomings with this approach and the research that has been produced, and these diverse sources may reflect what is realistic in New Zealand. However, the nature and process of innovation in New Zealand is not fully understood, and therefore worthy of continued study, and this could be part of the functions of a dedicated innovation centre.

3.3 Implication for building and construction innovation – a gap analysis to identify lessons from overseas building innovation centres

The review provides a basis to learn from leading examples of building innovation centres. Outstanding examples of innovation-related activities in building innovation centres include the following:

- From the UK we can see that building innovation centres can provide an innovation park or demonstration park to show leading house designs. In some cases, the more general innovation centres do this by building or renovating their premises in a cutting-edge design or provision of facilities. The just-started BRANZ campus refurbishment illustrates this approach
- From the UK we can see that a building innovation centres can provide sector strategy based on innovation research, demonstration projects, and providing KPIs and benchmarks
- From Sweden we can learn much from their BIC. This appears to be a model to follow and demonstrates the following key functions:
 1. Explicit focus on innovation but including end users, researchers, and stakeholders with an emphasis on cooperation.
 2. New technologies, new systems, and new services throughout the building network or system.
 3. Broad and inclusive membership
 4. Aims to ensure incentives exist to promote change.
 5. Comprehensive approach, including: applied research, development and implementation of pilot projects, information, demonstration, education, standardisation, guidance documents and recommendations.

The foregoing review also allows us to collate the range of functions that building innovation centres perform. These functions include, with examples:

- **Coordinating sector goals:** sustainability of the building sector; enhance the built environment
- **Enhanced sector functions:** increase profitability, improve safety, increase innovation
- **Research:** agenda for research, cooperate with government research agencies, innovation research, create research centres
- **Networks:** international links, manage interplay between government business and research community
- **Technical development:** building materials, promotion of materials e.g., wood, wood innovations, testing and appraisal

- **Promotion of design:** (only found in Norway and Tasmania)
- **Innovation management** e.g., the Nordic Innovation Centre theory and models of Measuring and Managing Innovation
- **Demonstration:** new designs, materials, houses, construction
- **Sector strategy:** think tank, KPIs and benchmarking, promoting change, awards and competitions.

The first five functions in this list include those already provided by BRANZ and DBH in New Zealand. The last four functions appear not to be regarded as important features in the building and construction sector at present as evidenced by the lack of direct mention or emphasis given to these topics in the available information.

Design is not featured strongly in building innovation centres but would seem to be a vital component. It may be more significant in the Scandinavian innovation centres than it appears because other components of their culture mean that this component is a given rather than needing specific mention.

Innovation management refers to the theory and method used to promote innovation. The Nordic Innovation Centre has a process to measure and manage innovation, thus making it clear what they are trying to do and how to achieve their goals. The important implication here is that any organisation representing building and construction innovation needs to explicitly articulate a theory and method of innovation. Similarly, the Swedish BIC has a clearly articulated vision of innovation, see below.

Demonstration is something BRANZ does, via part ownership in entities such as Beacon Pathway (designers and builders of the NOW Home[®]) but New Zealand does not have a large and comprehensive venue where innovation designs can be showcased. Large-scale building companies have show homes but these tend not to be at the leading edge of innovation.

Involvement in sector strategy is something falling under the BRANZ umbrella, most notably by its support of pan-industry entities such as the Construction Industry Council and more recently the Construction Strategy Group. However it does not have a think tank and does not itself develop and promote KPIs. BRANZ did fund an attempt to establish KPIs for the New Zealand Industry via a university project, but this was unsuccessful and probably ahead of its time. It is likely that the current push across the industry for greater productivity will result in the revisiting of industry KPIs within a wider framework, where they will be seen as valuable inputs to broader activities. In New Zealand, building awards are the province of competitions that are run by The Registered Master Builders Federation. For example, they have a House of the Year competition, also supported by leading retailers. The New Zealand Institute of Architects also run a design awards competition.

BRANZ already performs many of the functions listed above but does not have such a strong emphasis on the last four, and does not explicitly promote the functions of innovation and change. Thus, this review of building innovation centres provides some grounds for concluding that while BRANZ is concerned with innovation and change, these functions are not to the fore. If there is evidence that the building and construction sector is in need of greater change and adaptation to the emerging needs of New Zealand society then a case can be made that the innovation and change functions could be enhanced by following the examples of where this is already happening. This conclusion points to a new organisation along the lines of a dedicated New Zealand building innovation centre, or NZBIC, which would continue with the current building and construction sector

roles but reposition innovation and change as a primary goal and achieve this by taking on some additional roles, such as:

- Promotion of design
- Establishing a demonstration park
- Leadership of sector strategy
- Promote the use of new technologies, new systems, and new services throughout the building network or system by using proven innovation management (theory and method).

In addition, NZBIC could also take on an important role in IP management and education as well illustrated by some of the North American innovation centres. This is needed to assist builder inventors negotiate the multiple pathways through the IP issues and to develop a strategy best suited to their circumstances.

Following the example of the Swedish BIC, NZBIC should be a peak organisation which includes all building and construction stakeholders, relevant research centres and government representatives. However, the situation in New Zealand is fluid at present with a number of organisations such as the Construction Industry Council and the Construction Strategy Group, contending, to some degree, for this role.

Perhaps NZBIC should be linked to Australia? The Scandinavian examples of the Nordic Innovation Centre and even the Swedish BIC clearly demonstrate the degree to which inter-country cooperation is achieved to help achieve their goals. It is likely that they cooperate to better achieve their international aspirations. Further, some innovation centres actively pursue international roles by setting up innovation centres in one or more countries with a view to stimulating innovation both at home and abroad. These examples raise the question as to whether Australia and New Zealand should also cooperate to better improve their position within the world. Such a move would parallel recent developments in the sharing of systems and processes between the two countries.

3.4 Broader support for a New Zealand innovation centre

The case for an NZBIC is supported by earlier research (Fairweather, 2009) which asked the question: why do builders innovate? In answering this question the report concluded that policy needs to recognise that the home building system is dynamic and open to influence, and policy should be comprehensive and synergistically target each part of the system, and work to link the different parts. This conclusion built on the idea that there are two main strands to the literature on home building innovation: one focusing on the individual and one focusing on the supra-individual context or social structures. The former is relevant to smaller and discrete technologies and has been superseded by the latter which better recognises the complexities of home builder innovation. In this view, building decision makers are in a social network that includes many different agents, each with particular motivations and predispositions that directly influence innovation. Therefore, the system has to be managed to achieve innovation rather than leaving it to individual builders. Accordingly, such a systems view of builder innovation points to a key role for a BIC to nurture, guide and lead building sector innovation.

Beyond the immediate implications for the role of NZBIC in leading building and construction sector innovation, there is the broader function of promoting cultural change, in parallel to the points made earlier for general innovation centres. It is not enough to believe that New Zealand culture features inventiveness. There is a need to work on its form to make it more successful. Our TUI research is showing that New Zealand culture can inhibit innovation. Specifically, in modelling cultural, national, and innovation identities, Rinne and Fairweather (2010) offer an explanation for

New Zealand's low innovation performance. They argue that while inventiveness is an important cultural trait, this does not feature in current notions of national identity. Further, the make-do attitude, the Tall Poppy Syndrome, and an emphasis on lifestyle, all work to take an emphasis off turning inventions into commercial innovation. This is similar to results reported by Smale (2008) who found a 'make and use' mentality rather than a 'make and sell' mentality. Therefore, an NZBIC can contribute to changing cultural values, encouraging the commercialisation of building sector inventors at the same time as this fosters more general change in cultural values. There is also a role for a New Zealand innovation centre in this regard.

Other TUI research suggests ways in which general cultural values, other than those directly related to innovation, could change. There are two relevant areas, one to do with personality factors, and one to do with cultural values and innovation. The former has found that for cross-national data there are linkages between personality factors and national levels of innovation (Steel et al. 2010). Countries with higher scores on openness to experience have higher innovation levels. Thus countries could do well to encourage people to embrace novel thinking in order to foster innovation and help the economy grow. The latter research on personality factors research on personality far has found strong negative relationship between power distance and national scores on innovation (Rinne et al., 2010). These findings mean that nations in which people believe they are able to approach, make suggestions to, or debate with someone in a higher-status position have better levels of innovation. Further, since power distance was related to measures of creativity, nations which support an environment amenable to the production and diffusion of new ideas are more able to innovate. These results could guide how NZBIC promotes innovation. For example, they suggest how a NZBIC might provide innovation leadership. The policies to support innovation should evince an egalitarian tone, that is, encourage innovation among all people and be based on the expectation that the sources of innovation are broad. This means that policies which encourage openness and creativity generally may assist building sector innovation. Support for such broadly-focused policies can be found in Kay's (2010) book entitled *Obliquity* in which he argues that in complex systems goals can be more effectively obtained indirectly.

References

- Fairweather, J. (2009), Why do builders innovate? A review of the international literature on home-builder innovation. Report to BRANZ, Wellington.
- Kay, J. (2010), *Obliquity: Why our goals are best achieved indirectly*. Profile Books, London.
- Rinne, T. and Fairweather, J. (under review), Modelling cultural, national and innovation identities in order to understand New Zealand's modest innovation performance. Sites.
- Rinne, T., Fairweather, J. and Steel, G. (under review), Hofstede's Cultural Value Dimensions and Innovation – What Role for Creativity? Cross-Cultural Research.
- Smale, T. (2008), The influence of national culture on New Zealand innovation outcomes. PhD thesis, Henley Management College, Reading, UK.
- Steel, G., Rinne, T. and Fairweather, J. (revised and resubmitted), Personality, nations, and innovation: Relationships between the Big Five personality traits and national innovation scores. Cross-Cultural Research.