A Research Centre of Excellence

Workshop
Held in Christchurch
Monday 29th September 2014

Workshop Report
Prepared by

Dr Ian Town
Principal Advisor
Christchurch Central Development Unit

Disclaimer

This report has been prepared on a best endeavours basis by
Dr Ian Town, Principal Advisor to the Christchurch Central Development Unit
The report does not represent Government Policy and is not binding on any participants or their employers.

Acknowledgements

CCDU for meeting the costs of the Workshop
Francesca Bradley for her excellent support during the planning and delivery of the programme
Rydges Hotel, Christchurch for their professional organisation
All the speakers
Professor Sir Peter Gluckman for his support and work as moderator
Sarah Petersen for assisting in compiling the report

Contents

Executive Summary

The Health Precinct is one of the key Anchor Projects being developed by the Crown as part of the rebuild of the Christchurch Central Recovery Plan in Christchurch (http://ccdu.govt.nz/projects-and-precincts/health-precinct).

The Workshop, hosted by the Christchurch Central Development Unit (CCDU), was held in Christchurch on Monday 29th September 2014 and attended by 40 participants from around New Zealand representing the major players in research, industry and the health system (Refer **Attachment A** for the workshop programme and list of attendees and **Attachment B** for the background reading for the workshop).

Presentations were delivered covering the Centre of Research Excellence in Medical Technologies, The Consortium for Medical Device Technologies, The Medical Technology Association of New Zealand, Researchers involved in the new MARS Scanner, a key medical device manufacturer (Enztec), and a Design Thinking coach.

In the afternoon a series of small group sessions covered the future options for the proposed Centre, national and international links, specialisations and the steps needed to attract a major multinational company to the Precinct.

Findings

1. There is substantial basic and applied research activity in the Medical Technology and related areas in New Zealand and significant contestable resources have been secured for applied research in Canterbury.

2. The MARS CT Scanning project has attracted over $12M of new funding to the region and provides an excellent case study.

3. There are excellent existing collaborations between health and engineering researchers in Medical Technologies which would provide a strong platform for growth.

4. The Canterbury District Health Board has a strong track record of innovation and has a successful Design Laboratory.

5. There are a number of established medical device and technology companies in Christchurch, some of which have international reach and revenues in excess of $10M PA.

6. The newly established MedTech and Neurosciences Centres of Research Excellence both involve collaborations between Otago, Christchurch and Auckland based researchers.

7. The National Science Challenges provide additional opportunities for strategic investment.

8. The Consortium for Medical Device Technologies provides a business facing vehicle for researchers to engage with Industry.

9. The Medical Technology Association of New Zealand represents the key players in the MedTech space and will be able to support the proposed Centre.

10. It will be critical to engage with relevant Multinational Corporations with the goal of having one or more establish an R & D programme in Christchurch.

11. Design thinking and human factors should be considered as a key element of the strategy.

Recommendations

1. That the Feasibility Study report is informed by the workshop findings.

2. That further work be undertaken to develop a comprehensive proposal for GE Healthcare, who will be visiting New Zealand in November 2014 (MOU with University of Otago is in place and one with CDHB in prospect).

3. That Health IT (including e-health and m-health) be considered as an additional theme for the Centre of Excellence (to be led by the Canterbury Development Corporation).

4. That a wider discussion with the musculoskeletal/orthopaedic clinical and research community takes place to further explore the opportunities.

5. That consideration be given to the type of facilities (space and equipment) required for the proposed centre and the soft infrastructure required.

6. That consideration be given to identifying a strong leadership figure to help share the Centre.

Further Work and Next Steps

1. Follow up discussions with Dr Catherine Mohr on 20th October 2014 (refer page 19 of this report for a summary of this discussion).

2. Finalise the Feasibility Study for the Minister for Canterbury Earthquake Recovery taking into account possible Crown investment opportunities. To be completed by November 30th 2014.

3. That the Canterbury Development Corporation develop a scoping paper on e/mhealth for discussion at a workshop in November.

4. A presentation and discussions with the Health IT Cluster on 29th October 2014 in order to gauge their interest in the Health Precinct.

5. Visit by Ian Town and Ingrid van Elst (MBIE) to A-STAR in Singapore in November 2014, to explore their model for applied research and technology transfer and assess opportunities for collaboration. These findings to be incorporated into the Feasibility Study.

6. Further discussion at the November 2014 meeting of the Health Precinct Advisory Council with a view to forming a Working Party to progress the proposal and if appropriate commence work on a Business Case, depending on the outcome of discussions with the Minister for Canterbury Earthquake Recovery.

7. Ensure that relevant Government agencies are briefed about progress with the project (MBIE/NZTE/Ministry of Health/TEC).

Background

This workshop was planned, funded and delivered by the Christchurch Central Development Unit (CCDU) in their role as a facilitator in the development of the Health Precinct. The facilitators were Dr Ian Town, Principal Advisor and Sheila McBreen-Kerr, Manager Investment Facilitation for CERA.

The workshop drew heavily on previous work including:

- The early workshop held on 13th December 2013 where the theme of Medical Technologies and devices emerged as a lead contender;
- Consensus amongst the Precinct stakeholders that this theme should be investigated;
- Advice and guidance from Sir Peter Gluckman about the strengths and opportunities regionally and nationally;
- Investment and funding trends from government agencies including TEC and MBIE;
- Advice from the Health Precinct Advisory Council; and
- Discussion and consultation with industry representatives.

Workshop Format and Attendance

The workshop was planned in 3 main sections:

1. Background and scene setting (Health Precinct, National and International);
2. Key presentations from researchers, industry bodies and a design coach; and
3. Workshop small group sessions to build a future focussed scenario.

Attendees were handpicked from key players representing the various sectors and expanded to include key organisations and agencies such as CDC and MBIE. The numbers were capped at 40 to ensure good participation and effective small group work.

Session One: Setting the Scene

Dr Ian Town summarised the progress to date with the planning for the Health Precinct and the significant milestones over the past year including (**Attachment C**):

1. The signing of a Collaboration Agreement by the lead institutions on 21st May 2014.
2. The establishment of the Advisory Council to oversee long term strategy.
3. The signing of an MOU to bring the key institutions together in planning for the initial facilities in the precinct.
4. The release of updated Master Planning advice with concepts for the built environment and public realm
5. The policy and statutory environment in terms of the overall Recovery Plan for Christchurch and the CBD in particular.
6. The opportunities to collaborate nationally and internationally.

Sir Peter Gluckman, the Prime Minister's Chief Science Advisor discussed international trends in R & D funding and noted the low levels of investment by New Zealand, including the very low levels of private sector investment (refer **Attachment D** for a copy of his presentation). He observed that New Zealand has a low risk culture and has perpetuated misunderstandings about innovation. The short electoral cycle and recent emergence from a controlled

economy have been contributors to the present situation.

He challenged the participants to accept risk and embed innovation and entrepreneurism into the system. He contended that our cities should be the focus of larger clusters and that we must aspire to attract multi-national corporations to the precinct. He encouraged thinking globally from the outset.

Challenges would be leadership, critical mass and scale. We will need international advice from colleagues in similar countries, ie. small economies such as Israel, Denmark along with cities such as Waterloo in Ontario, Canada.

He encouraged participants to assess the opportunities in ehealth and mhealth given the presence of major players such as Orion health and McKessan along with the large number of SMEs in the field. The concept of social license – the support and participation of the public in research was highlighted.

Session Two: Invited Presentations

1. Professor Merryn Tawhai, University of Auckland

Professor Tawhai is the Deputy Director of the Auckland Bioengineering Institute and will be a Deputy Director of the recently established Medical Technologies Centre of Research Excellence (CoRE).

She defined the scope of MedTech and described the vision for the CoRE, which is to develop a MedTech entrepreneurial ecosystem fuelled by high quality basic science. The goal is to see 20 new companies established with one or more new multinationals emerging on the scale of Fisher and Paykel Healthcare.

The MedTech core will undertake translational research and establish quality technology platforms and undertake workforce training and education. This will be achieved through core academic programmes, higher degrees and internships/placements.

She described the 5 key themes and flagship projects (refer **Attachment E** for a copy of this presentation). The Director and management team were introduced.

2. Dr Gavin Clark, University of Otago

Dr Clark discussed the role of the Consortium for Medical Device Technologies (CMDT). He summarised the scale of the sector which comprises over 100 companies, of which 10% are of international scale. CMDT estimates that these companies have revenues of $1.4b per annum if we include devices, software and informatics, and is growing rapidly.

The role of CMDT is to accelerate collaboration across the sector and enhance industry engagement. The complementary role played by other organisations and agencies was discussed including Callaghan Innovation. The research themes were highlighted and activities and resources summarised (**Attachment F**).

3. Mike Munley - MTANZ

Mike Munley CE of the Medical Technology Association of New Zealand laid out the following challenges for the participants, based on his international experiences (**Attachment G**):

- Establishing the right culture is a critical success factor;
- Do not fall into the trap of doing more of the same; and
- Ensure that the Precinct becomes a beacon that draws critical mass, demonstrates and encourages the culture for all of New Zealand.

4. Paul Morrison, Enztec

Paul Morrison described Enztec and its pathway to success as a leading supplier of orthopaedic devices supplying the major multinationals (**Attachment H**). The involvement of Ossis as a company supplying specialist titanium implants was also covered.

He challenged the participants with the following comments:

- Industry has existing national and international networks so what value will the Health Precinct bring;
- It is safe to engage with industry;
- New ways of thinking are required;
- MBIE funding settings need review;
- Manufacturing does not have to be in New Zealand.

5. Anthony Butler – Opportunities in Imaging

Professor Butler outlined his vision for a National Centre for Medical Imaging Research (**Attachment I**). He noted the very long history of MedTech and imaging research in Christchurch and the collaborations between the institutions. The emergence of Spectral Molecular CT was summarised along with the research and education opportunities.

He proposed the co-location of key existing new imaging equipment including the 3T-MRI scanner, the proposed MARS CT scanner and a possible PET-MRI scanner. The recently awarded funding was noted and the opportunities for collaboration and industry engagement summarised. He concluded that specialist facilities in the Health Precinct were highly desirable.

6. Stefan Sohnchen – Design Coach

Stefan described the international discourse on Design Thinking and its key elements, noting the intersection of technology, business viability and human factors (**Attachment J**). He summarised the roles played by the Stanford .school, the u-lab in Sydney and the Hasso Plattner Institute in Germany.

He gave an example of how this works in practice by summarising a project undertaken by u-Lab in developing solutions for people with Cerebral Palsy. The cycle of observe, think, prototype, test and learn was discussed.

He encouraged the participants to adopt design thinking in their future plans providing the opportunity for experimenters to learn new things; blend art, craft, science, business with and understanding of customers and markets.

Session Three – Small Group Activities

The small group activities comprised 3 key elements:

1. Future thinking – what could the Centre of Excellence be and achieve in its first 5 years?
2. What needs to change/happen to bring the project to reality?
3. What are the next steps?

The Workshop reporting back and findings are provided below.

Element One – future thinking

What could the Centre of Excellence be and achieve in its first 5 years?	
Group 1 – Launch Event	Dr Catherine Mohr appointed as Director of Research Centre with an emphasis on e-health. Google and GE are to establish a design led facility in Christchurch creating some 200 new jobs. Flagship project using up to 100,00s smartphones for m-health. Links with Orion Healthcare.
Group 2 – Launch Event	Television 3 Panel Discussion at the time of the launch. Director enthusiastic about the partnerships. Collaboration has enabled links between SMEs and Multinationals and incubation function. Minister Joyce asserts that there will be innovation and economic growth along with the new jobs. Service to patients has improved. CDHB pleased that services will improve for patients.
Group 3 – (5 years on)	Briefing to Prime Minister prior to his speech. Outcomes have included: • Exceed business case LPIS – 3 MNCs and 50 local companies • New MNCs include devices and big Pharma • Self-sustaining financially • Clinical studies in imaging and devices • Spill-over benefits emerging • Social license evident • Magnet for talent
Group 4 - (5 years on)	Briefing to Prime Minister: • Economic benefits – growth in companies, MNCs, $500M revenues from device sales, new jobs created • Two major conferences annually, study visits from overseas colleagues • Over 100 new postgrads per annum • Publications from local tertiaries have increased 3-fold

Group 5 - (5 years on)	Briefing to Prime Minister: • Centre of Excellence globally recognised • International graduates studying on-line and on campus • MARS project very successful, reverse take-over of GE Healthcare • New medical implant devices and assistive technologies • Hospital de-centralised, Design lab has expanded • Next DG Health a former senior nurse

Element Two

What needs to change/happen to bring the project to reality?	
Group 1	Themes included: • Collaboration and sharing • Centre for PhD training, with innovation led curriculum • Inter-professional education, qualitative research • Resourcing included entrepreneurs in residence • Self-funding in time – a virtuous cycle • Leadership – strong team with an internationally recognised leader • Emphasis on marketing and regular international quality events • Value proposition for all users
Group 2	Themes included: • Collaboration and partnerships especially international • Research partnerships and attracting talent, including highly engaged students • Built environment facilitates collaboration, including soft infrastructure and single IT system • Commercial – attracting MNCs, offshore capital, commercial companies in the precinct • Engaged public and social license • Strong culture of innovation • Supportive policy and regulatory environment • Funding streams aligned from various agencies including MBIE, Pharmac, HRC, NZTE

Group 3	Themes included • Strategy, leadership, culture and resources – things that drive activity • Infrastructure required to enable outcomes • Dreams

Group 4	Themes included:
	• Resourcing, Delivery, Focus and Engagement
	• Cross cutting themes:
	  ○ Key leadership required
	  ○ Adopt a strong New Zealand Inc approach – avoid perceptions of competition with Auckland
	  ○ Communication

Group 5	Themes included: • Defining the problem, IP strategies, early successes • Relationships with regional, national and international colleagues • Integrated health ecosystem • Strong governance • Big data and attracting global IT companies • Community support • Social license • Innovation • Strong vision • Resources – imaging centre, snow-ball local investment, venture capital attraction • Recruiting talent and additional expertise

Element Three: "Rubber on the Road"
Groups were divided into two further topics – key relationships and roles, and key enablers and constraints.

What are the next steps?		
Key relationships and roles identified		
Group 1	Attracting people with the right skills	
	Community Groups	• NGOs including CMRF • Education and outreach
	Government Agencies	• Policy and regulatory framework
	Iwi	• Health statistics and burden of disease • Engagement with health provider groups • Investment though Ngai Tahu properties • Maturanga Maori – education and research opportunities
	Citizens and Communities	
	Health Providers	• Public sector • Private sector
	Tertiary Education	• Graduate profiles • PhD students
Group 2	Business and Commercial Ventures	• Ideas pull from researchers to industry • Funding assistance/incentives • Attraction of MNCs • More market analysis would help
	Tertiary Education	• Converting ideas into evidence • Collaboration with industry • Training and workforce development
	Health Providers	• Define the problem/challenges • Enable clinical trials • Develop new models of care • Evidence based medicine • Generate data sets

	Citizens	• Develop social license • Participate in research • Advocates for innovation
Group 3	Commercial and business ventures	• Expertise and skills, input into strategy • Assistance with commercialisation • Funding for R & D • Collaborative leadership contribution
	Tertiary Sector	• Talent supply – research, training, customised curriculum • Wider framework for outreach • Leadership development
	Health Providers	• Access to patients and clinicians • Infrastructure • Defining the challenges/questions • Policy innovation
	Citizens	• Positive engagement • Ambassadors and advocates • Exhibitions, tours, conferences • Promoting healthy lifestyles
	Government Agencies	• Need for robust framework • Managing IP issues • Funding and governance • Need to define the entity that hosts the Centre – alliance/institute/trust
	Iwi	• Engagement and partnerships
Group 4	**Key Enablers**	
	Governance	• Strong Board to exert wise governance • Passionate and visionary CEO required
	Relationships	• Engagement with NZ and overseas private companies • Academia • Health providers • Patients and communities • Government, both local and central

		• Iwi groups • International health systems • Investors
	Skills and staffing	• High performing team • Funding • Infrastructure • Marketing • Communications
	Measuring outcomes	• Establish a baseline and KPIs for CE • Need some quick wins
	Potential barriers identified	• Parochialism - significant risk • Culture clashes amongst various groups • Selection process for CE – risk of appointing a "safe pair of hands" • Stakeholder engagement and management plan • Uncertainty and fear of failure • Regulatory issues • Location – within NZ and globally
Group 5	**Enablers include**: • Competitive advantage in NZ – good IT literacy and systems e.g. NHI • Good existing skills and resources in the thematic areas • Good clinical relationships • Good industry relationships • Good collaborations between clinicians and researchers • Strong public health systems • Integrated primary and secondary health system • Good leadership present • Funding streams substantial	**Constraints include:** • Need a compelling Business Case – value proposition for investors • What are the aspirations of the potential private sector – unknown at this stage • How to ensure the ROI on investment • Need for culture change • Lack of investment • Geography– tyranny of distance • Small population base • DHB focus on patients outcomes – less emphasis on QA and research • Complexity of regulatory processes – risk averse

Note: Transcripts from the sessions were edited into bullet points by Dr Ian Town

Priority Areas and Themes

During the day groups were asked to identify priority areas and themes for further work on the Health Precinct. The facilitators then aggregated all the small group ideas into a summary.

Leadership	• Strong governance • Vision • Clear direction • Identify a top-class leader • Unifying leadership
Strategy	• Uniquely New Zealand • Strong vulture and values • Market needs • Attracting MNCs • Select anchor projects • Innovation culture • CDHB research strategy • Design laboratory as a focal point • Links with city
Human Resources-People	• Inspirational Director • International postgraduate students • Joint appointments • Professional development • Clinicians with dedicated research time • Inter-professional learning • Design school • Double degree programmes • Industry ready graduates • Entrepreneurship • International fellowships and exchanges
Resourcing	• Capital for the built environment • Angel investors and risk capital • Clinical trials revenue • International links • Public-private partnerships • Leveraging existing revenue • Private sector R & D • HRC partnership funding • Tax breaks • Pharmac projects
Culture	• Social license • Change management • Fear of failure • Avoid risk-averse culture • Community engagement and support • Outreach functions • Flexible HR policies

Collaboration	• Formal agreements/MOUs • Cultural environment around partnerships • Links with MNCs • Collaboration between DHBs • Hub and spoke model • Integration of teaching • Innovation ecosystem • Business engagement
Relationships	• Stakeholder engagement • International collaborations • Public, Students, students • Patients • Government champions • Iwi
Process	• Early wins/successes • Advisory Council leadership • Confirming key themes • Business case including benefits realisation
Marketing and communications	• Tell the story to government, stakeholders. Industry and the public • Active strategy to engage MNCs • Social media • Branding • Awards, conferences and events
Infrastructure	• Soft infrastructure including services • ICT platform • Access protocols • Learning technology • Live streaming of content • Policy settings • Transport and parking • Retail and food/beverage • IP policies

Final Session Summary

Sir Peter Gluckman was invited to conclude the day with his reflections and advice to the participants:

1. Good work, goodwill, enthusiasm evident.
2. Not convinced that we have defined the outcome as yet.
3. What are you trying to set up?
4. Need more granularity and detail.
5. Define the scope of the Precinct.
6. What existing or potential models are you looking at (international examples).
7. How would a Centre of Excellence add value?
8. What about the relevant National Science Challenges?
9. People want to work together across New Zealand – a good sign of progress.
10. Avoid competition between institutions and cities.

What is our competitive advantage?

1. How good are we really?
2. New Zealand generally lacks scale and true excellence.
3. Look at what we are good at - then do an honest appraisal of strengths and potential.
4. Not many examples of truly world class activity - be honest.
5. Barriers do exist as the health system lacks an emphasis on R & D – a policy issue.

Areas with opportunity

1. Need to consider ICT area more carefully – ehealth and mhealth.

Next steps

1. Continue the discussions and planning, including follow up discussion with Dr Catherine Mohr on 20th October 2014.
2. Involve successful entrepreneurs who have international experience.
3. Try and get clarity on:
   a. What you want to do;
   b. Why you want to do it; and
   c. Who is going to lead the initiative – that person will shape it.
4. Keep talking with Auckland colleagues.
5. Build the innovation story – ensure city stays in step with the project.
6. Review policy settings around the R & D in the health system.

7. Pick a place to start – aim to get runs on the board.

Conclusions and Wrap-up: Ian Town

1. A successful day with hard work and engagement.
2. Good progress in collective thinking since December 2013 workshop.
3. Underpinning agreements set a positive framework:
   a. Collaboration Agreement; and
   b. Advisory Council

Next steps

1. Establish a working party – To be established by the Advisory Council;
2. Construct an action plan;
3. Complete Feasibility study for the Minister for Canterbury Earthquake Recovery;
4. Proceed with a Business Case (depending on advice from the Minister for CER);
5. Energise innovation system; and
6. Engage with the private sector.

Report on 20th October 2014 Workshop with Dr Catherine Mohr

Present:

Ian Town (Chair), Peter Joyce, Anthony Butler, Phil Butler, Peter John, Ria Chapman, Nigel Anderson, Helen McLeod, Sarah Petersen, Eric Walton, Marcus King, Catherine Mohr

Background

The workshop was held to follow-up on the wider forum held on 29 September 2014. The findings of that workshop are attached for context.
This session was held to coincide with the visit of Dr Catherine Mohr, Senior Director, Medical Research with Intuitive Surgical based in California. Her specialist international knowledge of MedTech was of particular interest to the group.

Main issues discussed:

1. Peter John (Canterbury Development Corporation):
   a. Noted that within New Zealand, return on investment is generally poor;
   b. Expressed concern that innovations developed in New Zealand generally go offshore for capital reasons;
   c. The current MBIE system is not overly supportive in the area of innovation; and
   d. It has been difficult to identify qualified CEOs for start-ups.

2. Agreed amongst participants that there is a need for a framework for engaging with investors and researchers (need to identify why people are not engaging and seek to address this).

3. Agreement that the route to market needs to be identified and addressed.

4. Success should affect each and every person involved in the process to allow innovation to succeed.

5. Agreed there needs to be the ability to bring together different skill sets (eg nurses, doctors, engineers, clinicians, etc) to provide similar training, in order to help everyone understand how systems work. Setting up this infrastructure will help create the right ecosystems.

6. Key elements to success:
   a. Market validation – what product are you trying to sell and why (what is the problem or issue you are solving?); and
   b. Exit strategy – there needs to be an understanding of what to do with the prototype once developed (ie retain ownership, sell company, etc) to be successful.

Challenges (what is required):

1. Whilst there is very good research, critical mass is required.

2. Securing a multi-national corporation is a worthy goal but may not be possible at this early stage.

3. Securing an internationally qualified director.

4. Strong international support and advice.

Comments from Dr Catherine Mohr:

1. Need to distinguish between the technology (service business), product (usually sale is the end result for the company) and business (this implies distribution channel) when looking at taking innovation through from concept to design and marketing.

2. Health technology assessment important – in order to determine the ability to market the product (nationally and internationally).

3. Need to create the right ecosystem to allow easy generation of ideas.

4. For the precinct to be successful, the following elements are required:
   a. Access to business school – to help understand all aspects of developing and marketing a prototype. Issue is how to integrate the business schools into the precinct and have those commercial skills introduced to students;
   b. Identification of "who succeeds when the prototype succeeds" – ie who is the owner of the end product;
   c. Creating the right environment for innovative individuals to find the right 'team' to develop and implement the product (eg entrepreneurs, lawyers, investors, etc) – need to understand that no one person with the idea will be able to take it all the way through; and
   d. Need to match the people making products with those that will help them take it forward – to succeed you need the ability for the idea to be taken to prototype and market.

Why Christchurch?

1. Longitudinal outcomes – South Island delivers excellent output in this area;

2. Good existing soft infrastructure;

3. Strong social license;

4. Better integration of primary and secondary care;

5. City is big enough but not too big – quality of life;

6. Good lines of communication already exist between the various organisations; and

7. Relative stability of the workforce.

Next steps

1. Needs analysis of all the relevant disciplines involved in the Precinct – ie the needs of the scientist, entrepreneur, director of research and government funding agency will all have a different focus and viewpoint. It is important to understand all of these needs to complete the narrative for why the Precinct is required and will be successful;

2. Once the needs analysis is complete, be able to build then complete the story of the Precinct;

3. Questions to be addressed include:
   a. Why here?

b. Why now?
c. What will success look like?
d. What will the Precinct be like in 10 years, 15 years?
e. Who are the people that will interact and how will they interact with organisations and other people to be successful?
f. Why are the people here? (eg is it the links and services?)
g. Will training/advice be available on issues such as international law, intellectual property, patents etc?

4. Identify what platforms are required to link into the various areas (hardware and software) – to assist people successfully develop and market their product/idea; and

5. Identification of what areas will be involved in the centre (eg will there be an initial set up of a few areas and further areas added later, or will it just focus on a small number of areas).

Attachment A – Workshop Programme and Attendees

CERA
Canterbury Earthquake Recovery Authority
Te Mana Haumanu ki Waitaha

HEALTH RESEARCH CENTRE OF EXCELLENCE WORKSHOP

Conference:	Christchurch Health Precinct Workshop – Research Centre of Excellence in Medical Devices and Technologies Including Imaging and Bioengineering
Location:	Rydges Hotel, Latimer Square, Christchurch
Dates:	Sunday, 28 September – Monday, 29th September
Times:	Sun: 5:00pm – 7:00pm Mon: 8:45am – 4:45pm

Sunday 28 September

Time	Programme Item
P.M.	Out of town delegates arrive
1700 – 1900	***Welcome Reception Function (Bloody Marys Bar, Library Room)***
	Welcome Remarks from Roger Sutton and Ian Town

Monday 29 September

0830 ***Registration: Savoy East Conference Room, Level 1 Rydges Hotel (Coffee and tea to be served in foyer)***

Time	Programme Item	Speakers
0845	Welcome – Setting the Scene	Ian Town
0900	Introductions	Sheila McBreen-Kerr
0915	Overview of the Health Precinct and Context for Workshop	Ian Town
0945	The National and International Context	Sir Peter Gluckman

1000 ***Morning Tea***

Time	Programme Item	Speakers
1030	Brief Presentations Chair – Ian Town	**Merryn Tawhai** – MedTech CoRE **Gavin Clarke** – Consortium for Medical Device Technologies **Mike Munley** – Medical Technology Association of New Zealand **Paul Morrison** – Enztec – An Industry View **Anthony Butler** – Opportunities in Imaging

1215 Lunch

Time	Programme Item	Facilitators
1300	**Small Group Workshop Sessions:** (3 cycles with reporting back by group) **Session 1** – Refer to workbook hand out	Ian Town Sir Peter Gluckman Sheila McBreen-Kerr
1330	Reporting Back	
1345	**Session 2** – Refer to workbook hand out	
1415	Reporting Back	

1430 Afternoon tea

Time	Programme Item	Facilitators/Speakers
1500	**Final Small Group Session** - Refer to workbook hand out	
1530	Reporting Back	Ian Town
1550	Summary	Ian Town / Sheila McBreen-Kerr
1600	Wrap up	Sir Peter Gluckman
1630	Close	Ian Town

1645 Workshop Close

CERA
Canterbury Earthquake Recovery Authority
Te Mana Haumanu ki Waitaha

WORKSHOP ATTENDEES

Conference:	Christchurch Health Precinct Workshop – Research Centre of Excellence in Medical Devices and Technologies Including Imaging and Bioengineering
Location:	Savoy East Conference Room Rydges Hotel, Latimer Square, Christchurch
Dates:	Monday, 29th September
Times:	Mon: 8:45am – 4:45pm

Speakers

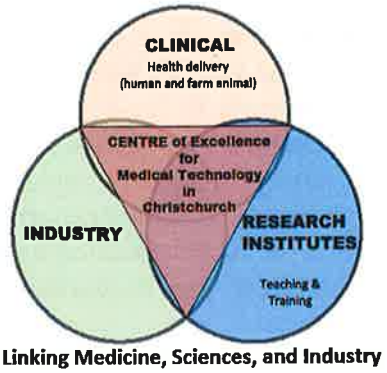
Name	Organisation
Sir Peter Gluckman	Prime Minister's Chief Science Advisor
Ian Town	CERA - CCDU
Sheila McBreen-Kerr	CERA - CCDU
Merryn Tawhai	University of Auckland
Gavin Clark	University of Otago
Mike Munley	MTANZ
Paul Morrison	Enztec
Anthony Butler	University of Otago
Stefan Sohnchen	Agile Business Process and Design Thinking Consultant

Attendees

Name	Organisation
Helen McLeod	CERA - CCDU
Greg Hamilton	CDHB
Stella Ward	CDHB
Rebecca Hickmott	CDHB
Geoff Shaw	CDHB
Helen Lunt	CDHB
Margaret Leonard	CPIT
Isabel Jamieson	CPIT
Lindsey Alton	CPIT
Jeremy Shearman	CPIT
Sonia Mazey	University of Canterbury
Wendy Lawson	University of Canterbury

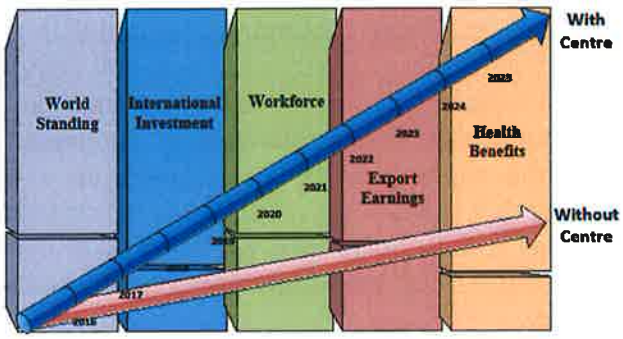
Geoff Chase	University of Canterbury
Peter Joyce	University of Otago
Richard Blaikie	University of Otago
Andy Shenk	Auckland UniServices Ltd
Ingrid van Elst	MBIE
Philippa Yasbek	MBIE
Marcus King	Callaghan Innovation
Frances Guyett	Health Innovation Hub
Jamie Cairns	CDC
Ria Chapman	CDC
Peter John	CDC
George Arnold	NZTE
Guy Tapley	NZTE
Bruce Davey	ARANZ
Madeleine Martin	Ossis
Kevin Sheehy	Medicines New Zealand
Roger Dennis	Sensing City
Pat Fogarty	Shamrock Industries Limited
Andy McNicholl	EPLinnovation
Graeme Moore	Chiptech Limited
John Johnson	Octant Ltd

The Current State of the Christchurch's Med.Tech Environment



Linking Medicine, Sciences, and Industry

Fig 1



Accelerating Benefits

Fig 2

Vision:

- To establish a collaborative Christchurch based Medical Technologies Institute linking basic science, health research, and industry; with the goal of developing new ways to diagnose disease, develop new treatments, and monitor therapy.

Purpose: Create a physical environment to foster and accelerate the development, manufacture, and application of existing and future advanced medical technologies specifically targeted to NZ health priorities, with crossover to farm animal health.

Choice of Medical Technologies: The Centre will bring together existing spread apart groups who already showcase the clinical and financial benefits of medicine, science, and industry (Fig 1) working together. It will act as an incubator to foster other groupings.
The initial technologies in the proposed Centre extend across 3 of the 6 NZ Centres of Research Excellence (CoREs) - MedTech, Brain Research NZ, MacDiarmid) with local industrial/manufacturing partners producing economic benefit already.

What will be in the building?:
Meeting places - for groups of experts from basic and applied sciences, animal sciences, biology, medicine, and industry to meet to accelerate ideas, collaboration, and IP that translates into exportable products to enhance human and animal health
Shared equipment – imaging devices (MRI, PET, MARS CT etc), laboratories (electronics, clean rooms for tissue engineering, cellular/molecular biology lab equipment), Additive Manufacturing and 3D printer
Clinical Translation Facilities for testing the technology: large animal trials, clinical trials
Bioengineering Workshops and expertise –design prototyping, maintenance of equipment
Animal welfare facilities –for small and large animals (link to Lincoln University)
Patient welfare facilities– space and support equipment for clinical assessment (CDHB)
Environmental protection – helium quenching, radiation protection (Xray and radioactive substances – links to ESR)
Quality Assurance: clean room facilities, Good Manufacturing practice (GMP) capability, sterilization facilities, ISO standards - all relevant to industry
Commercial tenants –a radiology provider and local/international Med-Tech manufacturers have shown interest in renting space

Building on an existing base

Christchurch has spawned successful biotechnology clusters meeting global demand in health-related fields. These clusters add entrepreneurial drive to a combination of pure sciences, applied sciences, animal sciences, biology, and medicine, demonstrating how well cross-discipline groups and industry can work together in Christchurch. Having a Centre will accelerate outputs from these groups, to obtain early health and economic benefits for Christchurch and New Zealand. Incremental improvements in health benefit, size of high-technology workforce, export earnings, and reputation arise from these groups already. The Centre's presence will enable these incremental beneficial improvements to be bigger and more frequent than is possible without the presence of the Centre. (Fig 2). This will continue to grow the reputation of Christchurch as a world-leader in clinically focused medical technology that can be manufactured in NZ or deliver economic benefit to NZ. The strength of these projects is underpinned by the critical involvement of members of the mathematics, physics, engineering and high performance computing departments at the University of Canterbury.

1) *MARS Project*: has developed, and manufactured the world's first small animal spectral CT scanner in Christchurch using a novel Xray detector technology. It is being used for novel preclinical research into cancer, heart disease, drug delivery, and bone and joint diseases. Competitive grant funding of $4.8M initiated the project. It has on-going funding of $1.2M annually from Universities of Canterbury and Otago, local and international industry, and CERN. A grant of $12.1M has just been awarded to develop a human spectral CT scanner. Potential export earnings are over $100M annually.

2) *Orthopaedic Medical Devices and Tissue Engineering*: Development and manufacture of longer-lasting joint replacement parts, and spinal fusion devices, and tissue engineering and reconstruction in Christchurch has been focused towards what works for surgeons and patients. The close working relationship between bioengineers, orthopaedic surgeons, and local manufacturers has seen research initiatives translated into high value manufacturing with Enztec exporting approximately $8M per year, Ossis pioneering additive manufacturing for orthopaedic implants, and an NZ-USA company (Omni) based in the US selling knee joint replacements ($55M annual turnover).

3) *Brain Research*: Christchurch based NZ Brain Research Institute (NZBRI) translates its own brain research into clinical care using new methods in MR imaging, technology for recording brain activity and eye movements, and new pharmacological approaches. NZBRI has substantive international collaborations in Europe, North America and Australia. The interdisciplinary team encompasses medical physics, biostatistics, neurology, psychology, and speech therapy. Its Clinical Director, Tim Anderson is a Theme leader ("Biomarkers") for the Brain Research NZ CoRE. NeuroTech, hosted by NZBRI, is a multi-institute grouping including University of Canterbury and CDHB with an emphasis on manufacturing and export potential.

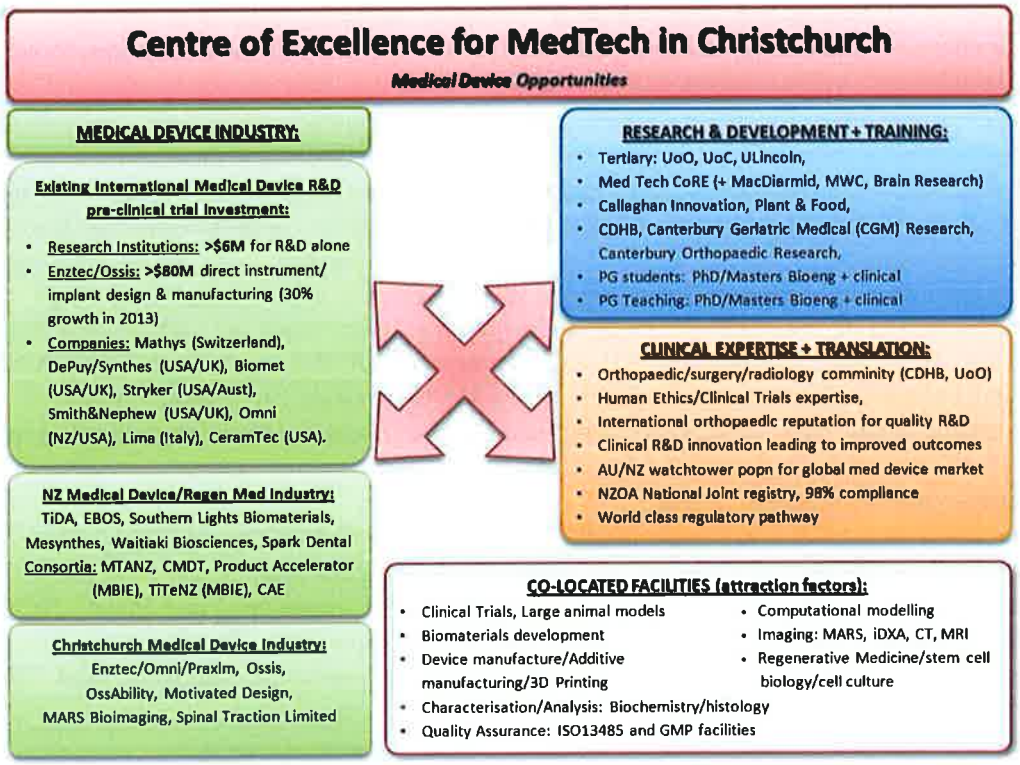
4) *Micro and Nano Devices for microfluidics*: This multi-institute research program within the MacDiarmid Institute (which has a track record of spinning out successful nanotechnology companies) has developed intellectual property for nano scale devices for application in many industries using switches, micro-pumps, cell-trapping and electrochemistry. This is another opportunity for world-leading technology based in Christchurch to benefit NZ through exports.

Nigel Anderson	University of Otago
Anthony Butler	University of Otago, U of Canterbury, CERN, MarsBioimaging Ltd
Tim Woodfield	University of Otago, University of Canterbury
Gary Hooper	Canterbury District Health Board, University of Otago
Tim Anderson	University of Otago, NZ Brain Research Institute
Paul Morrison	Enztec Ltd, Ossis Ltd

Medical Device Opportunities within Christchurch's MedTech Environment

Vision:

- To establish a collaborative Christchurch based Medical Technologies Institute co-locating basic science, health research, and industry; with the goal of advancing medical device R&D, clinical trials/translation and the treatment of musculoskeletal disease for ageing well.
- To leverage existing multi-institute and multi-disciplinary strength in high value medical device development and manufacture, regenerative medicine, and animal and clinical trials to become a National Centre for MedTech Research with international reputation and investment.
- To ensure the benefits are available to patients, the health workforce, and NZs MedTech industry.



Unique Opportunity:

- Total joint replacement of the hip and knee are the most common orthopaedic procedures
  - Global orthopaedic medical device market is currently $36B USD, and growing at 7.1% annually.
  - Global Regenerative Medicine market is currently $7B USD, and growing at 7% to 2018.
- Ageing demographics and epidemic of aging-related degenerative disease (e.g. osteoarthritis) is presenting a tremendous challenge to healthcare systems - incidence & costs escalating
  - 31% of the NZ population will be over 60 by 2051
  - joint replacement surgery will skyrocket 670% in the US by 2030, and by 200% in New Zealand[1].
- The Australasian market is considered a "watch tower" market by global orthopaedic community
- Need NZ industries' understanding of global market trends to drive innovation in MedTech research:
  - continued innovation or value additions form the core of today's orthopaedic device R&D.
  - acknowledge the fast-paced refinement of Regenerative Medicine/stem cell therapies coming online.
- Need co-located facilities and expertise to allow clinical translation of medical device R&D into patients.

---

[1] [GJ Hooper *et al.* Current trends and projections in the utilisation rates of hip and knee replacement in New Zealand. *NZMJ,* 2014; 127:1401]

- Ability to leverage Christchurch's established international reputation of its orthopaedic surgeons as well as orthopaedic device R&D and manufacture:
  - >20 years of experience in orthopaedic device manufacture (e.g. Enztec, Ossis and Omni)
  - Strong translational research groups working closely with orthopaedic surgeons: UO, UC, ULincoln (animal trials), CDHB, Canterbury Geriatric Medical (CGM) Research, St Georges, Southern Cross, Forté
  - Emerging NZ veterinary industry for orthopaedic implant manufacture in ChCh (e.g. Ossability)
- Current medical device initiatives and facilities within NZ are disparate with duplication of resources.
  - rate-limiting steps for rapid innovation is the lack of access to clinical expertise
  - large current NZ investment in HVM machinery/equipment, but 80-90% of the value (and IP) of a medical device is design and demonstrating clinical effectiveness not manufacture.
  - Requires investment in expertise, innovation and clinical translation.
- Collective "point of difference" is that Canterbury has a substantial quantity of internationally focussed orthopaedic device companies existing with 20yrs experience co-developing products with surgeons.
  - Opportunity for NZ Inc approach to accelerating medical device technologies & innovation in HVM
- Centre of Excellence will materially assist NZ MedTech companies, and new allied services, to contribute to the MedTech sector's 3-5 year target export revenue of $1.2B[2].
- With growing manufacturing and R&D demands, medical device industry is looking for new premises.
- Highly collaborative involving ChCh health and engineering related entities and institutes.
  - UO, UC, ULincoln, VUW, UWaikato, CDHB, Callaghan Innovation, Plant & Food, local industry, as well as related consortia with Christchurch stakeholders: CMDT, MTANZ, Centre for Advanced Engineering..
- Aligns with investment in:
  - CoRE's: MedTech, MacDiarmid Institute, Maurice Wilkins Centre
  - MBIE: currently >$27M invested in medical devices, animal trials, Regenerative Medicine R&D across UO, UC, UA, UoW and HVM industry. $15.8M of that from Christchurch bids in latest MBIE round (Amplifying bone growth in titanium implants; Taking MARS Spectral CT to human imaging)
  - National Science Challenges: "NSC3 Aging Well" and "NSC10 Science for Technology Innovation"

How should such an initiative be structured?

- Bringing together all expertise into a single medical device design and translational R&D facility.
  - Co-locate clinical orthopaedic, academic and industry expertise with all necessary facilities:
    - advanced additive manufacturing, biomaterials development, engineering and analysis facilities
    - advanced laboratories for Regenerative Medicine R&D, 3D Bioprinting, cell therapies.
    - animal trials facilities, surgery, anaesthesia, animal handling, imaging and biological assessment/assay/histology facilities
    - human clinical trials, imaging (CT, MRI, iDXA), functional outcome assessment
    - support for teaching/training clinicians, bioengineers, researchers (PhDs) and medical students
    - support quality assurance/documentation capability (ISO13485 and GMP) and clean room facilities to meet FDA approval and meet pre-clinical animal and human clinical trial standards
  - Provide end-user/industry access to institutions: UO, UC, ULincoln, CDHB, UoA, VUW
  - Provide basic science and clinical R&D access to end-user/industry and consortia (Callaghan Innovation, CMDT, MTANZ, CAE)
- Benefits:
  - Consolidates and enhances existing group of multidisciplinary experts required to drive medical device design, manufacture and pre-clinical/clinical trials.
  - End users can access the facilities and expertise they need for rapid innovation and clinical translation.
  - Reduces duplication of expensive manufacturing equipment, but also leverages the clinical expertise required to maximise return on investment in high value manufacturing.
  - Future proofs the skills as new therapies such as Regenerative Medicine evolve to take over existing implant technologies (link to NSCs).

---

[2] Medical Technology Assoc of NZ (MTANZ) Report 2011- Medical Technology industry sector Blueprint "A global ambition - A thriving MedTech economy" www.mtanz.org.nz .

Track record:

- Investment from international OEM medical device manufacturers in Canterbury is extensive:
  - Clinical trials/R&D contracts within orthopaedic community totalling $6M (Biomet, DePuy/Synthes)
  - Partnerships with 7 international medical device manufacturers with >$80M contracts/agreements invested in Christchurch industry:
- Christchurch based Enztec, Omni and Ossis have manufacturing contracts or agreements with 4 of the 5 largest orthopaedic companies; Stryker, DePuy/Synthes, Smith&Nephew and Biomet – with combined sales of $21.4B USD in 2009.
  - Enztec: internationally focused medical equipment design and manufacturing company. 99% export revenue. 38 employees, revenue NZ$8M >30% growth 2013
  - Ossis: ISO13485 audited manufacturer of custom orthopaedic implants. Successfully designed, manufactured and treated over 60 patients to date in NZ and Australia. Pioneers worldwide in additive manufacturing of titanium for complex hip revision surgery with >6yrs clinical experience in patients.
  - Omni: 55% NZ owned, US domiciled, Orthopaedic business (sister company to Enztec). Over 40,000 total knees implanted worldwide. Approaching US$50mil revenue 2013. Omni have the only FDA approved robot operating in the US market for total knee replacement surgery.
- Christchurch hosts the NZ National Joint Registry: (database of 183000 implants in 131000 patients)
  - Internationally recognised registry recording outcomes of every joint prosthesis in NZ since 1997
- Christchurch based researchers and clinicians from UO/UC/CDHB hold PI/AI positions across 4 of 6 CoRE's: MedTech, Brain Research NZ, MacDiarmid Institute, Maurice Wilkins Centre.
- National collaboration across high value manufacturing (HVM) sector for advancing device development including TiTeNZ, TiDA, Callaghan Innov, UoA ABI (physiological modelling), UoC (IBM supercomputer).
- CReaTE Group/Canterbury Orthopaedic Research Group:
  - Links UO (orthopaedics, Regenerative Medicine, devices, radiology), UC (MARS imaging, engineering, computational modelling), UL (animal trials), CDHB (orthopaedics, imaging).
  - Collaborations with national medical device and Regenerative Medicine industry including Ossis/Enztec, TiDA, Mesynthes, Southern Lights Biomaterials, EBOS, as well as CRIs (Callaghan Innov, Plant & Food), Lincoln University Animal Health Research, Queenstown Regenerative Medicine Centre.
  - Innovation in Teatment and improved outcomes following joint replacement surgery and advancing Regenerative Medicine/stem cell strategies for musculoskeletal tissues (cartilage and bone repair)..
  - Accelerating international reputation and knowledge - >13 Intl research partnerships in USA (Harvard, CSU), Australia (QUT) and Europe incl Marie Curie/EU-FP7 International Research Staff Exchange Scheme (IRSES) - A cross continent consortium for enhancing regenerative medicine in skeletal tissues.
  - Outputs: 4 current or completed postdocs, 14 current or completed PhD students with supervision/mentorship with orthopaedic surgeons or linked to industry.
- UOtago has 20year track record and >$5M investment in pre-clinical R&D and animal trials to GMP standards with Smith&Nephew UK. With Dunedin animal facilities closing – new premises are required.

Challenges:

- Requires co-ordinated approach from government and tertiary institutes
  - CERA, CCC, UO, UC, UL, CDHB, MBIE, MoH, CDC,
- Anchor research project(s) to provide momentum as other themes develop
- Industry engagement- both local and international
- Funding streams (possible via CoRE's, MBIE, HRC, RSNZ/Marsden, research institutes, and industry partners)
- Space for co-location (animal and human), including industry partners

Tim Woodfield – University of Otago Christchurch,
Gary Hooper – University of Otago Christchurch, CDHB, Canterbury Orthopaedic Research Trust
Nigel Gilchrist - University of Otago Christchurch, Canterbury Geriatric Medicine (CGM) Research Trust
Paul Morrison – MD Enztec
Dave Body – MD Ossis
Anthony Butler - University of Otago Christchurch, University of Canterbury, MARS Bioimaging

Imaging Opportunities within Christchurch's Med.Tech Environment

Vision:

- To establish a collaborative Christchurch based Medical Technologies Institute linking basic science, health research, and industry; with the goal of developing new ways to diagnose disease, develop new treatments, and monitor therapy.
- Within this framework, leverage existing multi-institute and multi-disciplinary strength in imaging to become a National Centre for Medical Imaging Research.
- To ensure the benefit are available to patients, the health workforce, and NZ industry.

Opportunity:

- Imaging accelerates the translation of both medical devices and pharmaceuticals into medical practice.
- Medical imaging is high value area of medical technology:
    - Human medical imaging equipment market is currently 28B USD, and growing at 4.8% annually.
    - Pre-clinical imaging equipment market is currently 1.7B USD, and growing at 16.5% annually.
- Imaging enables the rapid development and testing of devices and drugs and ensures NZ is competitive
    - Eg. orthopaedic implants, cancer drug delivery systems, monitoring cardiovascular therapy.
- Ability to leverage Christchurch's world leading status in imaging:
    - >40 years of experience,
        - eg. Prof Richard Bates (Obituary DOI: 10.1111/j.1440-1673.1991.tb02869.x)
    - Strong translational research groups working closely with health researchers: MARS, NZ Brain Research Institute, Lincoln University (LU) for animal health and production value.
    - Strong underpinning science from UC's computational imaging group, UC's HIT-Lab, UC's High Performance Computing.
- Aligns with investment in the MedTech CoRE, Brain Research New Zealand CoRE, and Auckland Bioengineering Institute, CMDT, MTANZ
- Training clinician and researchers to be experts in new developments in imaing technology for application in the health system.
- Human MARS scanner is being built with $12m of MBIE funding. University of Otago, plans to host this but the current facilities are limited.
- Locate within the precinct top end scanners (PET-MRI and/or 3T MRI) funded in partnership with private radiology (Pacific Radiology Group) – this is a time limited opportunity.
- Highly collaborative involving all ChCh health related entities and institutes.
    - UC, UO, LU, CPIT, CDHB, ESR-NCRS, NZ Brain Research Institute, PRG, local industry

How should such an initiative be structured?

- Bringing together all expertise into a single imaging facility
    - Co-locate scanners and support facilities
        - Have both human (clinical) waiting rooms, and large animal anaesthetics facilities.
        - Support facilities for on-site teaching and basic science activities.
    - Provide end-user access to UO, UC, LU, CDHB, CPIT, industry.
- Benefits:
    - Consolidates and enhance existing group of experts in imaging applications and data analysis.
    - End users are assured the most effective imaging methods are applied to their problem.
    - Expensive imaging equipment is shared amongst diverse groups.
    - Future proofs the skills as new modalities develop and evolve.

Track record:

- MARS Spectral CT:
  - Links UC (physics, maths, engineering), UO (devices, biomedical), LU (animals), CPIT (training).
  - Industry partners – >5 national, and >7 international (incl. GE Healthcare).
  - Improving healthcare:
    - Improved orthopaedic devices, target drug delivery for cancer, early detection of cardiovascular disease, etc.
    - Support for local healthcare manufacturing including Ossis/Enztec Ltd, Boutiq Nanoparticles Ltd.
  - Accelerating international reputation and knowledge. > 16 International researcher partnerships. Eg. Mayo Clinic, Yale Uni, Virginia Tech, CERN etc.
  - Outputs: >18 current or completed PhD students, spinout company with international sales, international partnerships and collaborations.
- NZ Brain Research Institute:
  - MRI major tool for most of their research (adding PET as additional tool).
  - In partnership with local industry (PRG).
  - Strong translation experience to clinical research.
  - Active partnership between UO, UC, CDHB, and local radiology private practice:
    - Provides MRI expertise for psychological and clinical research.
    - Strong clinical and community links.
    - Base for HRC, CoRE, and commercial pharmaceutical clinical projects.
  - Partnerships as a test site for major imaging equipment vendors (GE Healthcare).
  - Strong international collaborations and contributors to international diagnostic criteria.
  - Multidisciplinary training for students (20 completed PhDs, 13 current).
- Lincoln University Animal Health Research and Production:
  - CT and ultrasound are key tools for longitudinal assessment of animal physiology.
  - World centre for large animal model research into the fatal childhood condition Batten disease.
  - Animal production values (carcass composition) for commercial breeding and meat quality.
  - Bone density and mineralisation measures for monitoring the effects of seasonal hormone changes, deer antler growth.
- UO developing a Masters course in Medical Imaging in partnership with CPIT.
- UC Medical Physics programme includes imaging physics.

Challenges:

- Requires co-ordinated approach from government and tertiary institutes
  - CERA, CCC, UC, LU, UO, CPIT, CDHB, MBIE, MoH, ESR-NCRS, CDC
- Anchor research project(s) to provide momentum as other themes develop
- Industry engagement- both local and international
- Funding streams (possible via CoRE, MBIE, HRC, research institutes, and industry partners)
- Space for co-location (animal and human), including industry partners

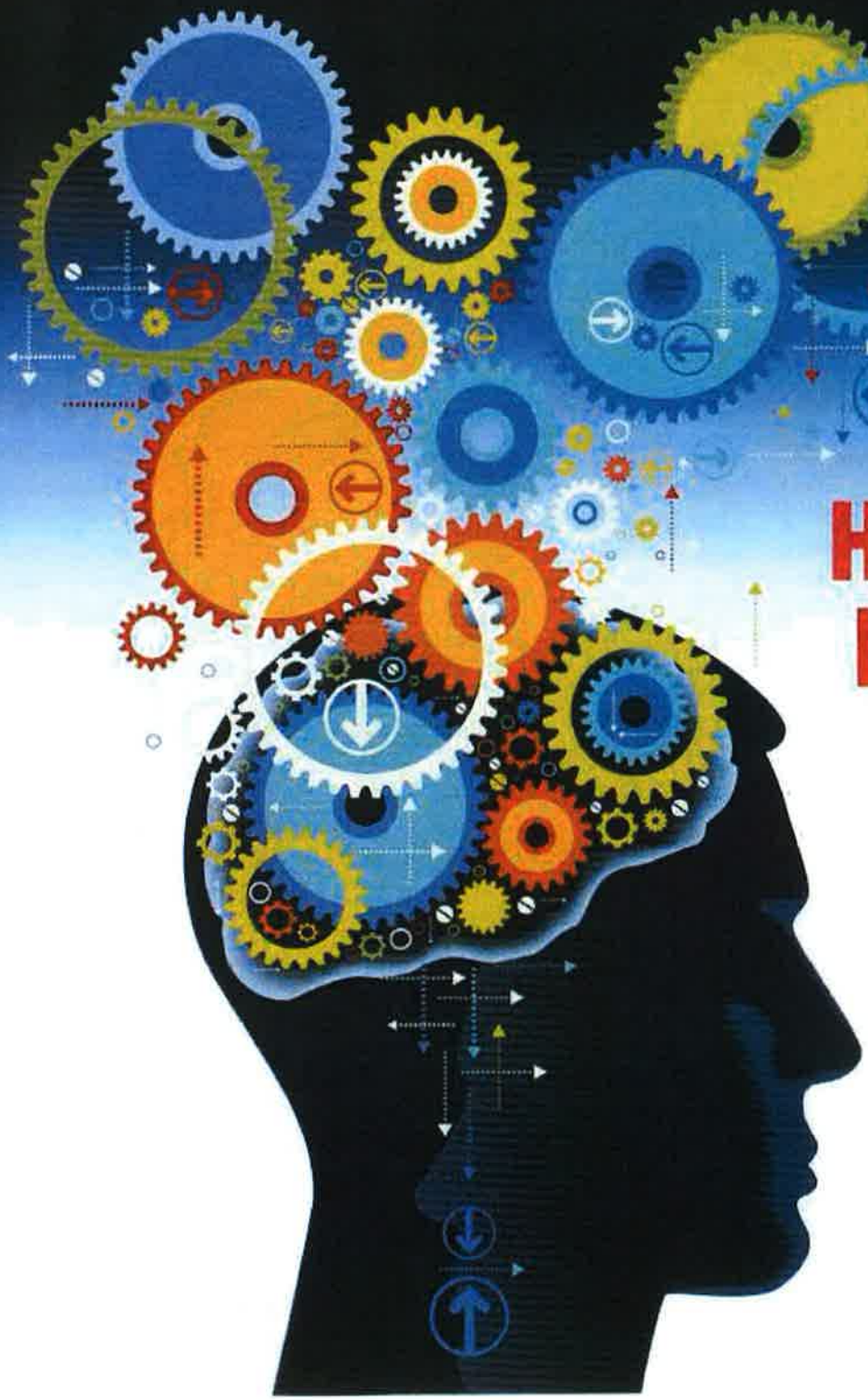
Biography

A/Prof Anthony Butler is a radiologist with formal training in physics and computer engineering. He has academic affiliations with the University of Otago Christchurch, the University of Canterbury, and CERN (European Centre for Nuclear Research). He works as a clinical radiologist at Canterbury District Health Board and is the Head of the University of Otago's Department of Radiology. He is the founding director of the Centre for Bioengineering at the University of Otago Christchurch. He has won more than 10 awards for his research including awards from the Royal Society of NZ and the Royal Australian College of Radiologists. He is the lead investigator on over $12m of NZ government research grants, and in addition a co-investigator on more than $30m.

January/February 2014
Volume 5 ▼ Number 1
http://magazine.embs.org

IEEE PULSE

A MAGAZINE OF THE IEEE ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY



Global Health Care Innovation

Challenges and Promise

Plus

- Forecast 2014
- Seven Steps to Innovation
- Bridging the Gap from Bench to Bedside
- Science by the Masses

Indexed in PubMed® and MEDLINE®, products of the United States National Library of Medicine

PubMed MEDLINE U.S. National Library of Medicine

EMB IEEE

IEEE PULSE

A MAGAZINE OF THE IEEE ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY

JANUARY/FEBRUARY 2014
Volume 5 ▼ Number 1
http://magazine.embs.org

FEATURES

IMAGE LICENSED BY INGRAM PUBLISHING

COVER IMAGE: ©ISTOCKPHOTO.COM/VLADGRIN

COLUMNS & DEPARTMENTS

Digital Object Identifier 10.1109/MPUL.2013.2289457

Accelerating the Innovation Cycle

A Boston model seeks solutions for lagging ingenuity in health care

By John A. Parrish, Steven C. Schachter, Penny Ford Carleton, Mike Dempsey, Diane Spiliotis, and John Collins

If ever an industry was in need of both incremental and disruptive innovation, it is today's health care industry. Realizing the full potential of innovation across the spectrum of health care environments is critical to address the well-documented, emerging global crisis generated by the aging of the population, the obligation to increase access for all to the best standard of care, and the societal imperative to contain costs. In addition, as budgets at funders such as the U.S. National Institutes of Health (NIH), the U.K. National Health Service (NHS), and others are increasingly constrained, it is more important than ever to increase the efficiency and effectiveness with which investments in fundamental R&D translate into products, services, and procedures that improve the health and well-being of people around the world.

The painful conundrum and related opportunity are these: why has health care, one of the most technology-intensive industries, with tens of billions of dollars invested in R&D annually in the United States alone, not only failed to see more of an impact from that investment but also lagged behind the innovation performance of other industries? The 15+ years of experience at the Consortia for Improving Medicine with Innovation and Technology (CIMIT) in Boston, Massachusetts, offers insight into this puzzle and evidence that solutions are available to help realize the full power of technology and innovation in health care (see www.cimit.org).

Examples abound of the power of technology and innovation to enable disruptive step changes in performance while simultaneously slashing costs. One of the best known is Moore's law in semiconductors, which projects a doubling of central processing unit capacity every 18–24 months, typifying the exponential power of technology. Innovator and futurist Ray Kurzweil extended Moore's law to show that whenever a specific technology approaches some kind of physical limit, a new technology platform emerges to allow the exponential growth to continue, bypassing the perceived barrier (Figure 1).

What, then, is the basis for the general perception, if not reality, that

IMAGE COURTESY OF A*STAR

Digital Object Identifier 10.1109/MPUL.2013.2289464
Date of publication: 24 January 2014

2154-2287/14/$31.00©2014IEEE

new technologies and innovations in health care mostly result, at best, in incremental improvements at higher costs? Counter examples exist, such as the dramatic cost savings in genomic sequencing, outpacing Moore's law, and showing what technology can do in a laboratory setting, but the actual impact on health and wellness remains elusive. Experience in the pharma industry, codified as Eroom's law (see http://www.nature.com/nrd/journal/v11/n3/fig_tab/nrd3681_F1.html), illustrates the disappointing results in practice. Rather than show an improvement over time, the trend for new drug approvals by the U.S. Food and Drug Administration (FDA) per inflation-adjusted U.S. dollars spent on R&D shows a decrease of 50% every nine years—a negative rather than positive exponential growth.

Further, while no generally accepted law exists for health care as a whole, the U.S. macroeconomic picture of health care is consistent with Eroom's law. For example, as described by Michael Mandel, chief economic strategist at the Progressive Policy Institute (www.progressivepolicy.org), employment in the health care sector is rising faster than the growth of the population. The increase in employment, including from physicians, nurses, paraprofessionals, and support staff, far outstrips what can be explained by the increase in older Americans, and this is a key reason for rising health care costs—employment costs account for a much larger fraction than the cost of new drugs, supplies, and capital expenses for new technology. The most likely conclusion is that productivity in health care is actually in decline, with technology not improving productivity as it has in other industries.

There are many barriers unique to health care cited as reasons for the inability of technology to transform the health care industry. These include misaligned incentives, technological complexity, organizational fragmentation, physician training and bias, documentation burdens, and regulatory convolutions. While there are unique challenges in every industry, it is hard to argue that health care is so unique and different from all other industries that the impact of technologies is fundamentally different. CIMIT's premise is that lessons from other industries can inform the way that technologies and innovations can be better developed and used in health care.

CIMIT and the Health Care Innovation Cycle

CIMIT was founded in 1998 as a "living lab" to study and catalyze health care innovation. A "center without walls," its charter is to foster multidisciplinary and multi-institutional collaborations that bridge silos of medicine, technology, and business to rapidly improve patient care. CIMIT was an innovation itself: a new type of public–private partnership designed to support innovative translational research by leveraging and combining expertise from across academia, industry, and government to address unmet medical needs. By way of example, much of CIMIT's early funding came from the U.S. Department of Defense (DoD) through its Telemedicine and Advanced Technology and Research Command (TATRC) to help address the rapidly changing health care needs of soldiers and their families, with dual-use potential for the civilian population.

The CIMIT founders and leadership over the years recognized that addressing major challenges in translational research required treating the process of innovation in health care as a discipline itself. They had learned from experience that researchers working alone could not meet the transformative improvement needed in diagnostics and treatments for complex diseases and medical conditions. Instead, it requires close collaboration among innovative clinicians, engineers, scientists, and implementation experts. CIMIT created and cultivated an innovative model as a resource for translational research teams. Pioneered in Boston, CIMIT has since been widely emulated in other locales, successfully connecting clinical, engineering, and commercialization communities across

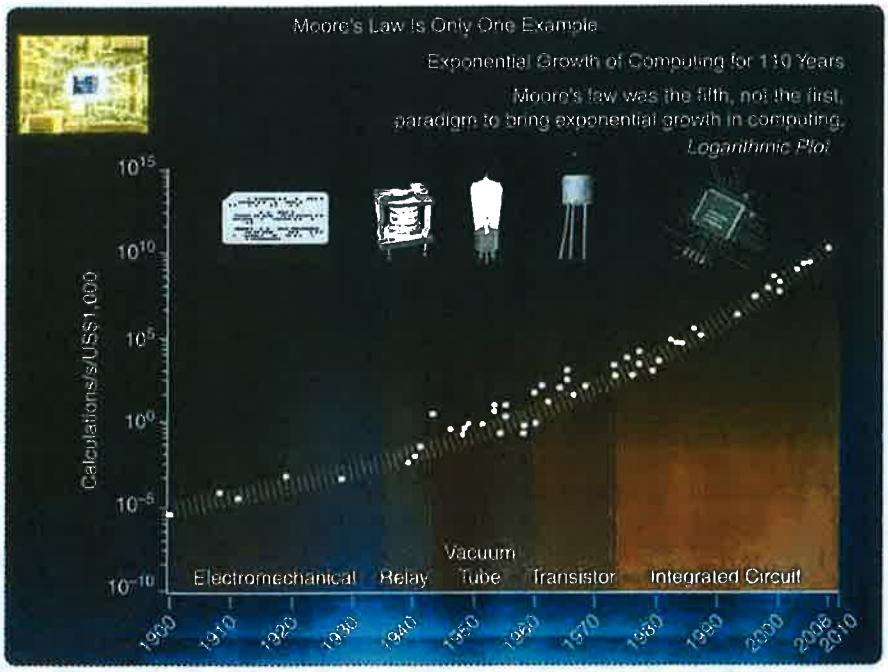


FIGURE 1 Moore's law as depicted by Ray Kurzweil shows the exponential growth of technology. (Image used with permission from Ray Kurzweil, kurzweilai.net.)

academic departments and institutions together with patient advocates, funders, and companies.

CIMIT is a voluntary consortium of independent institutions and represents a massive network of experts in medicine, life sciences, physical sciences, information technology, regulatory practice, and commercialization with a shared passion to bring about paradigm-changing outcomes. Steadily growing since 1998, the CIMIT consortium now draws on 13 academic medical centers, universities, and laboratories in the greater Boston area along with four international affiliates; the international affiliates include Manchester: Integrating Medicine and Innovative Technology (MIMIT) in the United Kingdom the Agency for Science, Technology and Research (A*STAR) in Singapore and the Eastern Health Alliance (EHA) in Singapore and just recently the AIAQS for the Catalan Health System in Spain (Figure 2).

CIMIT provides funders and investigators alike with a single portal into a huge pool of clinical and technology domain experts with an enormous diversity of talent and extensive expertise in areas relevant to all aspects of health care. Many of these experts are well-networked, international thought leaders whose contributions to innovative approaches to patient care have become standards of care.

From the start, CIMIT recognized that sophisticated innovation methods along with technologies developed for nonmedical uses could be applied to unmet medical needs. In addition, CIMIT observed that early stage, multidisciplinary translational projects have little chance of funding from conventional sources. In response, CIMIT focused on the often unrecognized and undervalued function of actively facilitating collaborations between multifunctional and multidisciplinary teams throughout the project life cycle to increase the potential for significant near-term clinical impact.

Over the years, CIMIT has evolved processes to efficiently and effectively define an important unmet medical need—perhaps the most critical of all ingredients—and then stimulate and support ideas to the point of creating clinical impact. We call the set of processes encountered on this journey *the health care innovation cycle* (Figure 3). CIMIT's experience results from facilitating more than 600 projects through some portion of or the entire journey. In working closely with project teams, CIMIT's facilitators focus on anticipating and then addressing the many reasons that disruptions occur in the transition from one stage of the health care innovation cycle to the next or a later stage (Figure 4).

CIMIT Leadership and Governance: Top-Down Support for the CIMIT Mission and Model

CIMIT's leadership team works closely with CIMIT faculty and investigators and enjoys significant bottom-up support from its investigators as a result. In addition, it receives important

CIMIT Consortium

- Beth Israel Deaconess Medical Center
- Boston Medical Center
- Boston University
- Brigham & Women's Hospital*
- Children's Hospital Boston
- Draper Laboratory*
- Harvard Medical School
- Massachusetts General Hospital*
- Massachusetts Institute of Technology*
- Newton-Wellesley Hospital
- Northeastern University
- Partners HealthCare
- VA Boston Healthcare System

* Founding Members

International Affiliates

- MIMIT (Manchester, United Kingdom)
- A*STAR (Singapore)
- Eastern Health Alliance (Singapore)
- AIAQS (Barcelona, Spain)

FIGURE 2 The list of CIMIT institutions has grown since the consortium's founding and now includes four international affiliates.

top-down support from its Executive Committee: the chief executive officers/presidents of all CIMIT consortium institutions. They provide critical infrastructure support, but more importantly, by participating personally, they demonstrate the organization's commitment to translating technologies into improved patient care.

Great efficiencies result from having a formal legal agreement between CIMIT and each consortium institution and affiliate. This establishes explicit expectations so that collaborative projects can start fast and with minimal administrative burden. For example, to overcome the challenges of managing intellectual property (IP) in multi-institutional projects, and to expedite IP filings by institutional tech transfer offices, the agreement sets clear guidelines that ensure each institution retains the rights to all IP generated by its investigators. The agreement also provides a process by which the institutions collaborate in prosecuting a patent, sharing the costs and returns. CIMIT is a neutral broker and retains no rights to investigator-generated IP, even though it provides seed funding and facilitation.

The CIMIT Model: Integrated Methods and Processes to Innovate in Health Care

Over the years, CIMIT has developed various integrated methods and processes referred to collectively as the CIMIT model (http://www.cimit.org/about-cimit-model.html) to find, fund, and facilitate collaborations that impact patient care.

- *Finding* significant unmet medical needs and identifying potential collaborators to work on solutions occurs through CIMIT-sponsored meetings, forums, innovation congresses, and other physical and virtual social networking opportunities. These events bring together diverse stakeholders from academia, MedTech, biopharma, the venture community, medical foundations, and representatives from government agencies, including the U.S. DoD, NIH, FDA, and Defense Advanced Research Projects Agency. By proactively engaging the broad CIMIT community to discover, evaluate, and address unmet needs, these events stimulate novel ideas and spawn new collaborations, leveraging synergies from across different technical and clinical domains, and encouraging creative problem solving.
- *Funding* investigator teams has taken many forms at CIMIT:
  - *Innovation Grants* support early stage, high-risk, collaborative research for improving patient care, with an emphasis on devices, procedures, diagnosis, or systems of care. They are typically one-year projects with budgets up to approximately US$100,000, intended to scientifically derisk a novel idea by showing early stage proof of concept.
  - *Accelerator awards* support the facilitation and execution costs of projects that have the potential for a commercial handoff in 12–18 months. Whereas Innovation Grant projects are proof of principle and scientifically derisk a project, projects that receive an Accelerator Award start with a proof of value and then develop and implement a plan to derisk projects technically and commercially for hand-off to industry via the lead institution Tech Transfer Office in 18–24 months.
  - *Fostering "rising stars"* takes on many forms at CIMIT. CIMIT sponsors several awards, fellowships, and student projects to attract the brightest new minds into this community of innovation. For example, the CIMIT Young Clinician Award recognizes outstanding clinicians within the consortium, early in their careers, who are engaged in the development of transformative innovations in health care. The awards are an important way CIMIT helps retain the best and brightest minds by providing a viable career-advancement path while encouraging the pursuit of high-risk–high-payoff translational work.

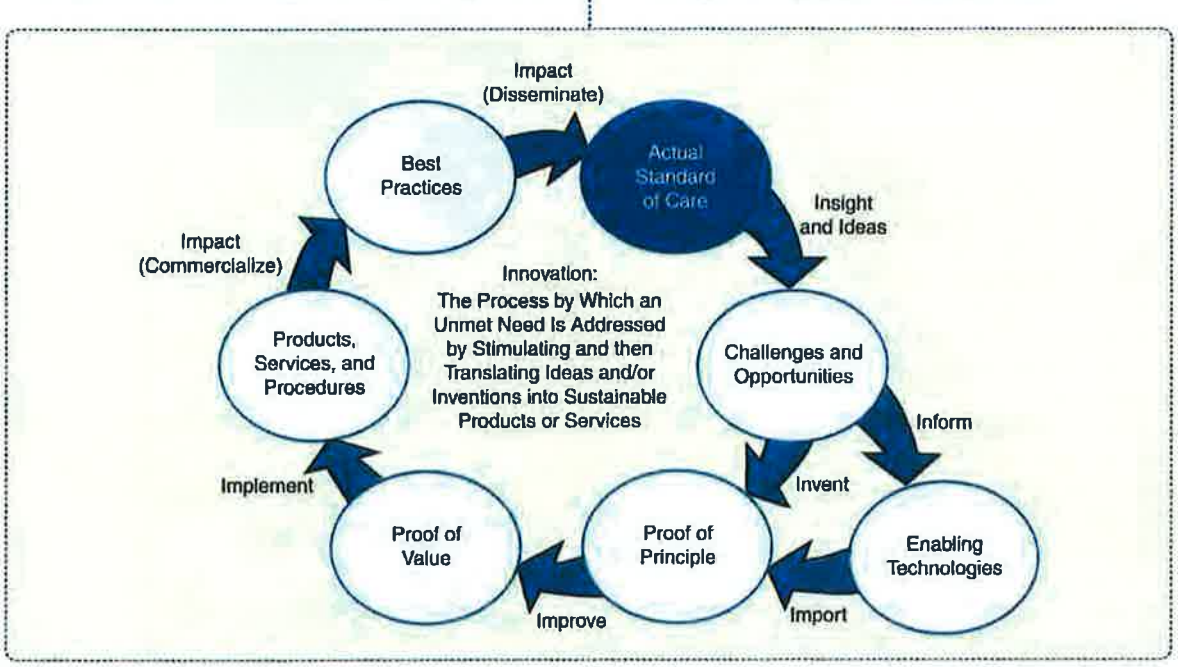


FIGURE 3 CIMIT has evolved processes to efficiently and effectively define an important unmet medical need and then stimulate and support ideas to the point of creating clinical impact, all part of the health care innovation cycle.

- *Facilitating* the formation and progress of teams of clinicians, engineers, and commercialization experts to propose and conduct translational research is the charge of CIMIT faculty, including site miners, program leaders, and accelerator executives, as well as CIMIT facilitators:
  - *Site miners* are senior members of the clinical research community who literally mine their institutions for projects and investigators deserving of funding and coaching. Site miners open and maintain dialogues between the clinicians and researchers at the front lines of health care and technology within their institutions. They work with CIMIT and its program leaders to find and assess areas of clinical unmet need, seek out and connect clinicians and scientists who have creative ideas about applying technologies to solve these patient-care challenges, provide seasoned guidance and mentorship for early career investigators, and serve as expert reviewers of proposals submitted to CIMIT in its grant processes. Site miners are the glue to connect people and ideas across the cultural walls of consortium institutions and even across the boundaries separating the departments within them. Collectively, CIMIT site miners have thousands of interactions with both established and potential investigators annually.
  - *Program leaders* are responsible for CIMIT's clinical and technical focus areas. They are senior researchers, faculty at a consortium institution, who seek out and bring together innovative scientists, clinicians, and engineers across the consortium to solve major unmet medical needs within their particular programmatic area. As national and international authorities on one or more medical or engineering specialties, program leaders serve as head coaches for the teams of investigators within their program area, imparting advice and offering encouragement as these researchers plan and execute their collaborative projects. They challenge CIMIT to pursue emerging areas of clinical need where devices and other technologies could make a powerful difference in the standard of care.
  - *Accelerator executives* are successful serial MedTech entrepreneurs and business leaders who proactively engage with teams to accelerate a handoff to industry within 12–18 months. This relatively short time requires that the accelerator executives work as a team as well as working intimately with the project team to not only advance the technology but also to develop and begin executing a complete strategy for moving the solution into practice, specifically transitioning the project from the academic to a commercial setting.
  - *CIMIT facilitators* are CIMIT staff members who provide facilitation and support for investigators. The expertise ranges from contracts and compliance to human use approvals and proposal writing.

CoLab: CIMIT in the Cloud to Encourage, Manage, and Measure Innovation

Effectively traversing the health care innovation cycle involves navigating numerous interrelated processes with geographically dispersed people and groups operating behind numerous institutional firewalls throughout the CIMIT consortium and beyond. In response to the resulting logistical challenges and to support other process-related functions, CIMIT leadership launched the development of a suite of cloud-based software tools—CIMIT CoLab, a health care collaboration platform—to manage those processes efficiently and to facilitate communications and collaborations across disciplines, functions, and institutional walls.

CoLab's developmental direction is established with the leading institutions across the globe with whom CIMIT is

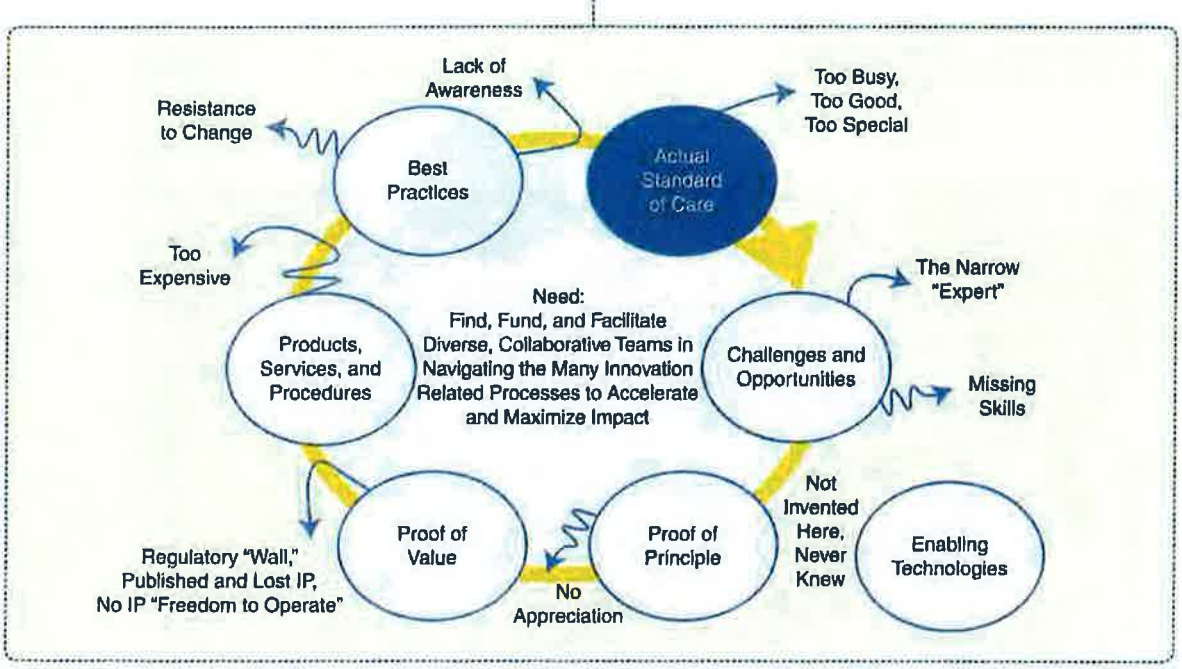


FIGURE 4 Working closely with project teams, CIMIT's facilitators focus on anticipating and addressing the reasons that disruptions occur in the transition from one stage of the health care innovation cycle to the next stage.

Case Study: MIMIT, the CIMIT Model Applied in Manchester

One of the first international affiliates of CIMIT was MIMIT.

Like CIMIT, the primary aim of MIMIT is to drive innovation to improve patient care. Clinicians, scientists, engineers, industry, tech transfer organizations, health economists, and investors are brought together in a structured way to catalyze development of innovative health care technologies through a rigorous analysis of clinical need and derisking of investment.

Led by Director Prof. Jackie Oldham (Figure S1), MIMIT forms a cornerstone of the Manchester Academic Health Science Centre (MAHSC), a partnership between The University of Manchester, Central Manchester University Hospitals NHS Foundation Trust, Manchester Mental Health and Social Care Trust, Salford Clinical Commissioning Group, Salford Royal NHS Foundation Trust, The Christie NHS Foundation Trust, and University Hospital of South Manchester NHS Foundation Trust (see www.mahsc.ac.uk).

FIGURE S1 Prof. Jackie Oldham is the director of MIMIT, the director of the Centre for Rehabilitation Science, the MAHSC health technology lead, and the honorary director of the Edward Centre for Healthcare Research.

During a four-year period, MIMIT has developed 38 projects identified by MIMIT site miners (Figure S2). These projects were selected from 148 unmet needs scoped from across the MAHSC partnership. Examples include repairing severed nerves, replacing damaged discs in the spine with novel microgels, next-generation colostomy bags, reducing ventilator-associated lung injury in children and adults, a new disposable tamponlike electrostimulation device to treat incontinence, and a device to help with swallowing post stroke.

MIMIT has provided £1.45 million initial direct investment (£15,000–100,000 per project) matched by an equal amount of indirect investment to support projects for approximately 12 months. To date, projects have received £5.1 million in direct funding to investigators (1:5 ratio) and £18 million in venture capital (VC) and industry investment (1:18 ratio). In addition, clinical research studentships/fellowships, and numerous publications/patents have arisen from MIMIT activity. Two of the MIMIT projects have won the Northern England Bionow Healthcare Project of the Year awards (2010 and 2012).

MIMIT projects have led to two new spinout companies, a third company has been taken up by a small to medium enterprise, and MIMIT is directly supporting two other small to medium enterprises in a joint project. Four projects are in commercial negotiations, and a further four are in the pipeline. In addition, MIMIT has contracted with three global companies to scope and validate unmet health care needs. A further seven projects have led to joint industry initiatives ranging from design to implementation.

MIMIT Statistics

A summary of statistics is as follows:

- 148 unmet needs considered
- 38 projects developed
- £1.45 million MIMIT direct investment
- £5.1 million follow-on investment
- in excess of £18 million VC/industry investment
- two Bionow Health Care Project of the Year awards (2010 and 2012)
- more than 20 industry collaborations.

FIGURE S2 Members gather for an MIMIT team meeting in April 2013.

The CIMIT Model in Singapore

A*STAR is the lead agency for fostering world-class scientific research and talent for a vibrant knowledge-based and innovation-driven Singapore (Figure S3). A*STAR oversees 14 biomedical and physical sciences and engineering research institutes, as well as six consortia and centers, located in and near the R&D complexes known as Biopolis (Figure S4) and Fusionopolis. A*STAR supports Singapore's key economic clusters by providing intellectual, human, and industrial capital to its partners in industry. It also supports extramural research at the universities, hospitals, research centers, and with other local and international partners.

In 2009, the A*STAR MedTech Initiative was launched with the mission to promote R&D in the MedTech sector to foster a vibrant and sustainable ecosystem in Singapore. The A*STAR MedTech Initiative currently oversees three programs: 1) the Biomedical Engineering Program (BEP), 2) the A*STAR-CIMIT-Eastern Health Alliance (EHA) Collaboration, and 3) the Singapore-Stanford Biodesign (SSB) Program.

The BEP is the flagship program that seeks to fund and facilitate the development of MedTech innovation from idea to first-in-man. To do this, the BEP fosters collaborations between Singapore's research performers and medical professionals to address unmet needs identified by the medical community. A competitive, multidisciplinary grant call is also administered yearly, in which all funded projects must be driven by needs identified by the clinical community and must demonstrate high potential for commercial outcome with a high likelihood to rapidly impact patient care.

Recognizing that the proven success of CIMIT in building a vibrant MedTech ecosystem in Boston could be leveraged to strengthen BEP, A*STAR has collaborated with CIMIT on growing MedTech innovations and activities between Singapore and Boston since January 2010. This mainly involves: 1) adopting and adapting CIMIT's "find, fund, and facilitate" model that is aimed at creating a CIMIT-like consortium among research engineers at

FIGURE S3 The A*STAR is leading Singapore in fostering world-class scientific research. (Photos courtesy of A*STAR.)

collaborating. CoLab currently comprises configurable modules that map to the health care innovation cycle. As an integrated solution, it can work alone or in combination with an institution's existing infrastructure to augment available social media, knowledge, and innovation management tools. It combines four key elements in one platform:

- *communities*: individuals and groups linked in dynamically defined roles
- *processes:* user-configurable, codified workflows for collaborative practices, such as the CIMIT model
- *portfolios:* projects and activities organized for reporting and management oversight
- *content:* secure, structured, Web-accessible information such as documents, wikis, videos, links, ratings, decisions, etc.

CoLab is being used by CIMIT and its collaborators to enable effective collaborations in managing processes, such as proposal and "challenge" calls; working together in secure, virtual workspaces; capturing metrics as well as providing a real-time dashboard on the status of a portfolio of projects, ideas, or initiatives. CIMIT alone was able to increase the number of ideas in its annual call by 50% while using less than one-half the staff time.

CIMIT Clinical Impact Study: Proof the CIMIT Model Works to Drive Solutions to Patient Care

By treating innovation in health care as a process, the pathway to improvement starts with measurement. As such, CIMIT conducted a clinical impact study (CIS) in 2009 and updated it again at the end of 2012 (final report is in preparation) to assess the outcomes of projects on which CIMIT had applied its "find, fund, and facilitate" model (see www.cimit.org/about-clinical-impact-study.html). Each analysis was limited to projects initiated more than three years before the analysis occurred to give projects a reasonable time to generate results. For both studies, the CIMIT leadership, with the help of investigators and program leaders, captured, quantified, and analyzed the impact created by the CIMIT-funded projects, including the resulting products, procedures, and services. The team quantified input metrics, such as funding and facilitation, as well as output metrics, such as patients impacted, publications, patents, and career impact.

The 2012 CIS evaluated a subset of CIMIT's entire portfolio that consisted of 538 Innovation Grant and Accelerator projects, representing US$62 million in funding. This portfolio comprised 175 stand-alone projects and 363 projects conducted as part of 106

A*STAR and clinicians in local hospitals, 2) collaborating on shorter-term projects from a pipeline of clinically vetted ideas from CIMIT with a shorter timeline toward clinical applications, and 3) launching bilateral grant calls to initiate upstream and longer-term collaborative projects between Boston and Singapore engineers and/or clinicians to build capabilities, know-how, and IP in MedTech innovations.

Through the A*STAR-CIMIT Collaboration, A*STAR has successfully adopted CIMIT's best practices by implementing the rigorous and highly selective process for finding, funding, and facilitating projects with high potential for improving care in the near term. The BEP currently engages the CIMIT faculty in the review of BEP project proposals. A*STAR has also adapted several initiatives, such as the BEP MedTech Innovation Forums, which are conducted quarterly, and the appointment of site miners in several of Singapore's hospitals, universities, and A*STAR research institutes. A*STAR has also appointed its program leaders in the clinical domains of cardiology, ophthalmology, and neurology with the aim to build peaks of excellence within these areas. Two late-stage technology development projects have also been successfully brought into Singapore to increase the pipeline of commercially viable projects and adapt these technologies for the Asian market, one of which is now in clinical deployment. In November 2012, EHA joined as the third member of this collaboration. Accession to the collaboration allows EHA to leverage CIMIT's expertise, as well as A*STAR's research capabilities to introduce novel medical products, services, and procedures to EHA's network of clinicians to improve patient care.

The innovations coming out of this collaboration are many. They include new technology to reduce hospital acquired infection through a high-tech hand-washing monitoring system, self-help kiosks to help improve patient care and alleviate long wait times in crowded clinics, a new technology to automatically screen and diagnose large populations for glaucoma, and a brain–computer interface system that can help patients get personalized stroke rehabilitation outside a rehabilitation center.

FIGURE S4 The Biopolous campus in Singapore. (Photo courtesy of A*STAR.)

Also launched in January 2010, the SSB Program is a partnership between A*STAR, EDB, and Stanford University and is a talent development initiative that seeks to nurture and train the next generation of Asian medical device innovators in Singapore, serving Asia and beyond. Modeled after the established Biodesign Program at Stanford University, the SSB Program comprises the following components: 1) a one-year SSB fellowship, where fellows will undergo six months of training in the Biodesign process at Stanford University and will be based in Singapore for the remaining six months to bring their solution to the prototype or proof-of-concept stage; 2) the SSB Innovation Class, which allows graduate students at Singapore's tertiary institutions to undertake a semester-long innovation class, providing students accelerated exposure to the MedTech innovation process; and 3) the SSB-organized seminars, where key opinion leaders around the world will share and discuss the latest industry insights and experiences on medical technology development.

packs [defined as a group of tightly interconnected projects, typically under multiple principal investigators (PIs), for which the clinical impact created could not be attributed to any single project]. As of 2013, the projects CIMIT has supported have resulted in more than

- 36 companies or new product lines being formed
- 460-issued U.S. patents (with foreign counterparts in addition) along with more than 320 patent applications pending
- 700 peer-reviewed publications
- A 12:1 ratio in follow-on funding generated:
  - 3:1 for funding directly to the PI
  - 9:1 for commercial investment.

Correlations between the input and output variables provided insights that CIMIT is using to further improve how it uses resources. Some examples of the key lessons learned that emerged from studying the trends and correlations include the following:

- *Sweet spot*: CIMIT's greatest "bang for the buck" occurred in supporting numerous high-risk, early stage innovative projects, with funding in the US$100,000–300,000 range. While more funding created more clinical impact, this range is where CIMIT spends its resources most efficiently, with other organizations providing follow-on funding to advance them further.
- *Facilitation*: Regardless of the size of the grant or the promise of the study, targeted and skilled facilitation is a powerful amplifier of success. In addition, while facilitation is valuable at any stage of the innovation cycle, from the preproposal phase onward, it is most valuable in the early stages, particularly including the prefunded team-formation stage.
- *Packs*: A closely related insight is that projects conducted in packs were much more likely to achieve commercial success than single projects. Even when normalized by the amount of CIMIT funding, packs received ~20 times more commercial funding and garnered almost three times more awarded patents (about nine patents for each US$1 million CIMIT invested in packs versus about three for individual projects per US$1 million CIMIT funding).
- *Clustering*: Projects and packs conducted as part of a cluster of activities are more effective than those done in isolation. Clusters represent thematic communities of interest, examples being: optical coherence tomography, simulation mannequins for training medics and first responders, and near infrared light for neurological and cancer treatment. Clusters are not managed by a single person or group—they are effectively

facilitated by peers, CIMIT staff, and strong CIMIT program leaders. They benefit from the broader resource-rich environment of talent across the CIMIT consortium.

- *New translational investigators:* Junior faculty members were as successful as more senior investigators working within the CIMIT model to conduct translational research. Mentorship, raw talent, and "fresh eyes" were cited as potential equalizing factors along with the CIMIT facilitation.

We fully expect that the application of these lessons that have been learned over CIMIT's 15+ years will create even better results in the future.

Lessons Learned in Other Locales

The CIMIT model has been adapted and demonstrated to work just as effectively, if not even more so, in Manchester, United Kingdom, at MIMIT and in Singapore at A*STAR and the EHA (see "Case Study: MIMIT, the CIMIT Model Applied in Manchester" and "The CIMIT Model in Singapore"). A new collaboration in Catalonia is just starting. Success in adapting and implementing the CIMIT model in these locations has created more impact through the strong clinical and academic institutions that are in place. Through these experiences, we have learned that the model is not dependent on Boston's uniquely rich ecosystem. We have found that some key lessons do exist in successfully adapting and using the CIMIT model:

- *Institutional support and leverage:* Top-down institutional support, engaged site miners (or equivalent), good alignment with institutional priorities, and active involvement of clinical and research staff as well as support from functional departments such as marketing, tech transfer, legal, etc., are critical. In addition, working closely with and heavily leveraging other local resources is equally important to focus the finite resources available. In Boston's case, we are fortunate to leverage many organizations, including MassMEDIC, a trade organization of medical device companies, and the Mass Life Science Center, a state-funded initiative to grow the life science sector.
- *Resources:* A committed core team on the ground with a strong, well-connected leader and efficient methods to operate and connect people (with tools such as CoLab) along with a three- to five-year funding window to sustainability, most preferably from a number of sources to enhance sustainability.
- *Metrics of success:* Clear goals that are aligned with the priorities of the funders, be they oriented around general clinical impact (such as number of patients treated, cost savings, etc.), progress in treating specific conditions (such as trauma or neuropsych health), regional economic growth (number of jobs created, investment generated, etc.), or some combination, along with infrastructure to track the results.

CIMIT draws its power from networking the rich capabilities at its consortium institutions. As such, CIMIT has found that even more impact is created by networking CIMIT-like organizations across geographies. As the number of "nodes" in the network increases, thematic networks are being created, and solutions available in one locale are being used to address clinical problems in another.

Conclusions

Innovation in health care is an imperative. It is a process driven by clinical needs, and its practice should be studied, codified, shared, measured, and subject to continuous improvement. This is a well-accepted premise in most other industries, and CIMIT has shown it can apply in health care.

Successfully innovating to address an unmet clinical need does have unique challenges. It requires multidisciplinary teams of experts, often from different organizations, collaborating through a complex journey with misaligned incentives and strict constraints to protect patients from harm, operating in highly competitive and constantly evolving business and regulatory environments. Being able to navigate the journey through the cycle of innovation is a discipline itself. Historically, the discipline was "learned by doing," often without training or mentorship, or even worse, with mentors that had learned lessons that no longer apply. The CIMIT model, at its most fundamental level, addresses these historical problems by treating innovation as a learnable and dynamic process, linking a network of collaborators, providing seed funding and a virtual support infrastructure, and delivering expert facilitation. The combination helps teams focus on addressing the right clinical issues, getting the right collaborators, streamlining administrative obligations, anticipating challenges, and making decisions throughout the journey to use scarce resources in a way that minimizes risk and maximizes patient impact. The CIMIT model works well in Boston and elsewhere when adapted. It also has the potential to create even more impact by linking hubs of medical innovation across the world to address important challenges. It offers funders, academic health care centers, universities, and the private sector a successful model from which to learn and build upon to realize the exponential power of technology and accelerate the health care innovation cycle.

Acknowledgments

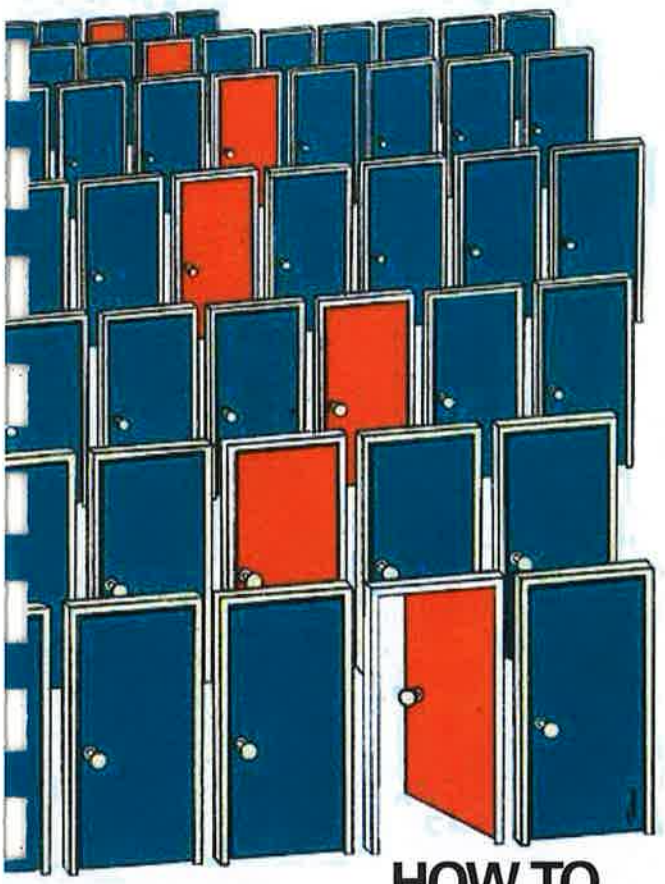
The authors are grateful to all of the program leaders, site miners, investigators, executive committee members, and CIMIT facilitators whose work and shared dedication to patients and wounded warriors have made CIMIT possible. They also thank the DoD and TATRC for their unwavering support.

John A. Parrish (jparrish@partners.org) *is an Edward Wigglesworth Distinguished Professor Emeritus of Dermatology at Harvard Medical School.* ***Steven C. Schachter (sschacht@bidmc.harvard.edu)*** *is the chief academic officer and program leader of neurotechnology at CIMIT and a professor of neurology at Harvard Medical School.* ***Penny Ford Carleton (pcarleton@partners.org)*** *is the program leader for CIMIT's Clinical Systems Innovation Program, the program manager for NIBIB Point-of-Care Technology Center in Primary Care, and the coordinator of the CIMIT/Boston Simulation Consortium.* ***Mike Dempsey (mdempsey1@partners.org)*** *is CIMIT's entrepreneur in residence and leads the Accelerator Program.* ***Diane Spiliotis (dspiliotis@partners.org)*** *is the chief finance and information officer at CIMIT.* ***John Collins (Jcollins11@partners.org)*** *is the chief operating officer at CIMIT.*

PARADOX AT TOYOTA...page 96 CLARITY AT IDEO...page 84

Harvard Business Review

www.hbr.org June 2008



HOW TO DELIVER ON A GREAT PLAN

...page 60


Design

Thinking like a designer can transform the way you develop products, services, processes – and even strategy.

Thinking

by Tim Brown

THOMAS EDISON created the electric lightbulb and then wrapped an entire industry around it. The lightbulb is most often thought of as his signature invention, but Edison understood that the bulb was little more than a parlor trick without a system of electric power generation and transmission to make it truly useful. So he created that, too.

Thus Edison's genius lay in his ability to conceive of a fully developed marketplace, not simply a discrete device. He was able to envision how people would want to use what he made, and he engineered toward that insight. He wasn't always prescient (he

Photo courtesy of IDEO

originally believed the phonograph would be used mainly as a business machine for recording and replaying dictation), but he invariably gave great consideration to users' needs and preferences.

Edison's approach was an early example of what is now called "design thinking" – a methodology that imbues the full spectrum of innovation activities with a human-centered design ethos. By this I mean that innovation is powered by a thorough understanding, through direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold, and supported.

Many people believe that Edison's greatest invention was the modern R&D laboratory and methods of experimental investigation. Edison wasn't a narrowly specialized scientist but a broad generalist with a shrewd business sense. In his Menlo Park, New Jersey, laboratory he surrounded himself with gifted tinkerers, improvisers, and experimenters. Indeed, he broke the mold of the "lone genius inventor" by creating a team-based approach to innovation. Although Edison biographers write of the camaraderie enjoyed by this merry band, the process also featured endless rounds of trial and error – the "99% perspiration" in Edison's famous definition of genius. His approach was intended not to validate preconceived hypotheses but to help experimenters learn something new from each iterative stab. Innovation is hard work; Edison made it a profession that blended art, craft, science, business savvy, and an astute understanding of customers and markets.

The surgeons described a new device for sinus surgery. One designer grabbed a marker, a film canister, and a clothespin and taped them together. "Do you mean like this?" he asked.

Design thinking is a lineal descendant of that tradition. Put simply, it is a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity. Like Edison's painstaking innovation process, it often entails a great deal of perspiration.

I believe that design thinking has much to offer a business world in which most management ideas and best practices are freely available to be copied and exploited. Leaders now look to innovation as a principal source of differentiation and competitive advantage; they would do well to incorporate design thinking into all phases of the process.

Getting Beneath the Surface

Historically, design has been treated as a downstream step in the development process – the point where designers, who have played no earlier role in the substantive work of innovation, come along and put a beautiful wrapper around the idea. To be sure, this approach has stimulated market growth in many areas by making new products and technologies aesthetically attractive and therefore more desirable to consumers or by enhancing brand perception through smart, evocative advertising and communication strategies. During the latter half of the twentieth century design became an increasingly valuable competitive asset in, for example, the consumer electronics, automotive, and consumer packaged goods industries. But in most others it remained a late-stage add-on.

Now, however, rather than asking designers to make an already developed idea more attractive to consumers, companies are asking them to create ideas that better meet consumers' needs and desires. The former role is tactical, and results in limited value creation; the latter is strategic, and leads to dramatic new forms of value.

Moreover, as economies in the developed world shift from industrial manufacturing to knowledge work and service delivery, innovation's terrain is expanding. Its objectives are no longer just physical products; they are new sorts of processes, services, IT-powered interactions, entertainments, and ways of communicating and collaborating – exactly the kinds of human-centered activities in which design thinking can make a decisive difference. (See the sidebar "A Design Thinker's Personality Profile.")

Consider the large health care provider Kaiser Permanente, which sought to improve the overall quality of both patients' and medical practitioners' experiences. Businesses in the service sector can often make significant innovations on the front lines of service creation and delivery. By teaching design thinking techniques to nurses, doctors, and administrators, Kaiser hoped to inspire its practitioners to contribute new ideas. Over the course of several months Kaiser teams participated in workshops with the help of my firm, IDEO, and a group of Kaiser coaches. These workshops led to a portfolio of innovations, many of which are being rolled out across the company.

One of them – a project to reengineer nursing-staff shift changes at four Kaiser hospitals – perfectly illustrates both the broader nature of innovation "products" and the value of a holistic design approach. The core project team included a strategist (formerly a nurse), an organizational-development specialist, a technology expert, a process designer, a union representative, and designers from IDEO. This group worked with innovation teams of frontline practitioners in each of the four hospitals.

During the earliest phase of the project, the core team collaborated with nurses to identify a number of problems in the way shift changes occurred. Chief among these was the fact that nurses routinely spent the first 45 minutes of each shift at the nurses' station debriefing the departing shift about the status of patients. Their methods of information exchange were

A Design Thinker's Personality Profile

Contrary to popular opinion, you don't need weird shoes or a black turtleneck to be a design thinker. Nor are design thinkers necessarily created only by design schools, even though most professionals have had some kind of design training. My experience is that many people outside professional design have a natural aptitude for design thinking, which the right development and experiences can unlock. Here, as a starting point, are some of the characteristics to look for in design thinkers:

Empathy. They can imagine the world from multiple perspectives – those of colleagues, clients, end users, and customers (current and prospective). By taking a "people first" approach, design thinkers can imagine solutions that are inherently desirable and meet explicit or latent needs. Great design thinkers observe the world in minute detail. They notice things that others do not and use their insights to inspire innovation.

Integrative thinking. They not only rely on analytical processes (those that produce either/or choices) but also exhibit the ability to see all of the salient – and sometimes contradictory – aspects of a confounding problem and create novel solutions that go beyond and dramatically improve on existing alternatives. (See Roger Martin's *The Opposable Mind: How Successful Leaders Win Through Integrative Thinking.*)

Optimism. They assume that no matter how challenging the constraints of a given problem, at least one potential solution is better than the existing alternatives.

Experimentalism. Significant innovations don't come from incremental tweaks. Design thinkers pose questions and explore constraints in creative ways that proceed in entirely new directions.

Collaboration. The increasing complexity of products, services, and experiences has replaced the myth of the lone creative genius with the reality of the enthusiastic interdisciplinary collaborator. The best design thinkers don't simply work alongside other disciplines; many of them have significant experience in more than one. At IDEO we employ people who are engineers *and* marketers, anthropologists *and* industrial designers, architects *and* psychologists.

different in every hospital, ranging from recorded dictation to face-to-face conversations. And they compiled the information they needed to serve patients in a variety of ways – scrawling quick notes on the back of any available scrap of paper, for example, or even on their scrubs. Despite a significant investment of time, the nurses often failed to learn some of the things that mattered most to patients, such as how they had fared during the previous shift, which family members were with them, and whether or not certain tests or therapies had been administered. For many patients, the team learned, each shift change felt like a hole in their care. Using the insights gleaned from observing these important times of transition, the innovation teams explored potential solutions through brainstorming and rapid prototyping. (Prototypes of a service innovation will of course not be physical, but they must be tangible. Because pictures help us understand what is learned through prototyping, we often videotape the performance of prototyped services, as we did at Kaiser.)

Prototyping doesn't have to be complex and expensive. In another health care project, IDEO helped a group of surgeons develop a new device for sinus surgery. As the surgeons described the ideal physical characteristics of the instrument, one of the designers grabbed a whiteboard marker, a film canister, and a clothespin and taped them together. "Do you mean like this?" he asked. With his rudimentary prototype in hand, the surgeons were able to be much more precise about what the ultimate design should accomplish.

Prototypes should command only as much time, effort, and investment as are needed to generate useful feedback and evolve an idea. The more "finished" a prototype seems, the less likely its creators will be to pay attention to and profit from feedback. The goal of prototyping isn't to finish. It is to learn about the strengths and weaknesses of the idea and to identify new directions that further prototypes might take.

The design that emerged for shift changes had nurses passing on information in front of the patient rather than at the nurses' station. In only a week the team built a working prototype that included new procedures and some simple software with which nurses could call up previous shift-change notes and add new ones. They could input patient information throughout a shift rather than scrambling at the end to pass it on. The software collated the data in a simple format customized for each nurse at the start of a shift. The result was both higher-quality knowledge transfer and reduced prep time, permitting much earlier and better-informed contact with patients.

As Kaiser measured the impact of this change over time, it learned that the mean interval between a nurse's arrival and first interaction with a patient had been more than halved, adding a huge amount of nursing time across the four hospitals. Perhaps just as important was the effect on the quality of the nurses' work experience. One nurse commented, "I'm an hour ahead, and I've only been here 45 minutes." Another

said, "[This is the] first time I've ever made it out of here at the end of my shift."

Thus did a group of nurses significantly improve their patients' experience while also improving their own job satisfaction and productivity. By applying a human-centered design methodology, they were able to create a relatively small process innovation that produced an outsize impact. The new shift changes are being rolled out across the Kaiser system, and the capacity to reliably record critical patient information is being integrated into an electronic medical records initiative at the company.

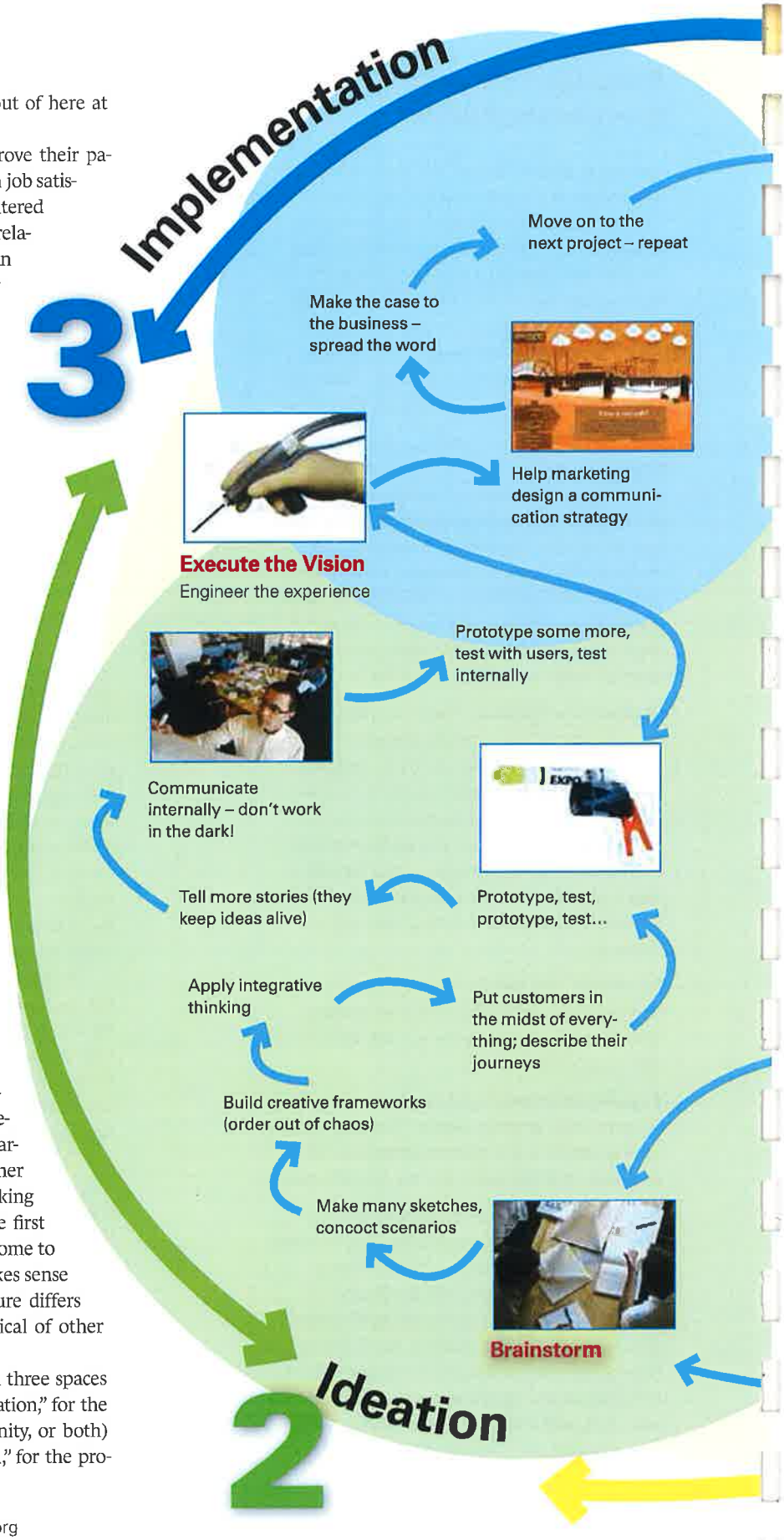
What might happen at Kaiser if every nurse, doctor, and administrator in every hospital felt empowered to tackle problems the way this group did? To find out, Kaiser has created the Garfield Innovation Center, which is run by Kaiser's original core team and acts as a consultancy to the entire organization. The center's mission is to pursue innovation that enhances the patient experience and, more broadly, to envision Kaiser's "hospital of the future." It is introducing tools for design thinking across the Kaiser system.

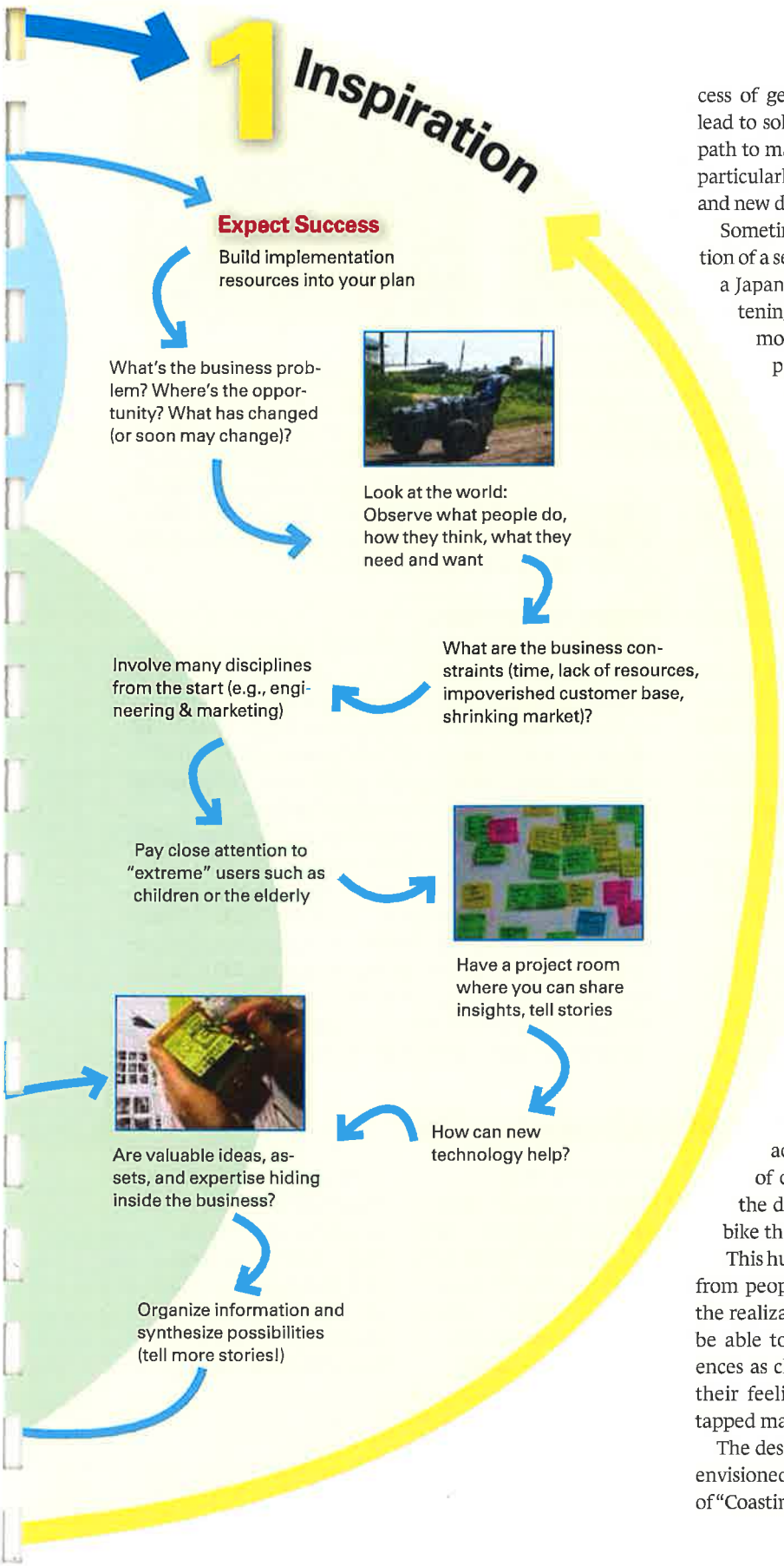
How Design Thinking Happens

The myth of creative genius is resilient: We believe that great ideas pop fully formed out of brilliant minds, in feats of imagination well beyond the abilities of mere mortals. But what the Kaiser nursing team accomplished was neither a sudden breakthrough nor the lightning strike of genius; it was the result of hard work augmented by a creative human-centered discovery process and followed by iterative cycles of prototyping, testing, and refinement.

The design process is best described metaphorically as a system of spaces rather than a predefined series of orderly steps. The spaces demarcate different sorts of related activities that together form the continuum of innovation. Design thinking can feel chaotic to those experiencing it for the first time. But over the life of a project participants come to see – as they did at Kaiser – that the process makes sense and achieves results, even though its architecture differs from the linear, milestone-based processes typical of other kinds of business activities.

Design projects must ultimately pass through three spaces (see the exhibit at right). We label these "inspiration," for the circumstances (be they a problem, an opportunity, or both) that motivate the search for solutions; "ideation," for the pro-





cess of generating, developing, and testing ideas that may lead to solutions; and "implementation," for the charting of a path to market. Projects will loop back through these spaces – particularly the first two – more than once as ideas are refined and new directions taken.

Sometimes the trigger for a project is leadership's recognition of a serious change in business fortunes. In 2004 Shimano, a Japanese manufacturer of bicycle components, faced flattening growth in its traditional high-end road-racing and mountain-bike segments in the United States. The company had always relied on technology innovations to drive its growth and naturally tried to predict where the next one might come from. This time Shimano thought a high-end casual bike that appealed to boomers would be an interesting area to explore. IDEO was invited to collaborate on the project.

During the inspiration phase, an interdisciplinary team of IDEO and Shimano people – designers, behavioral scientists, marketers, and engineers – worked to identify appropriate constraints for the project. The team began with a hunch that it should focus more broadly than on the high-end market, which might prove to be neither the only nor even the best source of new growth. So it set out to learn why 90% of American adults don't ride bikes. Looking for new ways to think about the problem, the team members spent time with all kinds of consumers. They discovered that nearly everyone they met rode a bike as a child and had happy memories of doing so. They also discovered that many Americans are intimidated by cycling today – by the retail experience (including the young, Lycra-clad athletes who serve as sales staff in most independent bike stores); by the complexity and cost of the bikes, accessories, and specialized clothing; by the danger of cycling on roads not designed for bicycles; and by the demands of maintaining a technically sophisticated bike that is ridden infrequently.

This human-centered exploration – which took its insights from people outside Shimano's core customer base – led to the realization that a whole new category of bicycling might be able to reconnect American consumers to their experiences as children while also dealing with the root causes of their feelings of intimidation – thus revealing a large untapped market.

The design team, responsible for every aspect of what was envisioned as a holistic experience, came up with the concept of "Coasting." Coasting would aim to entice lapsed bikers into

A SKETCH (left, seat plus helmet storage) and a PROTOTYPE (middle) show elements of Coasting bicycles. Shimano's Coasting WEBSITE (right) points users to safe bike paths.

an activity that was simple, straightforward, and fun. Coasting bikes, built more for pleasure than for sport, would have no controls on the handlebars, no cables snaking along the frame. As on the earliest bikes many of us rode, the brakes would be applied by backpedaling. With the help of an onboard computer, a minimalist three gears would shift automatically as the bicycle gained speed or slowed. The bikes would feature comfortably padded seats, be easy to operate, and require relatively little maintenance.

Three major manufacturers – Trek, Raleigh, and Giant – developed new bikes incorporating innovative components from Shimano. But the design team didn't stop with the bike itself. In-store retailing strategies were created for independent bike dealers, in part to alleviate the discomfort that biking novices felt in stores designed to serve enthusiasts. The team developed a brand that identified Coasting as a way to enjoy life. ("Chill. Explore. Dawdle. Lollygag. First one there's a rotten egg.") And it designed a public relations campaign – in collaboration with local governments and cycling organizations – that identified safe places to ride.

Although many others became involved in the project when it reached the implementation phase, the application of design thinking in the earliest stages of innovation is what led to this complete solution. Indeed, the single thing one would have expected the design team to be responsible for – the look of the bikes – was intentionally deferred to later in the development process, when the team created a reference design to inspire the bike companies' own design teams. After a successful launch in 2007, seven more bicycle manufacturers signed up to produce Coasting bikes in 2008.

Taking a Systems View

Many of the world's most successful brands create breakthrough ideas that are inspired by a deep understanding of consumers' lives and use the principles of design to innovate and build value. Sometimes innovation has to account for vast differences in cultural and socioeconomic conditions. In such cases design thinking can suggest creative alternatives to the assumptions made in developed societies.

India's Aravind Eye Care System is probably the world's largest provider of eye care. From April 2006 to March 2007 Aravind served more than 2.3 million patients and performed more than 270,000 surgeries. Founded in 1976 by Dr. G. Venkataswamy, Aravind has as its mission nothing less than the eradication of needless blindness among India's population, including the rural poor, through the effective delivery of superior ophthalmic care. (One of the company's slogans is "Quality is for everyone.") From 11 beds in Dr. Venkataswamy's home, Ara-

How to Make Design Thinking Part of the Innovation Drill

Begin at the beginning. Involve design thinkers at the very start of the innovation process, before any direction has been set. Design thinking will help you explore more ideas more quickly than you could otherwise.

Take a human-centered approach. Along with business and technology considerations, innovation should factor in human behavior, needs, and preferences. Human-centered design thinking – especially when it includes research based on direct observation – will capture unexpected insights and produce innovation that more precisely reflects what consumers want.

Try early and often. Create an expectation of rapid experimentation and prototyping. Encourage teams to create a prototype in the first week of a project. Measure progress with a metric such as average time to first prototype or number of consumers exposed to prototypes during the life of a program.

Seek outside help. Expand the innovation ecosystem by looking for opportunities to co-create with customers and consumers. Exploit Web 2.0 networks to enlarge the effective scale of your innovation team.

ARAVIND'S outreach to rural patients frequently brings basic DIAGNOSTIC TOOLS (left and center) and an advanced satellite-linked TELEMEDICINE TRUCK (right) to remote areas of India.

vind has grown to encompass five hospitals (three others are under Aravind management), a plant that manufactures ophthalmic products, a research foundation, and a training center.

Aravind's execution of its mission and model is in some respects reminiscent of Edison's holistic concept of electric power delivery. The challenge the company faces is logistic: how best to deliver eye care to populations far removed from the urban centers where Aravind's hospitals are located. Aravind calls itself an "eye care system" for a reason: Its business goes beyond ophthalmic care per se to transmit expert practice to populations that have historically lacked access. The company saw its network of hospitals as a beginning rather than an end.

Much of its innovative energy has focused on bringing both preventive care and diagnostic screening to the countryside. Since 1990 Aravind has held "eye camps" in India's rural areas, in an effort to register patients, administer eye exams, teach eye care, and identify people who may require surgery or advanced diagnostic services or who have conditions that warrant monitoring.

In 2006 and early 2007 Aravind eye camps screened more than 500,000 patients, of whom nearly 113,000 required surgery. Access to transportation is a common problem in rural areas, so the company provides buses that take patients needing further treatment to one of its urban facilities and then home again. Over the years it has bolstered its diagnostic capabilities in the field with telemedicine trucks, which enable doctors back at Aravind's hospitals to participate in care decisions. In recent years Aravind's analysis of its screening data has led to specialized eye camps for certain demographic groups, such as school-age children and industrial and government workers; the company also holds camps specifically to screen for eye diseases associated with diabetes. All these services are free for the roughly 60% of patients who cannot afford to pay.

In developing its system of care, Aravind has consistently exhibited many characteristics of design thinking. It has used as a creative springboard two constraints: the poverty and remoteness of its clientele and its own lack of access to expensive solutions. For example, a pair of intraocular lenses made in the West costs $200, which severely limited the number of patients Aravind could help. Rather than try to persuade suppliers to change the way they did things, Aravind built its own solution: a manufacturing plant in the basement of one of its hospitals. It eventually discovered that it could use relatively inexpensive technology to produce lenses for $4 a pair.

Throughout its history – defined by the constraints of poverty, ignorance, and an enormous unmet need – Aravind has built a systemic solution to a complex social and medical problem.

Blend big and small projects. Manage a portfolio of innovation that stretches from shorter-term incremental ideas to longer-term revolutionary ones. Expect business units to drive and fund incremental innovation, but be willing to initiate revolutionary innovation from the top.

Budget to the pace of innovation. Design thinking happens quickly, yet the route to market can be unpredictable. Don't constrain the pace at which you can innovate by relying on cumbersome budgeting cycles. Be prepared to rethink your funding approach as projects proceed and teams learn more about opportunities.

Find talent any way you can. Look to hire from interdisciplinary programs like the new Institute of Design at Stanford and progressive business schools like Rotman, in Toronto. People with more-conventional design backgrounds can push solutions far beyond your expectations. You may even be able to train nondesigners with the right attributes to excel in design-thinking roles.

Design for the cycle. In many businesses people move every 12 to 18 months. But design projects may take longer than that to get from day one through implementation. Plan assignments so that design thinkers go from inspiration to ideation to implementation. Experiencing the full cycle builds better judgment and creates great long-term benefits for the organization.

Getting Back to the Surface

I argued earlier that design thinking can lead to innovation that goes beyond aesthetics, but that doesn't mean that form and aesthetics are unimportant. Magazines like to publish photographs of the newest, coolest products for a reason: They are sexy and appeal to our emotions. Great design satisfies both our needs and our desires. Often the emotional connection to a product or an image is what engages us in the first place. Time and again we see successful products that were not necessarily the first to market but were the first to appeal to us emotionally *and* functionally. In other words, they do the job and we love them. The iPod was not the first MP3 player, but it was the first to be delightful. Target's products appeal emotionally through design and functionally through price – simultaneously.

This idea will grow ever more important in the future. As Daniel Pink writes in his book *A Whole New Mind*, "Abundance has satisfied, and even over-satisfied, the material needs of millions – boosting the significance of beauty and emotion and accelerating individuals' search for meaning." As more of our basic needs are met, we increasingly expect sophisticated experiences that are emotionally satisfying and meaningful. These experiences will not be simple products. They will be complex combinations of products, services, spaces, and information. They will be the ways we get educated, the ways we are entertained, the ways we stay healthy, the ways we share and communicate. Design thinking is a tool for imagining these experiences as well as giving them a desirable form.

One example of experiential innovation comes from a financial services company. In late 2005 Bank of America launched a new savings account service called "Keep the Change." IDEO, working with a team from the bank, helped identify a consumer behavior that many people will recognize: After paying cash for something, we put the coins we received in change into a jar at home. Once the jar is full, we take the coins to the bank and deposit them in a savings account. For many people, it's an easy way of saving. Bank of America's innovation was to build this behavior into a debit card account. Customers who use their debit cards to make purchases can now choose to have the total rounded up to the nearest dollar and the difference deposited in their savings accounts.

The success of this innovation lay in its appeal to an instinctive desire we have to put money aside in a painless and invisible way. Keep the Change creates an experience that feels natural because it models behavior that many of us already exhibit. To be sure, Bank of America sweetens the deal by matching 100% of the change saved in the first three months and 5% of annual totals (up to $250) thereafter. This encourages customers to try it out. But the real payoff is emotional: the gratification that comes with monthly statements showing customers they've saved money without even trying.

In less than a year the program attracted 2.5 million customers. It is credited with 700,000 new checking accounts and a million new savings accounts. Enrollment now totals more than 5 million people who together have saved more than $500 million. Keep the Change demonstrates that design thinking can identify an aspect of human behavior and then convert it into both a customer benefit and a business value.

Thomas Edison represents what many of us think of as a golden age of American innovation – a time when new ideas transformed every aspect of our lives. The need for transformation is, if anything, greater now than ever before. No matter where we look, we see problems that can be solved only through innovation: unaffordable or unavailable health care, billions of people trying to live on just a few dollars a day, energy usage that outpaces the planet's ability to support it, education systems that fail many students, companies whose traditional markets are disrupted by new technologies or demographic shifts. These problems all have people at their heart. They require a human-centered, creative, iterative, and practical approach to finding the best ideas and ultimate solutions. Design thinking is just such an approach to innovation.

Tim Brown *(tbrown@ideo.com) is the CEO and president of IDEO, an innovation and design firm with headquarters in Palo Alto, California. His designs have won numerous awards and been exhibited at the Museum of Modern Art in New York, the Axis Gallery in Tokyo, and the Design Museum in London.*

Reprint R0806E

"It's good to finally meet you after all those years of trying to avoid you."

P.C. Vey

Christchurch Central
Development Unit






The Christchurch Health Precinct

Research Centre of Excellence
Workshop
29th September
Dr Ian Town

CERA Canterbury Earthquake Recovery Authority
CPIT
Canterbury District Health Board Te Poari Hauora o Waitaha
UC University of Canterbury
University of Otago New Zealand

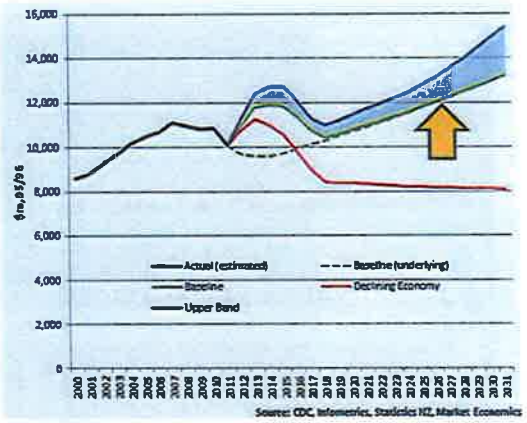
The Context and Challenges

- **Global challenges** in western health systems reflect mounting demand and costs spiralling out of control
- In **New Zealand** the aging population, aging workforce and disparities in access and outcomes are critical issues
- In **Canterbury** we have an effective and integrated health system that responded well to the many challenges that were triggered by the earthquakes; as well as strong tertiary education providers
- **Research and innovation** are critical to further improving health outcomes
- The **Health Precinct** represents a unique opportunity to establish world leading models of care

Scenarios for Canterbury

The Aim

- Sustainable economic growth
- Low risk of boom and bust
- Developed areas of competitive advantage
- Increased investment
- Increased talent and high value jobs
- Increased innovation and commercialisation
- Need sustainable uplift



Health Precinct Partners

- Christchurch Central Development Unit (CCDU)
- Canterbury District Health Board
- University of Otago Christchurch
- University of Canterbury
- Christchurch Polytechnic Institute of Technology (CPIT)
- PLUS the private sector

Health Precinct Vision

"The Health Precinct is the hub of a creative and inspiring network that integrates

- world class healthcare,
- research and innovation,
- education and industry
- with a strong emphasis on population health.

It will accelerate economic growth, act as a magnet for talent and promote community well-being"

Health Precinct Designated Areas

Health Precinct Concept – Aug 2014

Leadership and Integration Outcome Statements (from Recovery Strategy)

A legacy of enduring collaborative leadership. Developing and delivering cutting edge health, research and education outcomes

Strong partnerships between public and private sectors. Robust mechanisms that support these over the long term

Whole of government policy and funding mechanisms underpin the Health Precinct aspirations.

Economic Outcomes from the Health Precinct


Increased effectiveness of public investment in health and education infrastructure


Increased GDP contribution from Christchurch


Increase in quantity and speed of translational research


Aggregation and spill-over benefits


Increased research and development in private sector businesses

Economic Outcomes continued...


Cost escalation containment and better targeting of health spend


Increased numbers of high valued skilled positions


Attraction of businesses of global significance


Increased foreign direct investment, commercialisation and exports for New Zealand


Innovations of global significance

Social Recovery Outcomes


Health benefits to the community from research and service innovations


Health education is world class for students and for on-going professional development


Creation of high value jobs

Built Environment Outcomes


Delivery of coordinated infrastructure investment that supports the economy and community.

Public realm that welcomes people and supports investment


Supporting innovative design to redefine and future proof Christchurch. Design that supports new ways of working and interacting


Effective, efficient builds that support increased productivity. Commercially sustainable cost structures

Academic Health Science System

Vision:

- Enduring partnerships between tertiary providers and Canterbury District Health Board
- A hub that supports excellence in patient care

Outcomes:

- Better co-ordination and visionary leadership
- Partnerships with private sector
- Delivering collaborative health and education services
- Partnerships with Te Rūnanga o Ngāi Tahu

Progress to date:

- ***Collaboration Agreement – signed 21/05/2014***
- ***Advisory Council – established 25/07/2014***
- ***Agreement to share facilities - MOU signed July 2014***
- ***Partnerships with private sector being investigated***

Tertiary Teaching Hospital

Vision:

- A leading tertiary hospital that champions excellence in clinical care, teaching and research

Outcomes:

- Enduring partnerships delivering better, sooner, more convenient healthcare
- Translational research is widespread and celebrated
- Patient centric planning and funding

Enablers:

- Committed CDHB Board and management
- Policies and procedures that foster and reward innovation and research leadership. Protected time for clinicians
- Hospital redevelopment programme now underway on main site and at Burwood
- Uptake of new technologies – the Digital Hospital

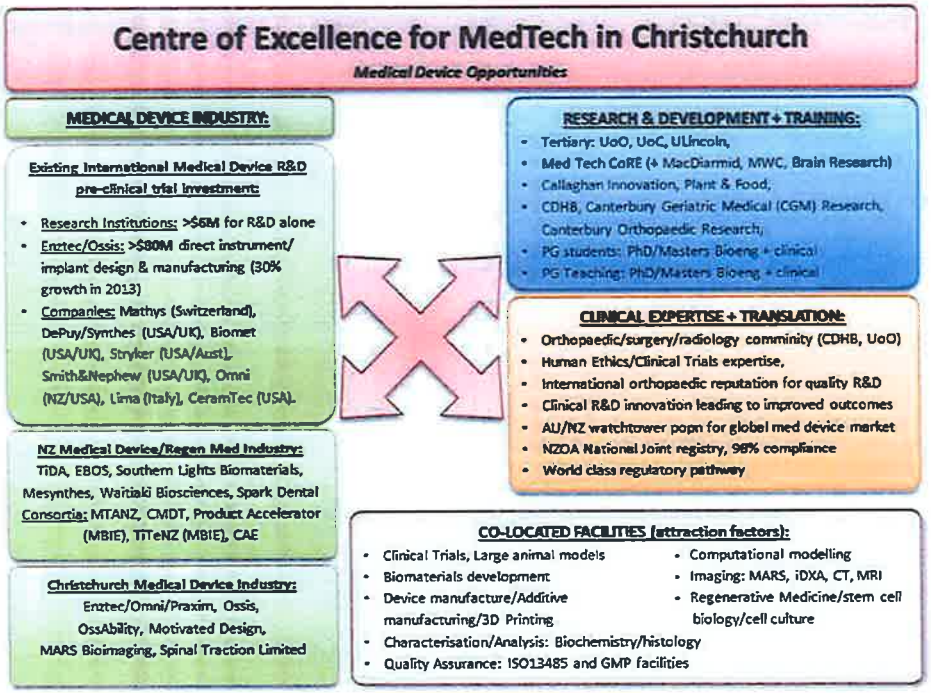
Translation & Integration

Examples include:

Melbourne: Parkville Precinct – University of Melbourne
Sydney: UNSW including the Garvan Institute
London: University College London
USA: MIT - Boston, Duke – Durham North Carolina
Auckland: Alliance between ADHB and UA signed Nov 2013

Lead Research Theme For The Precinct

- Medical devices and technologies including imaging and bioengineering:
  - Builds on existing local strengths in applied research
  - Leverages other national research programmes and industry groups
  - Leverages recent MBIE grants awarded ($15M+)
  - Complements activity in Auckland
  - Offers significant private sector opportunities with excellent local firms and expertise
  - Will attract international healthcare businesses of scale



Advice from Fisher and Paykel Healthcare

- NZ Company that has global reach:
  - Market cap of $2.6b
  - $637M turnover
  - 2013/4 Profit $97M
- Recent discussions with CE and VP Research:
  - Start with clinical challenges and leading clinicians
  - Focus on excellence in specific areas
  - Protect your IP
  - Understand the regulatory environment
  - Develop a sophisticated enabling infrastructure
  - Invest in D, D and more D !

Regional Innovation System

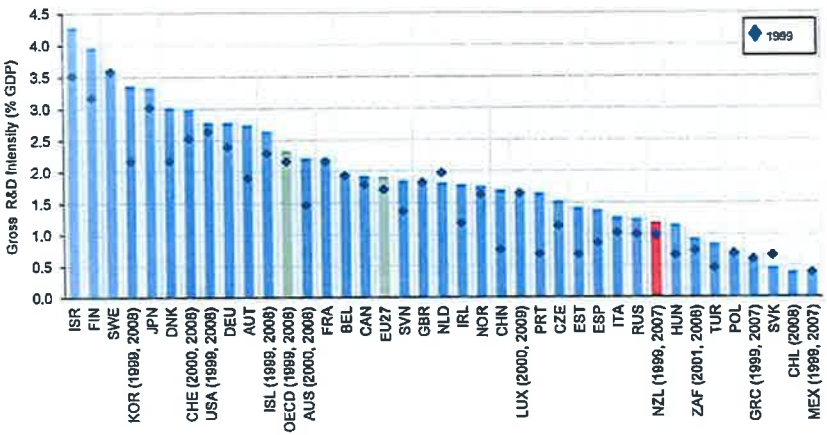
- Innovation and entrepreneurship are alive and well in Canterbury – a maturing ecosystem
- CDC Innovation:
  - MBIE supported initiative to accelerate the commercialisation of innovation in Canterbury (not just health)
  - Partner networks, KiwiNet, Return on Science, Callaghan Innovation
  - Investment through powerHouse Ventures
- Health Innovation Hub
- *Via Innovations* – CDHB

Now needs to be stronger, more visible and energised

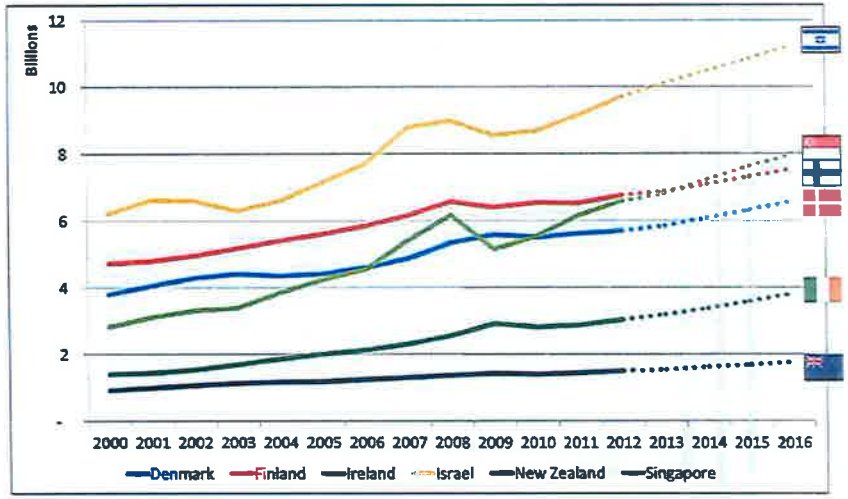
Workshop

- Thank you all for coming and bringing your expertise and enthusiasm
- We have an intensive programme for you
- Institutional hats not required !
- Be creative and future focussed
- Give generously of your thoughts aspirations and questions
- Use worksheets to jot down ideas, questions, issues
- Enjoy the day !

Gross R&D Intensity – 2009, by country



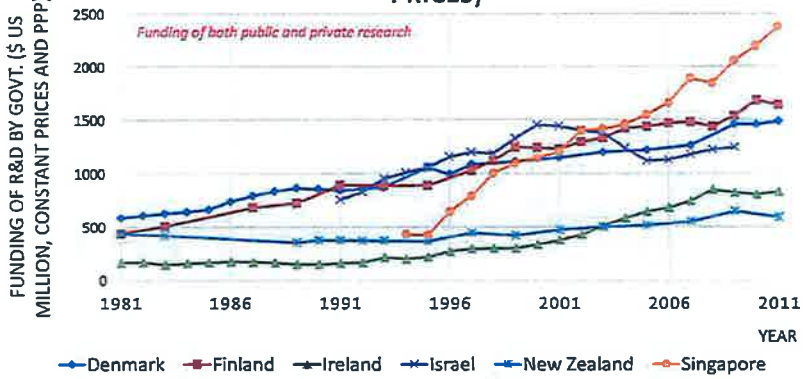
Gross Expenditure on R&D (GERD)



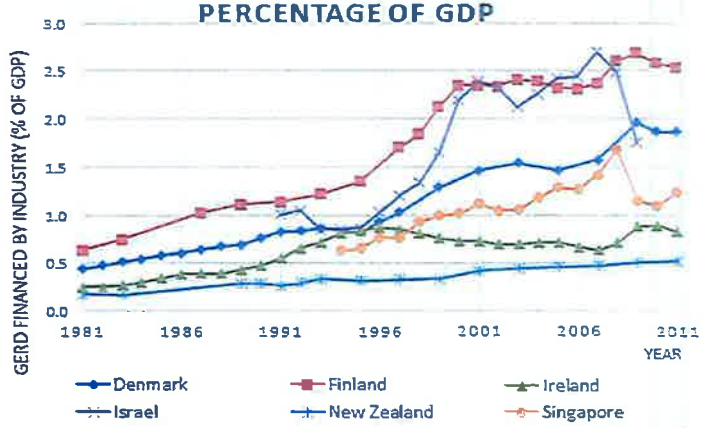
- Dotted lines indicate forecasted amounts
- Data Sources: OECD, IMF, UNESCO

Public funding of R&D

GOVERNMENT FUNDING OF R&D (CONSTANT 2005 PRICES)



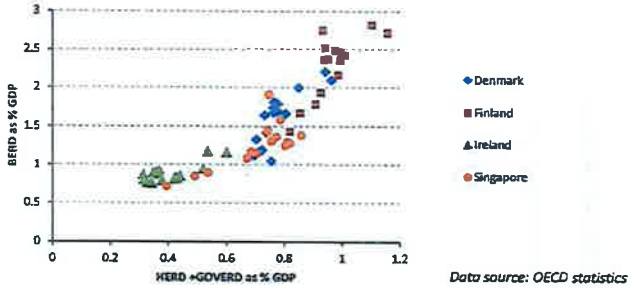
INDUSTRY-FINANCED GERD AS A PERCENTAGE OF GDP



Why has NZ had a chronically low investment in R&D?

- The lucky economy
- The lack of existential risk
- The low risk culture
- Short intellectual history and lack of intellectual culture
- The innovation myth
  - Inventiveness is not the same as innovation
  - Lack of entrepreneurship until recently
  - Recent emergence from controlled economy
- The short electoral cycle
- Incrementalism

Business + Public R&D investment are complementary. There is some evidence of a threshold public investment, beyond which BERD grows at a more rapid rate.

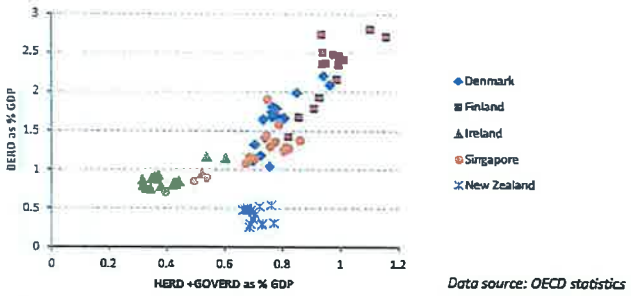


Data source: OECD statistics

At c. 0.7% public investment in R&D there appears to be an inflection point in results from 4 small nations, beyond this there is an increase in slope.

OFFICE OF THE PRIME MINISTER'S SCIENCE ADVISORY COMMITTEE

Business + Public R&D investment are complementary. There is some evidence of a threshold public investment, beyond which BERD grows at a more rapid rate.

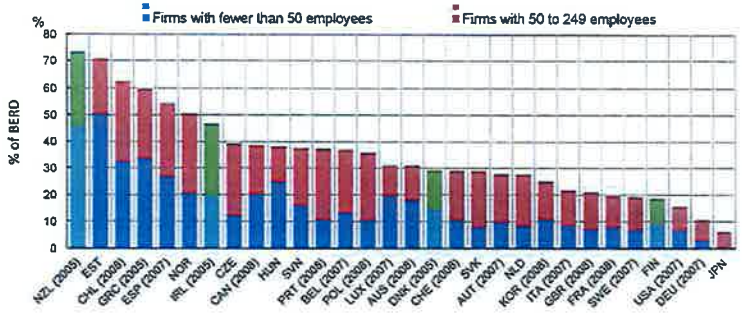


Data source: OECD statistics

New Zealand is a clear outlier on this graph, likely due to a combination of (i) industry structure (ii) company size (iii) lack of multi-national presence and (iv) distance from other R&D centres and markets.

Business Investment by: Size class of firms

New Zealand is extreme in % of business R&D being completed by small companies (>45%).



OFFICE OF THE PRIME MINISTER'S SCIENCE ADVISORY COMMITTEE

Needed actions

- Culture
  - Confront our national myth
    - Inventive not innovative
  - Individualism
  - Accept risk
  - Investment behaviours

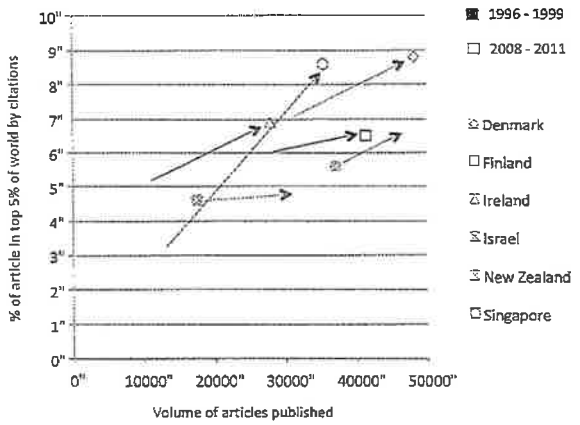
Needed actions

- Promote cities as units of innovation
  - Precinct
  - Clusters
  - Attract MNCs
  - Innovation Tsar

- Private sector
  - Invest in R&D
  - Think global from the start
  - Consortia
    - Don't copy the honey industry
  - Attract MNCs

Overall Outputs – Quality + Quantity

Figure: Articles in top 5% of world in 1996-99 vs in 2008-11, versus volume of articles for the same period



Implications for innovation activity in the Christchurch Health Precinct

- Issues
  - Low ideas flow
  - Low VC appetite
  - Low risk culture
  - Distance from market (the local market is largely irrelevant except for prototyping)
  - Small population
  - No MNCs

- Strengths
  - Good legal, patent and ethical system
  - Good health system
  - Digital health
  - IDS

  - Computing, engineering, medical school, SMEs in sector

Thoughts on city precincts

- Successful models
  - Waterloo – role of private sector, MNCs
  - Tel Aviv – ideas flow, risk culture
  - Singapore – investment, MNCs

- But do we have some of the core success criteria of other countries?
  - Low risk culture
  - MNCs
  - Low ideas flow – low public investment in R&D
  - KOLSs

An innovation precinct

- There is distributed talent in NZ
- Co-location – public & private
- What is the real core infrastructure needed?
  - Human factors, design
  - International linkages
  - Expertise

- If health is part of an innovation precinct is the system willing to be a prototype?
  - Social license

Some random thoughts

- Lack of MNCs – new models, eg Vistech, B2B
- Culture change – Communitech model
- E-health, m-health

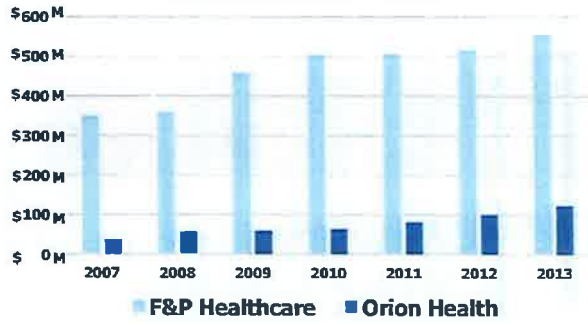
Medical Technologies CoRE

Bringing together researchers, clinicians and industry to support the growth of New Zealand's medical technology sector through world class translational science and innovation.

The MedTech opportunity

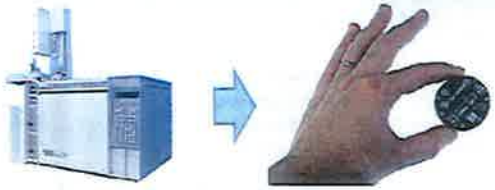
Healthcare costs → 10-20% of GDP
Med Tech sector → $1.4b (mainly exports)

Revenue 2007 - 2013

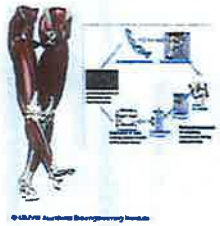


What does MedTech mean?

Devices .. minaturised .. & mobile .. & smart



Personalised models



Smart algorithms to interpret data

IT & Health informatics
(with electronic health records)

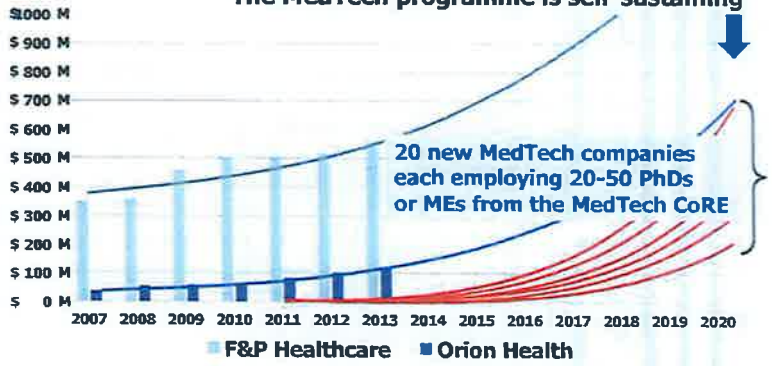
Our Vision

A MedTech entrepreneurial ecosystem fuelled by high quality basic science

Contracting & investment by international MedTech companies: Medtronic, 3M, Boston Scientific, Johnson & Johnson, Sanofi

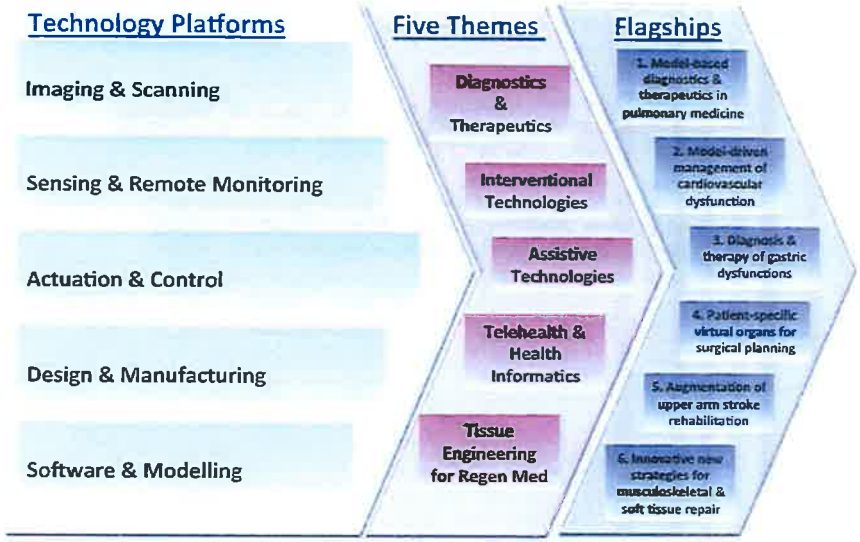
NZ and International investment

The MedTech programme is self-sustaining

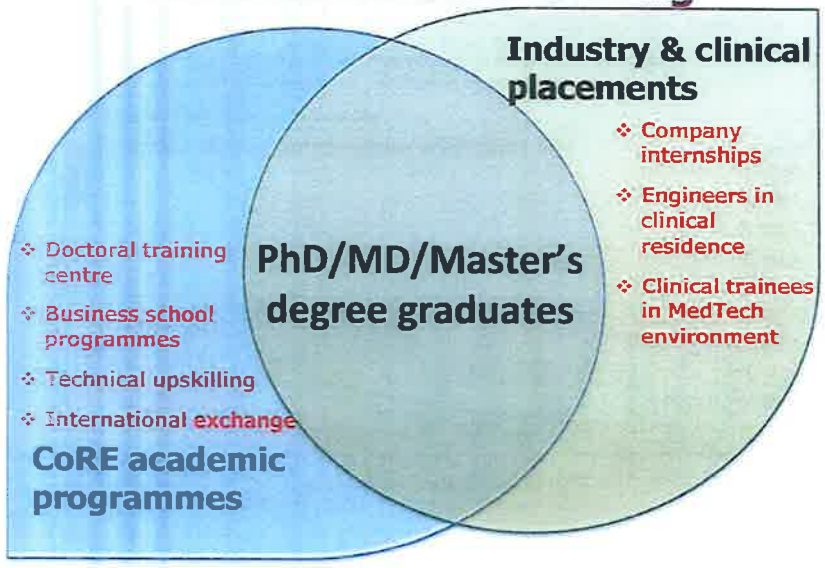


Filling a gap in the ecosystem

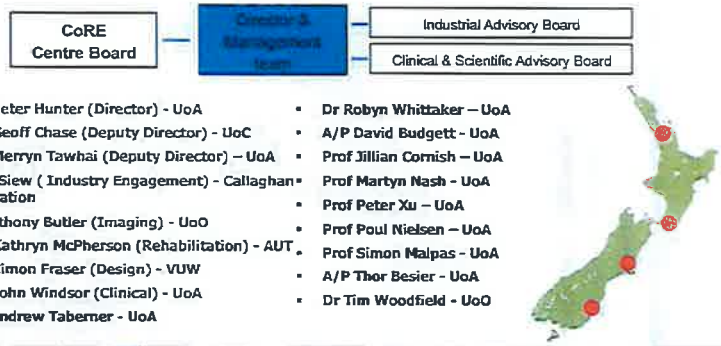
MedTech CoRE Focus Areas



Graduate student training



Principal Investigators



- Prof Peter Hunter (Director) - UoA
- Prof Geoff Chase (Deputy Director) - UoC
- Prof Merryn Tawhai (Deputy Director) – UoA
- Dr Di Siew (Industry Engagement) - Callaghan Innovation
- Dr Anthony Butler (Imaging) - UoO
- Prof Kathryn McPherson (Rehabilitation) - AUT
- Prof Simon Fraser (Design) - VUW
- Prof John Windsor (Clinical) - UoA
- A/P Andrew Taberner - UoA
- Dr Robyn Whittaker – UoA
- A/P David Budgett - UoA
- Prof Jillian Cornish – UoA
- Prof Martyn Nash - UoA
- Prof Peter Xu – UoA
- Prof Poul Nielsen – UoA
- Prof Simon Malpas - UoA
- A/P Thor Besier - UoA
- Dr Tim Woodfield - UoO

Consortium for Medical Device Technologies (CMDT)

Prepared for the Christchurch Health Precinct Workshop on 29th September 2014

Dr Gavin Clark

NZ's Medical Device Sector in 2013

- Comprises ~100 companies
  - ~90% SMEs <$5M turnover
  - ~10% large >$80M turnover - includes 6 multinationals and 4 home-grown in Fisher & Paykel, Orion Health, Ebos & Dynamic Controls
- MTANZ estimates a $1.4bn contribution to GDP from devices, software & informatics
- Projected to double in 3-5 years

Growing the Sector together

- **CMDT is NZ's medical technology network**
- Accelerates collaboration across industry, research base & clinic
- Enables critical mass & capture of synergies
- Leverages niche areas of global strength

CMDT

The Support Ecosystem

- CMDT
  - the national technology network / enhances industry engagement and knowledge translation
- MedTech CORE
  - the national science engine / generates the innovation pipeline
- MedTech Cluster / Callaghan Innovation

- Health Innovation Hub
  - accelerates translation of DHB clinical expertise
- Health IT Cluster
  - the national network focused on health IT
- MTANZ
  - the industry body: promotion, advocacy, policy

CMDT Foundation & Governance

- Led by Peter Hunter & Diana Siew
- Partnership / NZ Inc mind-set
  - Callaghan Innovation
  - 5 Universities: Auck, Otago, Canterbury, AUT, VUW
- Initiated with Callaghan seed support, now self-funded
- Steering Committee
  - Rep's for science/clinic & business
  - Decisions by concensus or vote

CMDT Scope

R&D Platform for Industry

Future needs — Immediate needs

Research Themes

- Diagnostics & Therapeutics
- Interventional Technologies
  - Assistive Technologies
- Telehealth & Health Informatics
- Tissue Engineering for Regenerative Medicine

CMDT Overview

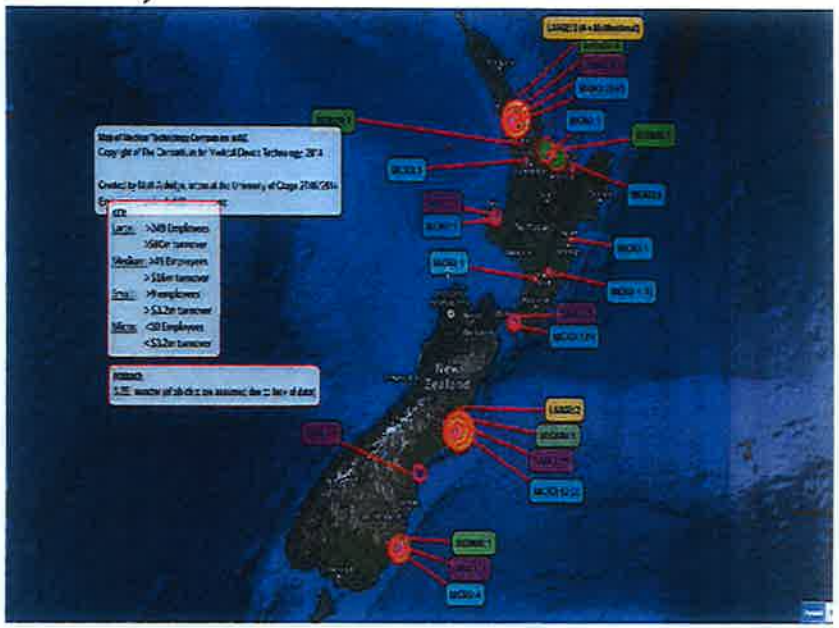
Activities

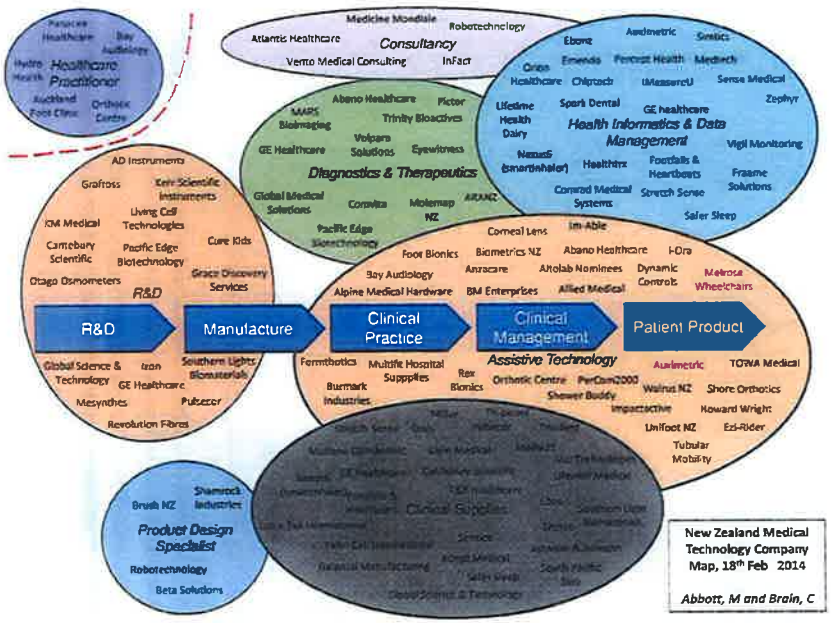
- Workshops / science & business, e.g. by research theme
- Industry outreach programme
- Mapping companies in the sector / to inform strategy and to assist business engagement

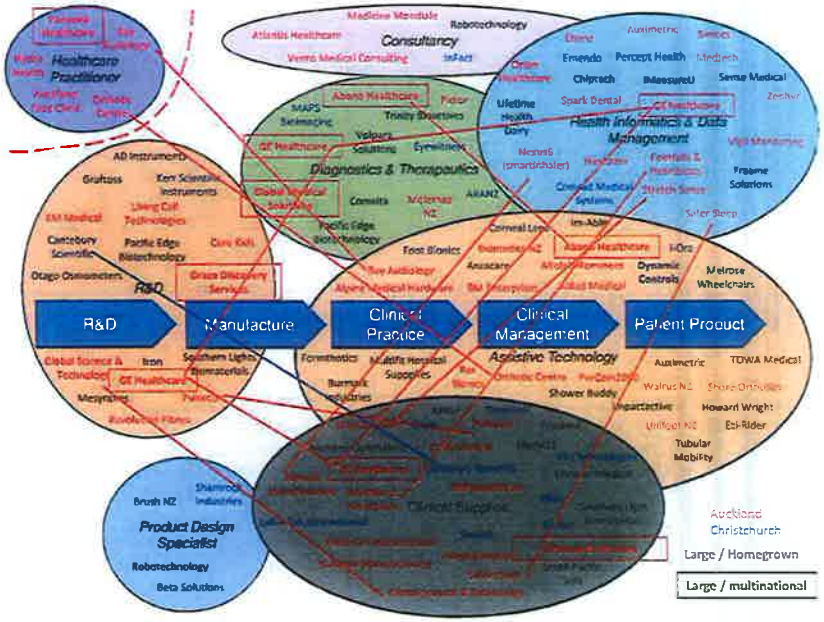
Resources

- Facilitated engagement
  - 'no wrong door' for industry or researchers
  - Template agreements
- Website www.cmdt.org.nz
- Newsletter
- Sector maps

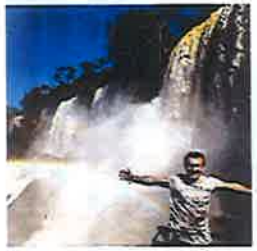
Size by Revenue







Credits / student interns



Matt Aldridge

Matt Abbott & Chelsea Brain

Mary Clark

Summary

Conclusions from the mapping

- NZ has two emerging clusters of medical technology companies - Auk (55) & CCh (27)
- Both clusters have companies that span both the supply chain and technology areas

Points to debate

- What is the potential for innovation-driven industry growth in C'Ch?
  - Based on C'Ch strengths & expertise?
  - That can be leveraged by the Health Precinct?
  - That complements Auck or differentiates from Auck?
- How do we seize the opportunities?
  - Make cluster development a component of Health Precinct strategy?
  - Coordinate support from CMDB, the MedTech CORE and the wider support ecosystem?
  - Funding? Callaghan Business R&D grants, MBIE, NSCs, HRC ...

Connect, Motivate, Deliver

For further information

- www.cmdt.org.nz

Contacts

Peter Hunter – p.hunter@auckland.ac.nz
Diana Siew – diana.siew@callaghaninnovation.govt.nz

Callaghan Innovation - Tim Balmer, Andy Kay (John Souter)
University of Auckland – Bruce MacDonald, Will Charles (Rachel McLeay)
University of Otago –Gavin Clark, Ian Tucker,(David Grimmett)
University of Canterbury – Geoff Chase, Nigel Johnson (John Duncan)
AUT University – John Bancroft, Kevin Pryor (Luke Kreig, Enrico Tronchin)
Victoria University of Wellington – Simon Fraser, Brenda Lazelle

Callaghan Innovation National Technology Networks and Industry Clusters

- Aligning technology and expertise for industry or sector benefit .
- Support groups of companies with common vision/focus

Networks

Materials
Sensing & Automation
Design & Manufacturing
Measurement & Compliance
Biotech
Foodtech
ICT

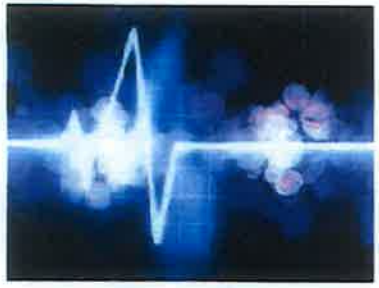
Clusters

Medical Technologies
Aviation
Marine Engineering
Telematics

Medical Technology Cluster

Help grow NZ's medtech sector

- Connecting: industry-researchers- clinicians
- Develop and implement: initiatives that help industry achieve its goals
- Underpinned by CMDT and MedTech CoRE



Cluster Manager – Diana Siew

Since returning to NZ I've seen the 'jaws' graph that shows the growth in public Healthcare expenditure outstripping GDP growth pretty much the entire time that the NZ health system has existed. However this is not that graph.. This is another one that struck me as telling a similar story.

The challenge to the CERA Heath Precinct is whether it emerges as a beacon of culture of an oasis. The opportunity is there to be the beacon for NZ and ROW.

This graph is a representation of one from Dan Pink whom I had the pleasure of meeting when GSK engaged him to speak about innovation and the need to design for differentiation. The green line is the growth of the square meters per person in US households. Driven by smaller family units and larger houses. The pink line is the growth in personal self storage volumes over the same time. In other words despite having larger living space Americans bought more stuff so needed to store it in ever increasing amounts. Pink called this abundance and it took a culture of consuming to drive it.
The yellow dotted line shows the level of personal happiness and fulfillment in the USA over the period. One may conclude if you wanted to make Americans happier driving more consumption might not be the answer. In other words don't expect a change by keeping doing more of the same thing.

I've come to agree with Peter Drucker that what matters most is culture. My experiences working in Japan made an impression on me as to how different and important culture within and between organisations is. There is no doubt that NZ has already spawned a number of innovative and successful Medtech companies. F&P HC, Ossis, Enztec, Howard Wright et at. I have no doubt they each have a culture that drives them. In fact Pat Fogarty from Shamrock summed it up a few weeks ago when I visited his works. He pointed out that Shamrock was winning business from Australian firms with identical kit. They didn't seem to be able to deliver the quality. I am sure that down to the culture that Shamrock has evolved.
One of my early influencers in this area was Jan Leschly as CEO of SmithKline Beecham. He realised a culture will develop anyway so it is better to think about and envision the culture you want and try and make it happen. SB's culture was captured architecturally in the HQ that was built in London and became GSK's HQ as it was completed after the merger. It really did work as a building that facilitated and built the culture.

MONOPOLY BUYER CAN WORK E.G. TVNZ

That is not to say that a state owned monopoly cannot be effective. I know from my experience working for Colgate – one of the biggest NZ TV media buyers at that time – that TVNZ had the lowest programming prices in the developed world. This flowed through to lower TV media costs. Essentially one man Des Monahan was responsible for this. He is a talented TV man who saw he needed to pay for quality – up to a point. He could have bought cheaper but needed to balance quality with the budget. He also commissioned local progammes to keep a vibrant local industry alive. However some producers wouldn't lower their prices as so NZ never saw these programmes locally. Other programmes we had to wait years for until the producers sold them at marginal cost. Once TV was privatised and channel 3 competed with TVNZ all bets were off the prices rocketed to world levels.

ABUNDANCE OF NZ HEALTHCARE ABUNDANCE OF HEALTH AND WELLBEING?

So if we apply similar reasoning to NZ Healthcare I would argue NZ enjoys an Abundance of healthcare and NZ has developed a culture of consumption of every increasing amounts of healthcare. (referencing Sir Peter's comments about NZ emerging from a controlled economy arguable healthcare was the only Abundance NZ enjoyed).

The question I have for this gathering is where does the line representing NZ Health and Wellbeing trend? Are we getting more or less what we pay for? Are we getting diminishing returns or worse is health degrading? I've not seen, nor sought this data rather I'm simply posing the question.

Which ever is the answer as we can't afford to keep doing more of the same a change of culture seems an imperative. There is a lot said and intended and much happening. A Healthcare Precinct could contribute much to informing this cultural change.

HEALTHCARE PRECINCT OASIS OR BEACON?

Brings us to the challenge – an oasis that is beautiful and valued but perhaps does not have a huge impact on the immediate landscape or a beacon that draws critical mass, demonstrates and encourages the culture for all of NZ?

MEDTECH IS ON A DIVERGENT PATH

And now for the the elephant in the room. At least as far as the NZ MedTech industry in concerned and particularly how innovation may be fostered in NZ even though ultimately the wider world is the target.

In my judgement, having returned recently from 20+years over seas, I believe the MedTech industry is walking on the opposite side of a small creek to PHARMAC now tasked with taking over procurement of medical devices. Currently it is possible to cross from on side to the other and to talk across the gap. However the reality is that as the divergent paths are walked the gap will become too large to cross. We might not like where that leaves the NZ industry in particular accessing the DHBs to trial and develop innovation solutions. While each of the MedTechs has its own culture ... more or less I worry that the PHARMAC culture as expressed by the values highlighted on the PHARMAC site does not include the need to foster trust. Either internally or with customers and suppliers. I believe in Healthcare trust is important and when I ask PHARMAC whether they measure it, they do not. Neither do they seem to value it.

Christchurch Health Precinct workshop

29 September 2014

Paul Morrison

enztec Est 1992

DePuy Synthes

BIOMET

Lima Corporate Orthopaedic motion

stryker

MATHYS European Orthopaedics

Enztec's Exceptional Success

"First Printed Titanium custom implant implanted in Christchurch 2007"

Christchurch Health Precinct workshop

OSSIS

Est 1998

"OSSIS Applies Science and Technology to build world leading custom Implant industry in New Zealand"

Questions:

"Something to think about"

- National and international networks already exist, and are well established. What Value is a "health precinct" going to add?
- It is safe to engage with the local industry!! Agreed the New Zealand orthopedic industry is a little incestuous... but I don't have 2 heads... I had it removed.
- Definition of insanity "Doing the same thing and expecting a different result"
- MBIE stop funding available technology, Manufacturing does not need to stay in New Zealand for New Zealand's prosperity.

Opportunities in Imaging

Anthony Butler

Vision

Collaborative MedTech Institute

Vision

Collaborative MedTech Institute

Hosting a

National Centre for Medical Imaging Research

Vision

Collaborative MedTech Institute

Hosting a

National Centre for Medical Imaging Research

Benefiting

Researchers, Industry, Patients

Scale of the opportunity

Medical imaging market: **28B USD**
4.8% GAGR

Pre-clinical market: **1.7B USD**
16.5% GAGR

Users who benefit

Industry

- Graduates *(ARANZ, Orion, MBI, ComRad, etc)*
- R+D for industry *(Enztec, Ossis, Scott Tech., etc)*
- Route to market via international partners *(GE, Striker, etc)*

Health workforce

- Training and attracting talent *(DHBs)*

Researchers

- Disease focussed *(Cardiac, brain, cancer, etc)*
- Technology focussed *(Engineering, physics, computing, etc)*

Christchurch history

George Rolleston

- Otago Uni Radiologist
- 1st Dean of Chch Medical School

Richard Bates

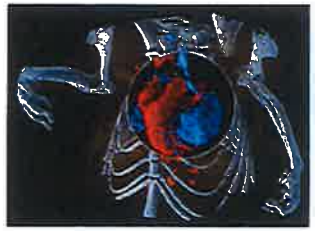
- Canterbury Uni Electrical Engineer
- 1971 First use of Fourier transform in CT
- 1972 First CT of biological tissue

Current themes: MARS

Spectral Molecular CT

- Human scanner in construction

  $12m MBIE investment (2016-2021)
- Previous $6m govt + $1.5m private + International sales
- NZ institutes UC, UO, UL, CPIT, CDHB, ESR
- Manufacturing by local industry *(Shamrock, ILR, Fabtek, etc)*
- International partners *(Mayo Clinic, CERN, GE, etc)*



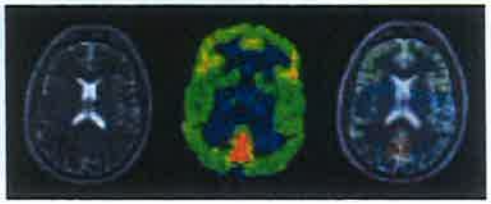
Current themes: Brain Imaging

NZ Brain Research Institute

- Planning PET-MRI scanner

  $13m investment by Private Radiology Group (PRG)

- Currently operating 3T f-MRI
- NZ institutes UC, UO, PRG, CDHB
- Test site for GE sequence development
- 20+ completed PhD



Current themes: Other

Canterbury Uni imaging science

- HIT-Lab *(medical data visualisation)*
- Engineering *(computational imaging group)*
- High Performance Computing *(supercomputer)*

Education

- CPIT – Bachelors in Medical Imaging Technology
- UC – Masters in Medical Physics *(NZs only accredited course)*
- UO – Masters in Medical Imaging *(planned 2016)*

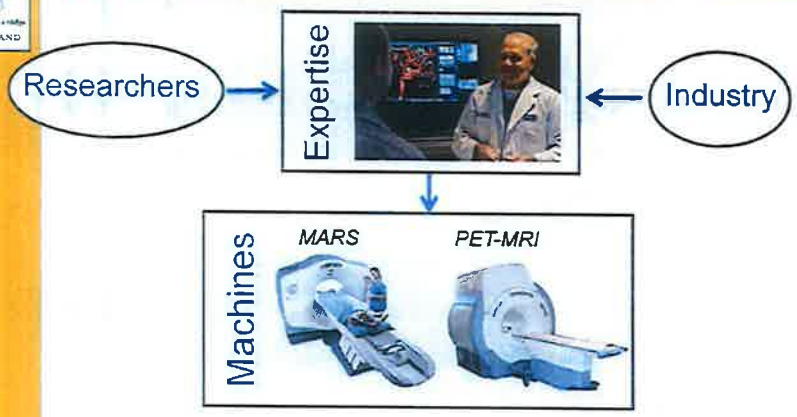
Lincoln Uni Animal Health

- CT and US are key tools
- Animal models of human disease
- Research for breeding programs for meat and wool industry

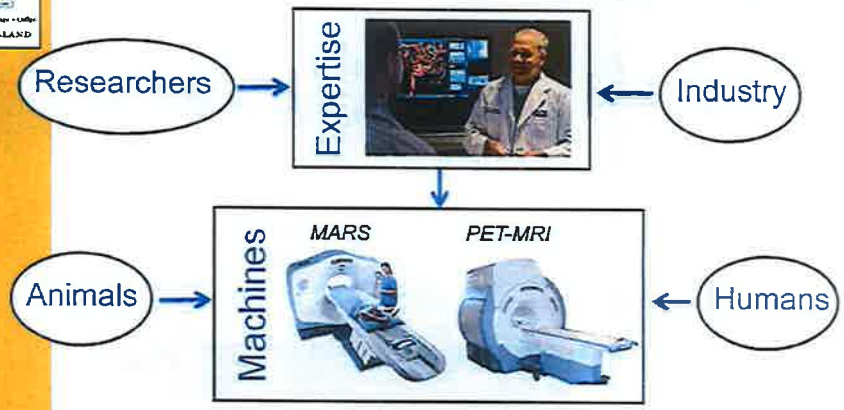
Co-location of "big" machines

Co-location of "big" machines

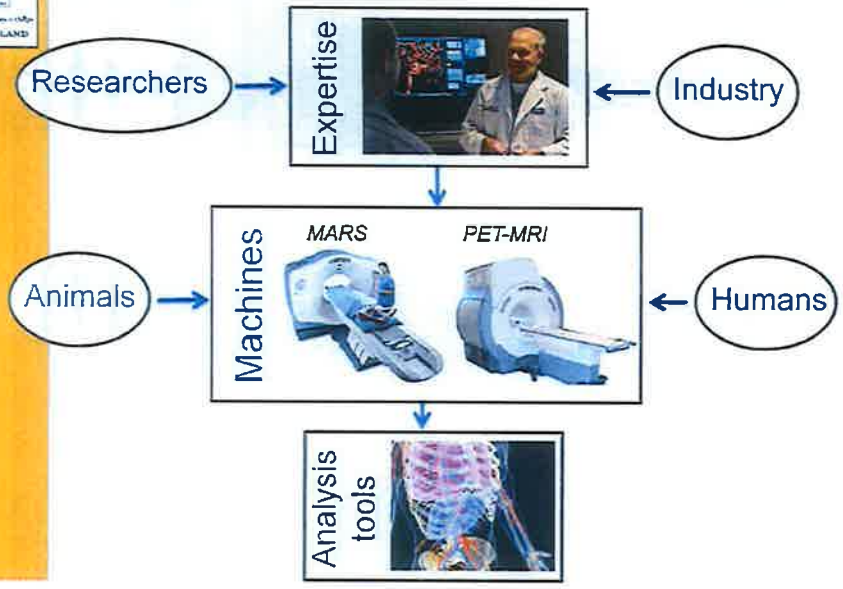
Co-location of "big" machines



Co-location of "big" machines



Co-location of "big" machines



Co-location of "big" machines

Enables

- Sharing of infrastructure
  (waiting rooms, animal anaesthetics rooms, IT, etc)
- Consolidates expertise across modalities
  (Image analysis, animal prep, etc)
- Single point of contact for users
  (eg. Cancers research access most appropriate tool)
- Future proofs expertise
  (history shows new imaging tools available every 5-10 years)

Challenges for this workshop

Anchor projects

- Human MARS - $12m secured
- PET-MRI – $13 Private radiology group *(needs certainty soon)*

Organisations need to work together

- UO, UC, UL, CPIT, CDHB, ESR-NCRS
- MoH, MBIE, CDC, CERA,

Future funding streams

- MedTech CoRE, Neuro CoRE, MARS-MBIE
- Aligns with NZ Science Challenges

Space for co-location

- ?????

Challenges for this workshop

Anchor projects

- Human MARS
- PET-MRI – $13 diology group *(needs certainty soon)*

Achieved

Organisations to work together

- UO, UC, R-NCRS
- MoH, MB RA,

Achieved

Future funding ams

- MedTech , MARS-MBIE
- Aligns wi e Challenges

Achieved

Space for co-location

- ?????

Challenges for this workshop

Anchor projects

- human MARS - $12m secured

Space is the key challenge

- ***this is what the Health Precinct is meant to provide !!!***

Space

- ?????

CERA
Canterbury Earthquake Recovery Authority

Christchurch Health Precinct Workshop

Research Centre of Excellence in Medical Devices and Technologies Including Imaging and Bioengineering

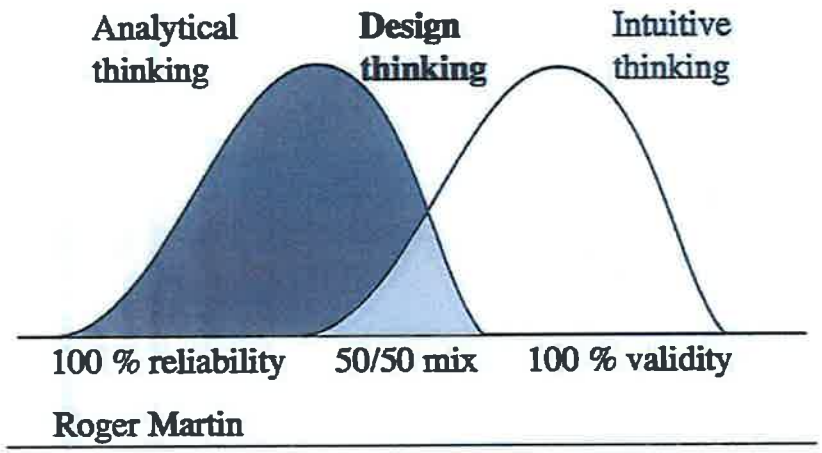
Rydges Hotel, Latimer Square, Christchurch
Monday, 29th September

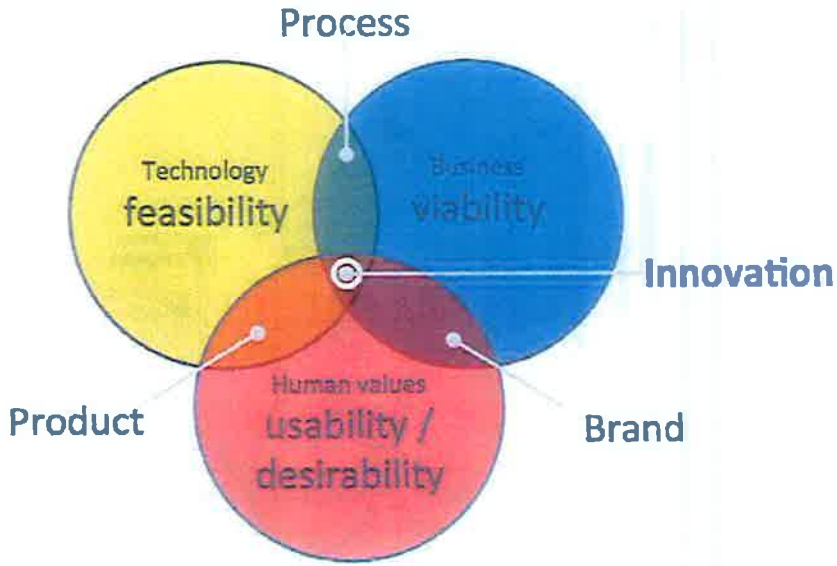
How Might We Apply Design Thinking?

Stefan Sohnchen

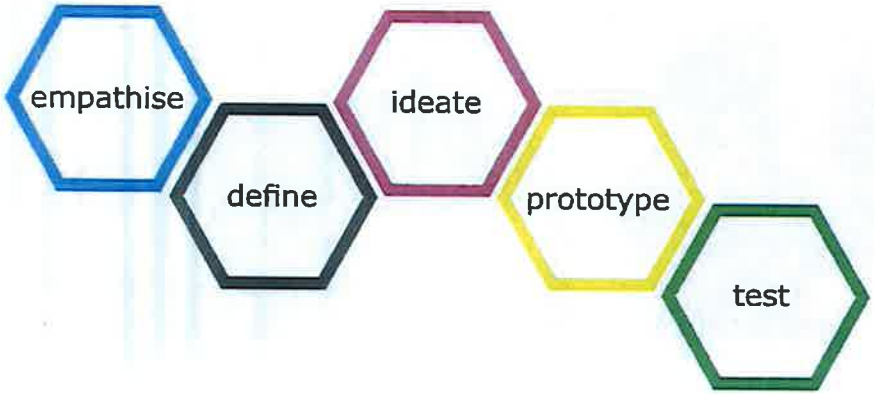
Design Thinking

Designerly thinking has its own logic

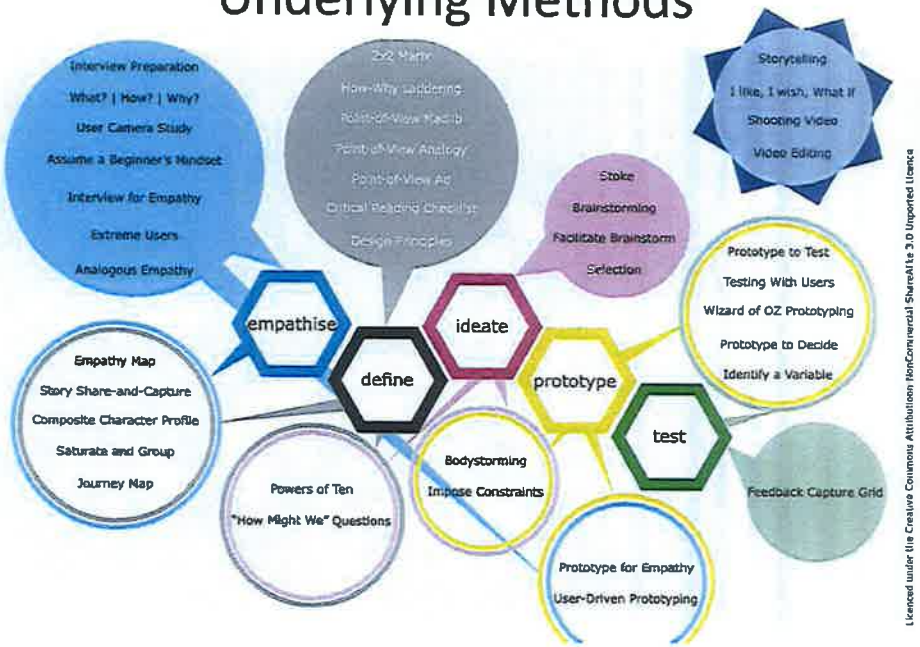




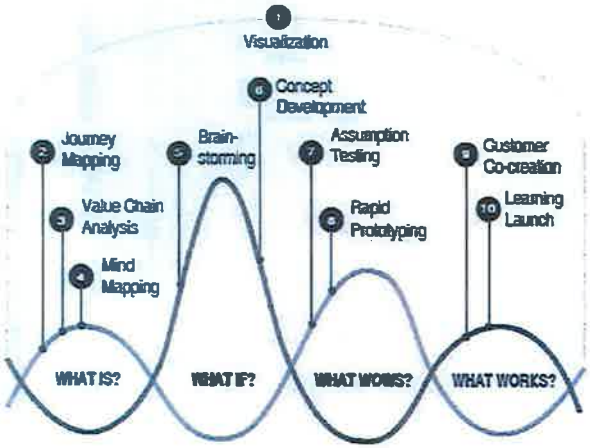
d.school Stanford



Underlying Methods



Liedtka: Designing for Growth



Essence

Inspiration

- motivate search for solutions

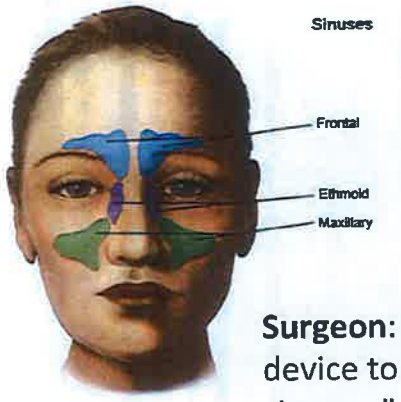
Ideation

- generate, develop and test ideas that may lead to solutions

Implementation

- chart a path to market

Design Thinking & Product Design



Surgeon: "I need a device to operate sinuses."

Designer: "Do you mean like this?"

Solution

U.lab Sydney

U.lab is an interdisciplinary platform for innovation projects.

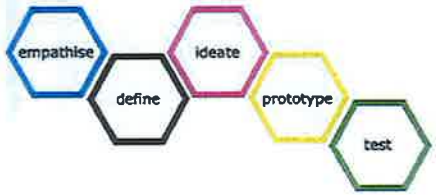
It creates opportunities for design-led innovation where learning, research and industry engagement come together.

U.lab Sydney – Cerebral Palsy Challenge

Robyn Clummins
Innovation Manager,
Cerebral Palsy Alliance

Dr Joanne Jakovich
U.lab co-founder
Senior Lecturer, UTS

Dr Jochen Schweitzer
U.lab co-founder
Senior Lecturer, UTS



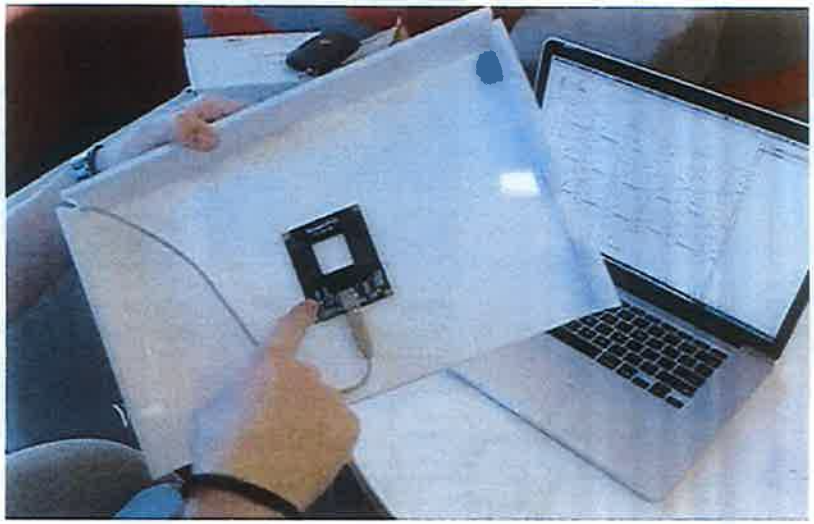
U.lab Sydney – Cerebral Palsy Challenge

U.lab Sydney – Cerebral Palsy Challenge

U.lab Sydney – Cerebral Palsy Challenge

U.lab Sydney – Cerebral Palsy Challenge

U.lab Sydney – Cerebral Palsy Challenge



It takes abduction to produce a discovery.
Prototype, test and learn. Then repeat.

"Abductive thinking begins with an incomplete set of observations and proceeds to the likeliest possible explanation for the set.

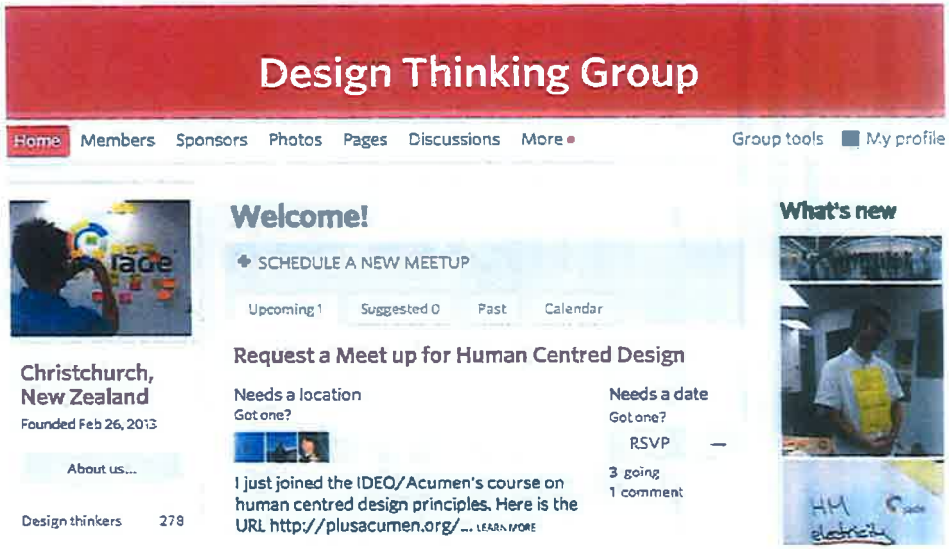
The goal is to explore what could possibly be true." Robert Curdale

Network

Internationalise

Synthesise

CDHB Design Lab in Christchurch



Design Thinkers at your Door Step

— STUDIO CHRISTCHURCH

HOME PROJECTS PUBLICATIONS PEOPLE EVENTS PRESS

A collaborative Christchurch based research and design platform for architecture and related disciplines.

Design Thinking Beyond Stanford

- U.Lab at University of Technology Sydney
- Genovasi, Malaysia
- Hasso Plattner Institute, Germany

How might we...?

What if...?

1

How might we create a centre of excellence that enables a thorough understanding, through direct observation, of what people want and need in their lives?

2

How might we create a centre of excellence that does not validate preconceived hypotheses but helps experimenters learn something new from each iteration?

3

How might we create a centre of excellence that blends art, craft, science, business savvy, and an astute understanding of customers and markets?

4

How might we create a place where design thinking is applied strategically?

- leading to dramatic new forms of value!

5

What if the centre becomes a place where people who are engineers *and* marketers, anthropologists *and* industrial designers, architects *and* psychologists interact with each other closely and often?

Thank you!

Stefan Sohnchen
021 799 803
stefan@sunbourg.com