



TRANSITIONS TO SUSTAINABILITY CONFERENCE - PROGRAMME OUTLINE

TUESDAY 30 November 2010, The University of Auckland Business School, Owen G Glen Building - Foyer

5.00pm	Registrations Open, Music by Scott, The AECCOM Official Welcome Reception
6.00pm	Powhiri – Haka the Legend
	Refreshments Served
6.30pm	Welcome: Professor Michael Davies, Dean of Engineering, The University of Auckland
	Guest Speaker: Bob Harvey, Chair of the Auckland Waterfront Development Agency
	Thanked by: James Hughes, AECCOM, Music by Scott continues
8.30pm	Function ends

WEDNESDAY 1 December 2010, Faculty of Engineering

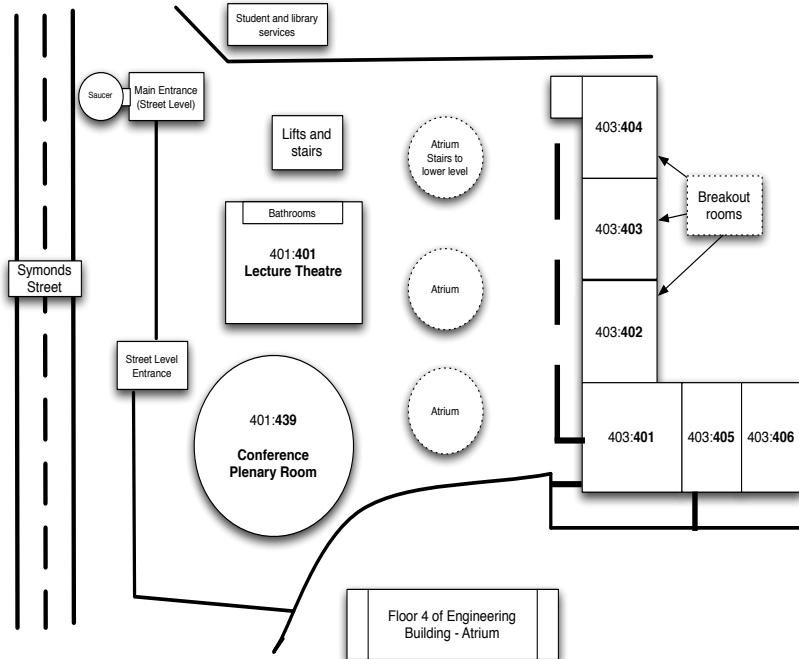
8.00am	Registration Desk Opens - Atrium
8.40am	Plenary Room 401:439, Opening Session
8.45am	Welcome: Dr Carol Boyle, Chair, NZSSES
8.50am	Official Opening: Dr Roger Blakeley, Chief Planning Officer, Auckland Council – Sustainable Cities
9.15am	Principal Keynote: Peter Head OBE FREng FRSA, Director of ARUR UK <i>Entering the Ecological Age-The role of science and technology in creating a sustainable economic future for New Zealand</i>
10.00am	Associate Professor Carol Boyle, International Centre for Sustainability Engineering and Research, ICSEER, The University of Auckland – <i>Critical Risks Forcing Sustainability</i>
10.30am	Morning Tea Break
Session 2	Plenary Room 401:439, Faculty of Engineering
11.00am	Prof. Martin O'Connor, Université de Versailles St-Quentin-en-Yvelines (UVSQ), Director of international research centre REEDS (Research in Ecological Economics, Eco-innovation and Tool Development for Sustainability) France <i>Sustaining What, Why, and For Whom? – Tools for grappling with the multiple bottom lines of self-respecting futures</i>
11.30am	Emeritus Prof. Ian Lowe, Griffiths University, Brisbane – <i>Values for Sustainable Futures</i>
12 noon	Dr Darlene Schuster, American Institute of Chemical Engineers: Institute for Sustainability <i>Measuring Sustainability Performance: Benchmarks, Roadmaps, and Certification</i>
12.30 pm	Lunch Break
1.30pm	Parallel Paper Session 1
	Chair: Prof. Hans Schrieber, Room 403:401 – <i>Mixed Session: Beyond Today's Infrastructure/Limits to Growth</i>
	Chair: Prof. Jorge Vanegas, Room 403:402 – <i>Limits to Growth (1)</i>
	Chair: Dr John Peet, Room 403:403 – <i>Embedding sustainability (1)</i>
	Chair: Mark Smith, Room 403:404 – <i>Resilient Societies (1)</i>
	Chair: Adj. Prof. David Hood, Room 401:401 – <i>Evolutions to Technology (1)</i>
3.00PM	Afternoon Tea Break
3.30PM	Parallel Paper Session 2
	Chair: Sue-Ellen Fénelon, Room 403:401 – <i>Beyond Today's Infrastructure (1)</i>
	Chair: Dr Maggie Lawton, Room 403:402 – <i>Resilient Societies (2)</i>
	Chair: Peter Head, Room 403:403 – <i>Embedding Sustainability (2)</i>
	Chair: Richard Taylor, Room 403:404 – <i>Resilient Societies (3)</i>
	Chair: Yazenko Krpo, Room 401:401 – <i>Evolutions to Technology 2</i>
5.00pm	Plenary discussion, PLENARY ROOM 401:439 – reports from sessions and workshops - Q&A session
5.30pm	Morphism Environmental Cocktail Hour, Atrium, Faculty of Engineering

THURSDAY 2 December 2010, FACULTY OF ENGINEERING	
Session 3	Plenary Room 401:439
8.45am	Introductions, Matt Coetzee, Development Manager, Aurecon Group
9.00am	Adjunct Prof David Hood, Queensland University of Technology <i>Achieving Sustainability in the Built Environment - Education and Culture Change</i>
9.30am	Dr Maggie Lawton, Manukau City Council – <i>Towards 2060: Engaging, Inspiring and Supporting Local Communities</i>
10.00am	Prof Jorge Vanegas, Texas A&M University, USA – <i>An Integrated, Transdisciplinary, and Evidence Based Approach for a Sustainability Dividend for the Built Environment</i>
10.30am	Morning Tea Break
11.00am	Parallel Paper Session 3
	Chair: Dr Darlene Schuster, Room 403:301 – <i>Beyond Today's Infrastructure (2)</i>
	Chair: Em.Prof. Ian Lowe, Room 403:402 – <i>Limits to Growth (2)</i>
	Chair: Prof. Martin O'Connor, Room 403:403 – <i>New Economics</i>
	Chair: Prof Hans Schreier, Room 403:404 – <i>Resilient Societies (4)</i>
	Chair: Dr John Peet, Room 401:401 – <i>Mixed theme Session (2) - design</i>
12.30 pm	Lunch Break, Workshop Session 1
1.30pm	Workshop Forum 1, Room 401:439 – <i>Towards 2060: Design the Future with Dr Maggie Lawton, Simon Harvey, James Samuel and Yaseko Kipo</i>
	Workshop Forum 2, Room 401:401 – <i>Turning Words into Action: Environmental Sustainability and Transportation Network Management with Jane Pudephot and Mayuné Gunatillake sponsored by MWH New Zealand</i>
3.00PM	Afternoon Tea Break
3.30PM	Workshop Session 2
	Workshop Forum 3, Room 401:439 – <i>Delivering Sustainable Infrastructure that Supports the Urban Built Environment, Dr Carol Boyle, with Dr Laurence Murphy FRICS and Dr Charlotte Sunde</i>
	Workshop Forum 4, Room 401:401 – <i>Future of Food: Supply, security and Sustainability, Dr Ron McDowall with Prof Jacqueline Rowarth, Massey University, and Rob Woodgate CFO PGGWrighton</i>
5.00pm	Plenary discussion, PLENARY ROOM 401:439 reports from sessions and workshops - Q&A
7.00pm	Conference Dinner, Top of the Town - Hyatt Regency Hotel
FRIDAY 3 December 2010, FACULTY OF ENGINEERING	
9.00am	Parallel Paper Session 4
	Chair: Caleb Clarke, Room 403:401, <i>Beyond Today's Infrastructure (3)</i>
	Chair: Richard Taylor, Room 403:402, <i>Limits to Growth (3)</i>
	Chair: Em Prof. Ian Lowe, Room 403:403, <i>Embedding Sustainability (3)</i>
	Chair: Sue-Ellen Fénelon, Room 403:404, <i>Resilient Societies (5)</i>
	Chair: Mark Smith, Room 401:401, <i>Resilient Societies (6)</i>
10.30am	Morning Tea Break
Session 4	Plenary Room 401:439
11.00am	Professor Sir Peter Gluckman KINZM FRSNZ FMedSci FRS, Chief Science Advisor to the Prime Minister – <i>NZ Addressing the perfect storm – the essential role of science</i>
11.30am	Prof Hans Schreier, University of British Columbia, Canada, <i>Urban Watershed Management – How to deal with the Combination of Land Use Intensification and Increased Climatic Variability</i>
12 noon	Dr John Peet, NZSSES – <i>Riches or Ruination? Has neoclassical economics reached its use-by date?</i>
12.30 pm	Lunch Break
1.30pm	Plenary Room 401:439, <i>Embedding Sustainability</i>
	Panel discussion with keynote speakers and experts facilitated by Professor Jorge Vanegas, Texas A&M University
3.30-4pm	Closing Session: Dr Carol Boyle

CONFERENCE VENUE ROOM LOCATIONS

Faculty of Engineering 4th Floor Layout

Note: Room numbers starting with 401 are for the large lecture theatres.
Room numbers starting with 403 are the breakout rooms



CONFERENCE DINNER VENUE

Top of the Town, Hyatt Regency Hotel
Cnr or Waterloo Quadrant and Princes Street (see map next page)

Please Note:

You need to confirm your attendance at the Conference Dinner

Please ensure that when you sign in at the Registration Desk that you have your name on the Conference Dinner list,
If you are not on the list you may be refused entry at the venue.

MAP OF UNIVERSITY OF AUCKLAND and surrounding streets



The NZ Society for Sustainability Engineering and Science

The New Zealand Society for Sustainability Engineering and Science (NZSSES) are the hosts of the 4th International Conference on Sustainability Engineering and Science - ***Transitions to Sustainability***.

NZSSES is a Technical Interest Group operating under the auspices of The Institution of Professional Engineers of New Zealand (IPENZ) and is an Affiliate member of the Royal Society of New Zealand.

The 2010 committee are:

Dr Carol Boyle Chair, The University of Auckland.

Email: c.boyle@auckland.ac.nz

Caleb Clarke Morhum Environmental

Sue-Ellen Fenélon Morhum Environmental

Yasenko Krpo CPG New Zealand Ltd

Misty Mossman Ministry of Agriculture and Forestry

Dr Ir Ron McDowall The University of Auckland,
Management and International Business

Richard Taylor formerly with Waitakere City Council

Dr John Peet (retired) Canterbury University - Ex-Officio

Members of the organising committee and NZSSES staff are wearing blue names labels.

Should you require any assistance during the conference, please contact -

- the registration desk
- phone Vicky - 027 2305 365
- or ask someone with a blue name label

The **AGM** and **Member's Christmas Function**

Thursday 16 December

All Welcome.

See Vicky for details about becoming a Member

NZSSES would like to take this opportunity to thank the respective employers of each Committee Member for supporting that member's commitment to the Society and to this conference.

GENERAL INFORMATION

1. The **Conference Proceedings** are provided on the USB stick, sponsored by BECA, included with this Handbook. Printed proceedings are not available.
2. Keynote speakers presentations and speeches (if provided) will be available for downloading from the website post the conference.
3. Parallel Paper Presentations will be available from the website post the conference for downloading.
4. Please note that Security will lock down the presentation rooms at 6pm. Do not leave anything in the rooms for collection later.
5. The **Internet Cafe** requires personal login codes. Please request your code from Vicky at the Reception Desk
6. A **secure lock up** area is available should anyone wish to use it. Contact Vicky
7. **Carparking concessions** are available in the Business School Carpark, Grafton Road. Enter the carpark in the normal way (turn at the lights half way down Grafton Road). Collect your ticket and exchange it with Vicky for a \$10 all day pass

DETAILED PROGRAMME

Tuesday - 30 November

	The AECOM Welcome Reception	
5.00pm	Registration Desk opens Music by Scott	
6.00pm	Powhiri	Haka the Legend
	Refreshments Served	
6.30pm approx	Welcome	Professor Jenny Dixon National Institute of Creative Arts and Industries, University of Auckland
	Guest Speaker	Bob Harvey Chair, Auckland Waterfront Development Agency
	Thanked by	James Hughes, AECOM
8.30pm	Music by SCOTT continues Function ends	
	The AECOM Welcome Reception	

Wednesday - 1 December

	Wednesday 1 December	
8.00am	Registration Desk opens	
	KEYNOTE PRESENTATIONS Plenary Room 401:439	
8.45am	Welcome	Dr Carol Boyle, Chair NZSSES
8.50am	Official Opening: Dr Roger Blakeley Chief Planning Officer, Auckland Council <i>Sustainable Cities</i>	
9.15am	Principal Keynote Address: Peter Head, OBE, Director and Chairman Planning Consulting, Arup <i>Entering the Ecological Age-The role of science and technology in creating a sustainable economic future for New Zealand</i>	
10.00am	Keynote Address: Associate Professor Carol Boyle International Centre for Sustainability Engineering and Research, ICSEr, University of Auckland <i>Critical Risks: Forcing Sustainability</i>	
	10.30 am - 11.00 am Morning Tea Break	

	Wednesday 1 December
11.00am	<p>Professor Martin O'Connor Université de Versailles St-Quentin-en-Yvelines (UVSQ)</p> <p><i>Sustaining What, Why, and For Whom? – Tools for grappling with the multiple bottom lines of self-respecting futures</i></p>
11.30am	<p>Emeritus Professor Ian Lowe Griffiths University, Brisbane</p> <p><i>Values for Sustainable Futures</i></p>
12 noon	<p>Dr Darlene Schuster American Institute of Chemical Engineers: Institute for Sustainability</p> <p><i>Measuring Sustainability Performance: Benchmarks, Roadmaps, and Certification</i></p>
	12.30 - 1.30 pm Lunch Break
1.30pm	PARALLEL PAPER SESSION I
Room 403.401	<p>MIXED SESSION: Beyond Today's Infrastructure / Limits to Growth Chair: Professor Hans Schreier</p> <p>Dr Hugh Byrd, presented by Dr Michael Rehm, University of Auckland <i>Changing Architecture for a Changing Climate; Unsustainable Trends in New Zealand</i></p> <p>Dr Ian Longley, NIWA, <i>What is Sustainable Air Quality?</i></p> <p>Dr John Morrissey, RMIT University, Melbourne, Australia <i>Proposal of a tiered conceptual framework for sustainable design and planning of large-scale development projects in the metropolitan context</i></p> <p>Dr John Russell, La Trobe University, Australia <i>Transitions to Sustainability - Are we confident about the IPCC climate change predictions for the future?</i></p>
Room 403.402	<p>LIMITS TO GROWTH Chair: Professor Jorge Vanegas</p> <p>Dr Damien Guirco, Institute for Sustainable Futures, University of Technology Sydney, Australia <i>Peak Minerals: mapping sustainability issues at local, national and global scales</i></p> <p>Sungsoo Koh, ICSER, University of Auckland, <i>Limits to growth defined by water resource, Waiheke Island case study</i></p> <p>Yasenko and Ana Krpo, CPG NZ Ltd <i>Urban Stormwater Runoff quality – lifecycle assessment</i></p> <p>Tara Smith, Sinclair Knight Merz, Australia. <i>Shallow Groundwater Resources and Future Climate Change Impacts: A Comparison of the Owens and Namoi Catchments, Eastern Australia</i></p>

	Wednesday December
Room 403.403	<p>EMBEDDING SUSTAINABILITY</p> <p style="text-align: right;">Chair: Dr John Peet NZSSES</p> <p>Shaharudin Idrus, Institute for Environment and Development (LESTARI), Malaysia <i>A Malaysian Initiative in Embedding Sustainability: Sustainable School - An Environment Award</i></p> <p>Professor Ali Memon, presented by Nick Kirk, Lincoln University <i>Sustainable Governance of Marine Fisheries: A Socio-Ecological Embeddedness Perspective</i></p> <p>Caleb Clarke, Morphum Environmental Limited <i>You Can Teach A Young Dog New Tricks: Starting At The Beginning - Sustainable Education</i></p> <p>Dr Stephen Reay, Auckland University of Technology <i>How to effectively engage students' with environmentally sustainable product design?</i></p>
Room 403.404	<p>RESILIENT SOCIETIES</p> <p style="text-align: right;">Chair: Mark Smith, NZSSES</p> <p>Gayathri Gamage, ICSE, University of Auckland <i>An integrated model for assessing sustainability of complex systems using Life Cycle Assessment and Risk</i></p> <p>Ella Susanne Lawton, Otago Polytechnic Centre for Sustainable Practice, Cromwell <i>The New Zealand Footprint Project: the Ecological Footprint of Kiwi Lifestyles and Urban Form</i></p> <p>Robert Perry, presented with Paul Chambers, Auckland Council <i>Carbon Now and Carbon Futures – a systems and performance based approach to reducing GHG Emissions in the Auckland Region</i></p>
Room 401.401	<p>EVOLUTIONS TO TECHNOLOGY</p> <p style="text-align: right;">Chair: Adjunct Professor David Hood</p> <p>Fahimeh Foudazi, Cape Peninsula University of Technology, Sth Africa <i>Sustainable solutions for Cooling Systems in Residential buildings: Case study in the Western Cape Province, South Africa</i></p> <p>Muaviyath Mohamed, presented by Dr Susan Krumdieck, University of Canterbury <i>Sustainable Renewable Electricity for Small Islands :A Methodology for Essential Load Matching</i></p> <p>Ibrahim Mosly, RMIT, Melbourne, Australia <i>Study on Risk Management for the Implementation of Energy Efficient & Renewable Technologies in Green Office Buildings</i></p> <p>Assoc. Professor Ahmad Zahedi, James Cook University, Australia <i>Sustainable electric energy supply by decentralized alternative energy technologies</i></p>
	3.00 - 3.30 pm Afternoon Tea Break

	Wednesday 1 December
3.30pm	PARALLEL PAPER SESSION 2
Room 403.401	<p>BEYOND TODAY'S INFRASTRUCTURE Chair: Sue-Ellen Fenélon NZSSES</p> <p>Hanani Abd Wahab, University of Waikato <i>Solar Roofing System Thermal Performance Analysis</i></p> <p>Taryn McQuinn, Beca Infrastructure and Claire Jewell, NZ Steel <i>Sustainable Steelmaking: Infrastructure for the Future</i></p> <p>Len McSaveney, Golden Bay Cement, <i>Towards More Sustainable Concrete</i></p> <p>Komsun Siripun, Curtin University of Technology, Perth, Australia <i>Sustainable Use of Crushed Concrete Waste as A Road Base Material</i></p>
Room 403.402	<p>RESILIENT SOCIETIES Session 2 Chair: Dr Maggie Lawton</p> <p>James Hughes, Aecom Limited, <i>Carbon Futures: Reducing Emissions for the Auckland Region</i></p> <p>Trivess Moore, presented by Dr John Morrissey, RMIT, Melbourne, Australia <i>Cost benefit pathways to zero emission housing: Implications for household cash-flows in Melbourne</i></p> <p>Phuong Ly, Queensland University of Technology, Australia <i>Towards Sustainable Housing for Vietnam</i></p> <p>Kay Saville-Smith, presented by Lois Easton, Beacon Pathway Limited <i>Market Transformation to Achieve Large Scale Uptake of Sustainable Residential Renovation in New Zealand</i></p>
Room 403.403	<p>EMBEDDING SUSTAINABILITY Session 2 Chair: Peter Head OBE</p> <p>Dr Patricia Kelly, Consultant Higher Education, Australia <i>Embedding Sustainability: painless is just delay</i></p> <p>Assoc. Professor Susan Krumdieck, University of Canterbury <i>The Survival Spectrum: the key to Transition Engineering of Complex Systems</i></p> <p>Dr Tim McLernon, University of Ulster, <i>Integrating Sustainable Development Into The Higher Education Built Environment Curriculum.</i></p> <p>Asst. Professor Annie Pearce, Virginia Polytechnic Institute and State University, USA <i>Strategic Entry Points for Sustainability in University Construction and Engineering Curricula</i></p>

	Wednesday 1 December
3.30pm	PARALLEL PAPER SESSION 2..... continued
Room 403.404	<p>RESILIENT SOCIETIES Session 3 Chair: Richard Taylor NZSSES</p> <p>Laurentiu (Larry) David, University of Toronto, Canada <i>On the road to sustainability - the case of the Romanian transportation sector</i></p> <p>Stacy Rendall, University of Canterbury, <i>Quantifying Transport Energy Resilience: Active Mode Accessibility</i></p> <p>Aaron Tanner, Yorkshire Water, UK <i>Sustainability, information needs and organisational change in UK water and sewerage companies</i></p> <p>Damian Young, Morphem Environmental Ltd. <i>Can catchment management can be delivered for the Auckland Super City watersheds and achieve sustainability</i></p>
Room 401.401	<p>EVOLUTIONS TO TECHNOLOGY Session 2 Chair: Yassenko Krpo NZSSES</p> <p>Craig Brown, Centre for Ergonomics, Occupational Safety and Health (CErgOSH) , Massey University <i>Achieving Transition: Lessons from Human Factors/Ergonomics</i></p> <p>Tim Martin, Monash University, Australia <i>Investigation of the National Pollutant Inventory (NPI) as a Sustainability Tool</i></p> <p>Lenny van Onselen, Delft University of Technology, The Netherlands <i>Technology Windows in Sustainable Innovation Projects: Experiences with an Innovation Tool for Identifying Sustainable Application Domains</i></p> <p>Jeff Vickers, ICSEr, University of Auckland <i>Design for Sustainable Development: A Framework for Sustainable Product Development and its Application to Earthmoving Equipment</i></p>
5.00pm	<p>Final Session - Plenary Discussion Plenary Room 401.439</p>
5.30pm	Morphum Environmental Cocktail Function

Thursday - 2 December

	Thursday 2 December
8.45am	KEYNOTE PRESENTATIONS Plenary Room 401:439 MC Day 2 - Matt Coetzee, Development Manager, Aurecon Group
9.00 am	Adjunct Professor David Hood Queensland University of Technology, Australia <i>Achieving Sustainability in the Built Environment - Education and Culture Change</i>
9.30 am	Dr Maggie Lawton Manukau City Council, Auckland, NZ <i>Towards 2060; Engaging, Inspiring and Supporting Local Communities</i>
10.00 am	Professor Jorge Vanegas Texas A&M University, USA <i>An Integrated, Transdisciplinary, and Evidence Based Approach for a Sustainability Dividend for the Built Environment</i>
	10.30 - 11.00 am Morning tea Break
11.00am	PARALLEL PAPER SESSION 3
Room 403.401	BEYOND TODAY'S INFRASTRUCTURE Session 2 Chair: Dr Darlene Schuster Sakina Mokhtar Azizi , University of Auckland <i>Risks Associated with Implementation of Green Buildings</i> Joshua Olutayo Olorunkiya , University of Auckland <i>Global Thinking- Local Action: Adopting the Low Impact Design (LID) Technologies in Urban Stormwater Management</i> Anna Robak , Opus International Consultants, NZ <i>Trade-offs between public health and environmental protection in a potable water supply context: Drinking Water Standards New Zealand vs resource consent conditions</i> Sarah Sinclair , Sinclair Knight Merz, NZ <i>Rethinking sustainable infrastructure using innovation tools</i>

	Thursday 2 December
Room 403.402	<p>LIMITS TO GROWTH Session 2</p> <p style="text-align: right;">Chair: Em. Prof. Ian Lowe</p> <p>Dr Maria Estela Varua, presented by Anna Evangelista, University of Western Sydney, Australia <i>(Un)sustainable Consumption in Australian Households: An Exploratory Study</i></p> <p>Michael Dale, presented by Dr Susan Krumdieck, University of Canterbury, NZ <i>Global Energy Modelling - a biophysical approach</i></p> <p>Dr Ian Mason, University of Canterbury, NZ <i>Transitioning to a 100% renewable electricity generation system: balancing the roles of wind generation, base-load generation and hydro storage</i></p> <p>Samuel Gyamfi, presented by Dr Susan Krumdieck, University of Canterbury, NZ <i>Pattern Recognition Residential Demand Response: An Option for Critical Peak Demand Reduction in New Zealand</i></p>
Room 403.403	<p>NEW ECONOMICS & EMBEDDING SUSTAINABILITY</p> <p style="text-align: right;">Chair: Professor Martin O'Connor</p> <p>Dr Robert Howell, Council for Socially Responsible Investment CSRI, <i>Transitions to Sustainable Investment</i></p> <p>Jonathan Slason, Beca, Auckland, NZ <i>Unintended Consequences of Reduced Consumption</i></p> <p>Dan Ducker, University of Auckland, NZ <i>Bridging formal research and informal approaches to enhance civic engagement processes</i></p> <p>Dr Rachel Wolfgramm, University of Auckland Business School, NZ <i>Creating leadership in transition to sustainability societies: Reflections from the Universitas 21 Sustainability Project</i></p>
Room 403.404	<p>RESILIENT SOCIETIES Session 4</p> <p style="text-align: right;">Chair: Professor Hans Schreier</p> <p>Dr Bruce Hucker, University of Auckland, <i>Auckland governance reforms: political legitimacy, democratic accountability and sustainable development.</i></p> <p>Asst. Professor Annie Pearce, Virginia Polytechnic Institute and State University <i>Sustainability and Capital Projects: Modeling the Emergent Property of Total Cost of Ownership</i></p> <p>Judelyn Salon, presented by Dr Ermelinda Tobias, Mindanao State University-Iligan Institute Of Technology, The Philippines <i>A Correlational Analysis of Collective Social Capital and Sustainable Development Program Outcome in Iligan City, Philippines</i></p>

	Thursday 2 December
11.00am	PARALLEL PAPER SESSION 3
Room 401.401	MIXED THEME Session 2 on design Chair: Dr John Peet NZSSES Dr Marcel Crul , Delft University of Technology, The Netherlands <i>Design for Sustainability: moving from incremental towards radical design approaches</i> A.Idil Gaziulusoy , ICSEER, University of Auckland <i>System Innovation for Sustainability at Produce Development Level: A Scenario Method and a Workshop process</i> Dr Stephen Reay , Auckland University of Technology <i>Design for Biodiversity: a new approach for ecologically sustainable product design?</i>
	12.30 - 1.30 pm Lunch Break
1.30 pm	WORKSHOPS Session 1
Room 401.439	Towards 2060: Design the Future: with Dr Maggie Lawton, Simon Harvey, James Samuel & Yasenko Krpo
Room 401.401	Turning Words into Action: Environmental Sustainability and Transportation Network Management With Jane Puddephatt and Mayurie Gunatilaka, MWH NZ Ltd. Sponsored by MWH New Zealand
	3.00 - 3.30 pm Afternoon Tea Break
3.30pm	WORKSHOPS Session 2
Room 401.439	Delivering Sustainable Infrastructure that Supports the Urban Built Environment with Dr Carol Boyle Presentation of Paper developed through the Blueprints for Sustainability Conference 2008. And Dr Laurence Murphy FRICS and Dr Charlotte Sunde making a presentation on Transforming Auckland: Institutional, Technological and Cultural Innovations for Sustainable Cities.
Room 401.401	Future of Food: Supply, Security and Sustainability with Dr Ron McDowall, University of Auckland; Prof Jacqueline Rowarth, Massey University, and Rob Woodgate CFO PGGWrighton
5.00pm	Final Session - Plenary Discussion Plenary Room 401.439

	Thursday 2 December
	Hyatt Regency Top of the Town
7.00pm	<p>Conference Dinner - Pre-dinner drinks Hyatt Regency Top of the Town Cnr Waterloo Quadrant and Princes Street 7.30pm Seated for dinner</p> <p style="text-align: right;">Music by: Scott</p>

Friday - 3 December

	Friday 3 December
9.00am	PARALLEL PAPER SESSION 4
Room 403:401	<p>BEYOND TODAY'S INFRASTRUCTURE Session 3 Chair: Caleb Clarke NZSSES</p> <p>Vince Dravitzki, Opus Central Laboratories NZ <i>Pathways to a more sustainable transport infrastructure</i></p> <p>Dr Jan Havenga, University of Stellenbosch, South Africa <i>Revitalisation of short railway lines in South Africa: A long term view for sustainability</i></p> <p>Assoc. Professor Susan Krumdieck, presented by Stacy Rendall, University of Canterbury <i>TACA Sim: a survey for adaptability assessment</i></p> <p>Professor Arthur Williamson, University of Canterbury <i>Transitions in transit: future options for transport energy in New Zealand</i></p>
Room 403:402	<p>LIMITS TO GROWTH Session 3 Chair: Richard Taylor NZSSES</p> <p>Assoc. Professor Ahmad Fariz Mohamed, Institute for Environment and Development (LESTARI), Malaysia <i>From the Linear to Cyclic Approach for Sustainable Waste Management in Malaysian City</i></p> <p>Dr Gavin Mudd, Monash University, Australia <i>The "Limits to Growth" and 'Finite' Mineral Resources: Re-visiting the Assumptions and Drinking From That Half-Capacity Glass</i></p> <p>Joshua Olutayo Olorunkiya, University of Auckland <i>Risk as a Fundamental Barrier to Adoption of Low Impact Design Technologies</i></p> <p>Zhehan Weng, Monash University, Australia <i>Projecting the Full Pollutant Cycle from Coal Utilisation to 2050: Understanding the Global Environmental Implications</i></p>

	Friday 3 December
9.00am	PARALLEL PAPER SESSION 4 - continued
Room 403:403	<p>EMBEDDING SUSTAINABILITY Session 3 Chair: Em.Prof Ian Lowe</p> <p>Lois Easton, Beacon Pathway Limited, NZ <i>The Eco Design Advisor Programme: Supporting the Transformation of New Zealand's Housing</i></p> <p>Francis Harrison, presented by Dr Maggie Lawton, of the former Waitakere City Council, Auckland, NZ <i>Community Advocacy for Sustainable Living</i></p> <p>Paul Quinlivan, Sinclair Knight Merz, Auckland, NZ <i>Embedding Sustainability into School Curriculums</i></p> <p>Eion Scott, Auckland Council <i>Resilience in sustainability</i></p>
Room 403:404	<p>RESILIENT SOCIETIES Session 5 Chair: Sue-Ellen Fénelon NZSSES</p> <p>Asst. Professor Annie Pearce, Virginia Polytechnic Institute and State University, USA <i>Costing Sustainable Capital Projects: The Human Factor</i></p> <p>Jesús Rosales Carreón University of Groningen, The Netherlands. <i>Sustainability: Seeing Through The Eyes Of Farmers</i></p> <p>Bridget Rule, ICSEER, University of Auckland <i>Challenges for sustainable infrastructure development in small island developing states</i></p> <p>Assoc. Professor Osamu Saito, Waseda University, Japan <i>Measuring lifecycle carbon footprint of a golf course and greening in the golf industry</i></p>
Room 401:401	<p>RESILIENT SOCIETIES Session 6 Chair: Mark Smith NZSSES</p> <p>Shaharudin Idrus, Institute for Environment and Development (LESTARI), Malaysia <i>Non-linearity of Urban Expansion: Transition to Sustainability</i></p> <p>Colin O'Byrne, Victoria University of Wellington, NZ <i>Urban Form as a Reflection of Governance Practices</i></p> <p>Matthew Paetz, Aecom, <i>Sustainable Suburbia – Oxymoron or Realistic Goal?</i></p> <p>Dr Felicity Powell, Opus Central Laboratories <i>The renaissance of inner city living and its implications for infrastructure and services: A Wellington case study</i></p>

	Friday 3 December	
	10.30 - 11.00 am Morning tea Break	
11.00am	KEYNOTE PRESENTATIONS	Plenary Room 401:439
11.00am	Prof Sir Peter Gluckman KNZM FRSNZ FMedSci FRS Chief Science Advisor to the Prime Minister <i>Addressing the perfect storm – the essential role of science</i>	
11.30am	Professor Hans Schreier University of British Columbia, Canada <i>Urban Watershed Management: How to deal with the Combination of Land Use Intensification and Increased Climatic Variability</i>	
12.00 noon	Dr John Peet NZSSES <i>Riches or Ruination? Has neoclassical economics reached its use-by date?</i>	
	12.30 - 1.30pm Lunch Break	
1.30pm	PANEL DISCUSSION - Embedding Sustainability Facilitated by Professor Jorge Vanegas A panel of experts will discuss effective methods of Embedding Sustainability	
3.30pm	CLOSING SESSION - Dr Carol Boyle	

System Innovation for Sustainability at Product Development Level: A Scenario Method and a Workshop Process

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Abstract

It is now commonly accepted that, in order to achieve sustainability, we need societal transformation, which requires institutional, social/cultural, organisational as well as technological change. This type of massive societal transformation in which all aspects of society are expected to co-evolve towards and align with sustainability goals is defined as sustainability transition or system innovation for sustainability. One of the major actors in system innovation is industry. Nevertheless, neither the theory nor the operational approaches currently based on this emerging theory address how to link macro-level innovation (i.e. institutional and social-cultural innovation) to the micro-level innovation (i.e. product/service and technology innovation). This paper presents the results of a recently completed Ph.D. study. The overall objective of this study was to effectively link the activities/decisions at product development (micro-innovation) level in companies with the transformation which needs to take place at the societal (macro-innovation) level to achieve sustainability. The research took place in three distinguishable phases. In the first phase a broad literature review was carried out covering areas of sustainability science, futures studies and system innovation theory. In the second phase, a theory of system innovation at product development level was developed based on the findings and insights gathered from the review of the literature. This theory was used to develop a scenario method to help product development teams in planning for system innovation for sustainability. During this phase a workshop tool was also developed as the operational component of the scenario method. The third phase consisted of a field work carried out to test, improve and evaluate the scenario method using an action research methodology. The detailed evaluation of the effectiveness of the scenario method as a futures work and the potential of it to aid in system innovation for sustainability provided supportive evidence for the claim that the scenario method is a valuable and a viable method.

Keywords: system innovation for sustainability, action research

1. Introduction

Interest in system innovation for influencing a transition to sustainability started in the early 1990s, initiated by the Dutch National Inter-Ministerial Programme for Sustainable Technology Development (see Weaver et al., 2000). This was followed by several other projects (e.g., see, Vellinga & Herb, 1999; Vergragt, 2000; Quist et al, 2001; Green & Vergragt, 2002; Partidario, 2002; Partidario & Vergragt, 2002; Elzen et al., 2002; Hofman, 2005; Geels, 2002; Elzen et al., 2004; Raskin et al., 2006; Loorbach, 2007; Tukker et al., 2008).

System innovation is defined as “a transition from one socio-technical system to another (Geels, 2005a, p.2)”. Since system innovation is a transformation which takes place at the wider societal context, it covers not only product and process innovations but also changes in user practices, markets, policy, regulations, culture, infrastructure, lifestyle, and management of firms (see, for example, Berkhout, 2002; Kemp & Rotmans, 2005; Sartorius, 2006; Geels, 2006). In other words, system innovation assumes structural changes take place in the socio-technical system. Companies are important actors in this transformation and will have important roles in developing the technologies of the new system (Charter et al., 2008). In addition, technology is not an abstract concept. It manifests itself through artefacts; i.e. infrastructure, products, and services, which are usually closely linked in a systemic structure. Products of a different technological paradigm will be essentially different from the products of current technological paradigm in terms of both technical characteristics and social meaning. Therefore, the development of tools and methods which would enable active participation of companies through their business practices in planning for system innovation is necessary both in order to effectively implement any plan at policy level and to increase the adaptive capacity of individual companies with regards to the substantial change which will take place through transitions.

Even though system innovation has become a central focus in policy development, especially within the European Union, a systematic theory on system innovations in general and how to use this theory to influence transitions towards sustainability in particular are currently emerging yet rapidly growing areas. This paper aims to contribute to this ongoing dialogue by presenting a scenario method developed as a result of a PhD project. The scenario method is intended for the use of product development teams of companies in planning for system innovation.

2. The Overall Research Methodology

The PhD research which resulted in the development of the scenario method took place in three distinguishable and progressive phases. The first phase involved a critical review of literature relevant to system innovation for sustainability. The topics reviewed during this phase covered sustainability science, characteristics of innovation for sustainability, the newly emerging theory of system innovation, futures studies, the relationship between futures studies, sustainability and system innovation, and, the role of industry in achieving sustainability. The second phase of the research built on the findings of the first part and integrated insights in order to first develop theory and models on how to involve product development teams in system level innovation for sustainability and second to develop a scenario method and a workshop process for product development teams of companies. Following the second phase, in order to test, improve and evaluate the scenario method, a field work was carried out.

The field work consisted of receiving feedback from potential expert users through one-to-one consultation sessions and from potential members of product development teams through workshops following an action research methodology (i.e. iterative cycles of improvement). A potential expert user of the method was defined as any person who has expertise in providing advice/consultancy to businesses in the joint area of sustainability and innovation and/or any person who has expertise in facilitating group processes. A potential member of product development teams was defined as anyone with a professional qualification of product/service design, design engineering, innovation management, strategy development, environmental/ sustainability management, and sales and marketing who provides input to the team during product design/development phase. Expert users are not the end-users but potentially the intermediary users of the scenario method who can introduce the method to businesses and lead/facilitate workshops with product development teams. Product development teams of companies are the intended end-users of the method. Any member in these teams can assume the role of a change agent and lead/facilitate a workshop or a workshop can be delivered to these teams by external change agents (which are represented by the potential expert users).

The field work covered five action research cycles (ARC) over a period of six months (see Figure 1). A total of thirteen (eight local and five overseas) experts were consulted and a total of three workshops (one in New Zealand, one in the Netherlands and one in Turkey) were held. The scenario method (its conceptual and operational frameworks) was improved and evaluated based on observations during workshops and participant feedback (collected via open-ended questionnaires).

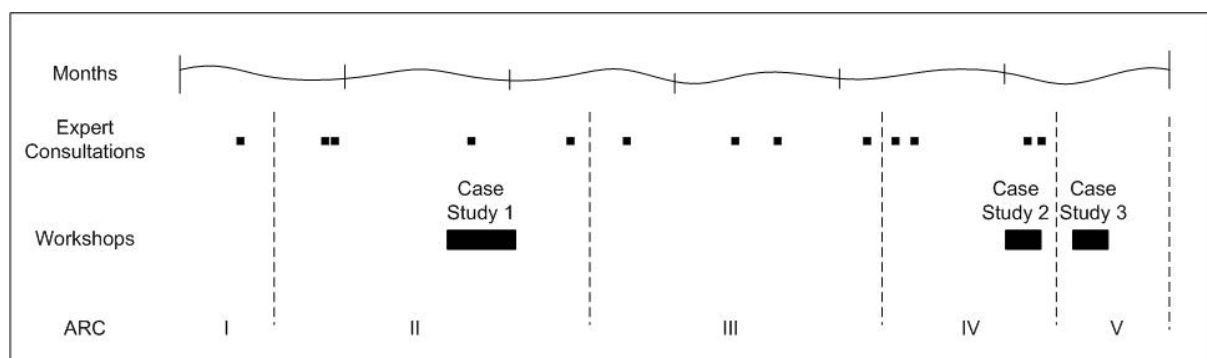


Figure 1. The schedule of the field work

At the end of the field work following the fifth ARC the final version of the scenario method was released. The next section presents the scenario method and its operational tool, i.e. a workshop process.

3. The Scenario Method: Final Version

The scenario method presented here is based on the multi-level perspective on system innovations (see Kemp, 1994; Van den Ende & Kemp, 1999; Kemp, Rip & Schot, 2001; Geels, 2005a; 2005b; Geels & Schot, 2007) and the theory and models developed as part of the PhD research (details can be found in Gaziulusoy & Boyle, 2008; Gaziulusoy, Boyle & McDowall, 2008a; 2008b; Gaziulusoy, Boyle & McDowall, 2009). The scenario method emphasises that the entity (i.e. the company) is within a context of complex socio-technical

system and the ultimate aim (i.e. the vision) of undertaking the process is to sustain the society (not necessarily the entity itself). It is developed to fulfil seven criteria:

1. The scenario method should be based on the strong sustainability model;
2. The scenario method should enable businesses to model themselves within the strong sustainability model;
3. The scenario method should link the planning periods applicable to companies (operational and strategic) to the long-term planning period (visionary) in order to enable companies to address long-term societal visions in their strategies and effectively implement these strategies in product development;
4. The scenario method should aid companies in identifying not only technology development requirements but also organisational/human development requirements;
5. The scenario method should aid companies in developing integrated business strategies aligned with societal level sustainability visions and day-to-day business activities and should facilitate integration of all business functions in line with the company strategy;
6. The scenario method should have a double-flow approach in order to link present and future in a realistic way and enable identification of alternative innovation paths which are possible from a technological point of view, acceptable from a social/cultural point of view and desirable from a sustainability point of view, and;
7. The scenario method should have a layered risk approach in order to identify implications of overarching sustainability risks on the companies' business as contextual risks. This way, sustainability can be internalised in the companies' organizational and product development strategy and active participation of companies in setting sustainability visions at societal level can be enabled.

Figure 2 shows the outline of the scenario method. As seen, there are three phases: preparation, scenario development and completion. The first task is to develop understanding of the system by analysing the relationships between the environment, society and economy as well as the interactions between the organisation and these three subcomponents. This is followed by identifying sustainability risks, analysing the dynamic relationships between these risks and articulating the implications of the risks on the business of the organisation. The third task in the preparation phase is identifying the social function being met by the products and services provided by the organisation and analysing how this social function is currently being met. The scenario development phase starts with developing a sustainable society vision within which the sustainability risks previously identified are either mitigated or adapted to. Then, how the social function is being fulfilled in this sustainable society is articulated. Following visioning, forward and backward scenarios are developed. The forward scenarios start from present and identify the successive technological and organisational changes necessary to reach the envisioned state. The backward scenarios start from the vision and identify the preceding technological and organisational changes necessary to reach the present state. The aligning paths are identified as the alternative innovation paths that the organisation can follow towards system innovation. The scenario development task is followed by analysing the present and future stakeholders and placing them on the scenario map where they can be of high influence in achieving associated goals. Also, product and service ideas are generated and placed on the scenario map where they can be introduced if that particular state is reached in the future. In the completion phase an action plan or strategy is prepared to identify the steps to be taken, the responsibilities and the follow up procedure.

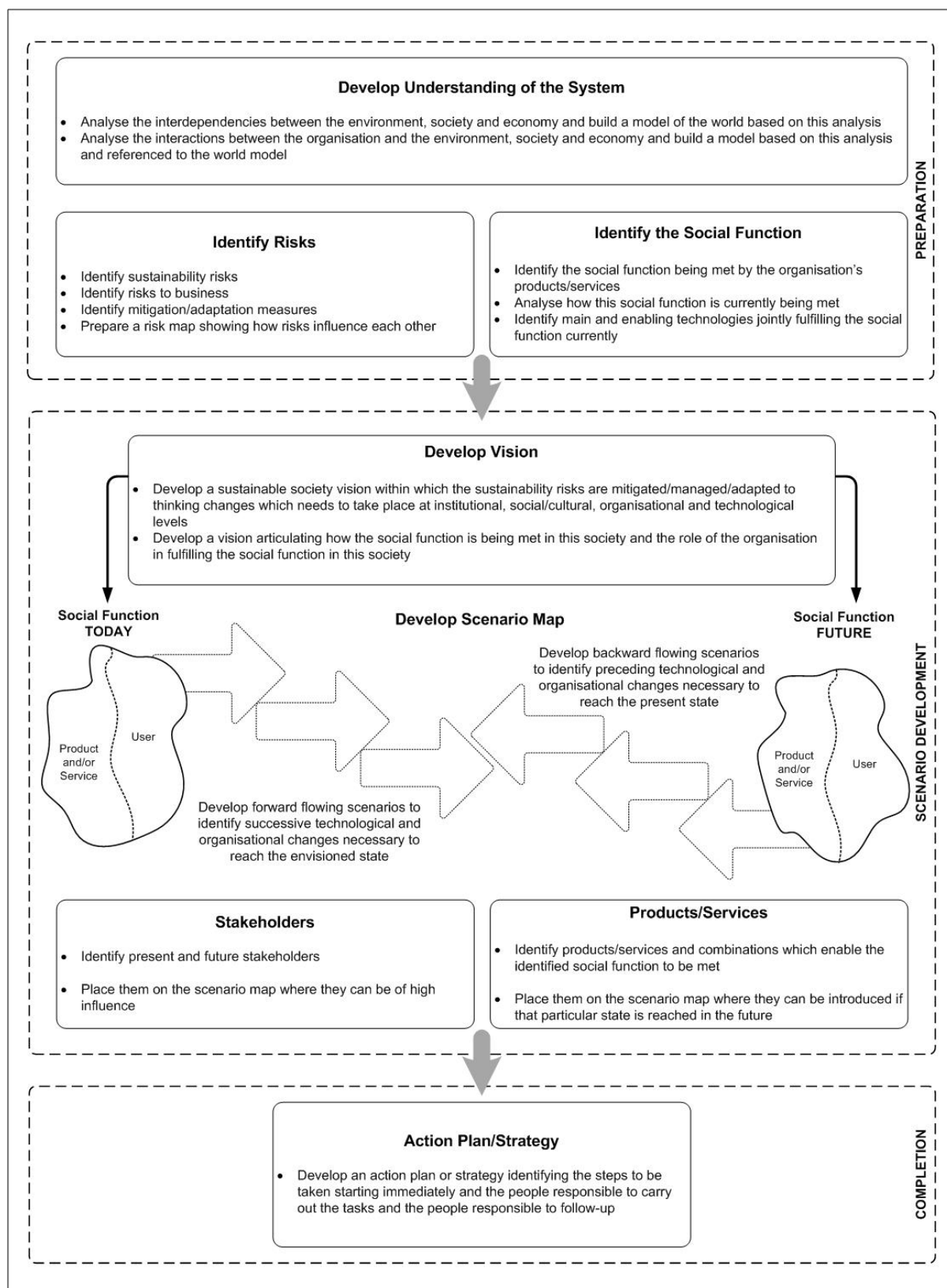


Figure 2. The outline of the scenario method

Based on this outline, a workshop process is designed which can be followed by facilitators. Table 1 shows the progression of the workshop modules along with brief explanations of what the module involves and what are the expected outcomes. This table also provides indicative times for completion of each module.

Table 1. The workshop process

	Min. Duration	Module	Activity	Outcome/Deliverable
1 st Half-Day	45 mins.	0. Introduction	1. The participants check-in; 2. The facilitator briefs the group about the purpose and agenda of the workshop and gives a short presentation clarifying the concepts used.	Outcome: Everybody checked-in, common understanding of the purpose of the workshop and the concepts used, group ready to start.
	40 mins.	1. We are a system	1. The group builds a world model showing the interrelationships between the environment, society and economy; 2. The participants position their organisation on this world model and articulate the interactions taking place between each sub-system and their organisation; 3. (Optional) The participants draw a life-cycle map of one of their organisation's product/service.	Outcome: Participants understand the irreversible and hierarchical relationships between the environment, society and economy. The participants understand the major interactions taking place and dependencies between their organisation and the three sub-systems. Deliverable: A world model based on the hierarchical interdependencies between the environment, society and economy showing the interactions taking place between the organisation and the three sub-systems.
	80 mins.	2. Risks	1. The group prepares a list of risks to sustainability; 2. The facilitator checks this list against a pre-prepared list compiled from different resources (e.g. Kates et al., 2001; MEA, 2005; IPPC, 2007; UNEP, 2009) and makes suggestions to expand the list if any risk relevant to the organisation is missing; 3. These risks are mapped on the world model the group built in the previous module and the dynamic relationships between them are identified; 4. The participants identify implications of the risks to sustainability to the business of their organisation.	Outcome: The group understands how long-term wider-scale sustainability risks which threaten the society do and will affect the organisation's business and products/services it delivers. Deliverable: A list of risks to sustainability; a risk map (mapped on the world model developed in the previous module) showing dynamic relationships between risks; a list of implications of risks to sustainability on the organisation and the products/services it delivers.
2 nd Half-Day	60 mins.	3. Social Function	1. The group identifies the social function fulfilled by the products/services offered by the organisation	Outcome: The group starts to think conceptually and is able to shift the existential focus of the organisation from itself to the wider context of society. Deliverable: Written expression of social function.

3 rd Half-Day	105 min.	4. Visions	1. The group develops a normative vision for a sustainable society within which the risks identified in the previous section are mitigated/ managed/adapted to; 2. The group develops an organisational vision (can be referenced to the social function the organisation would like to fulfil) compatible with the vision of a sustainable society.	<p>Outcome: The group involves in development of societal visions for sustainability and understands the systemic relations between the future of the society and their organisation. The group understands how institutional and social/cultural changes need to go in parallel with organisational and technological innovations to achieve sustainability.</p> <p>Deliverable: Vision(s) of a sustainable society documented on paper in written form (can be accompanied with imagery).</p>
	130 mins.	5. Scenario Development	1. The group is divided into two sub-groups; 2. One group develops forward flowing, explorative scenarios; 3. The other group develops backward flowing, normative scenarios; 4. Some group members switch between groups to cross-fertilise each flow; 5. Two groups share their work with each other; 6. Aligning paths are identified and further work can be done to help some other paths to align.	<p>Outcome: The group gains an understanding on the availability and characteristics of the possible innovation paths the organisation can utilise towards system innovation.</p> <p>Deliverable: A scenario map</p>
	50 mins.	6. Products/Services	1. The group brainstorms to generate product/service ideas which can be introduced if particular events anticipated happen; 2. These ideas are mapped on the scenario map; 3. (Optional) The product/service ideas are evaluated.	<p>Outcome: The group gains an understanding on the availability and characteristics of products/services that can be introduced along the innovation paths developed in the previous module.</p> <p>Deliverable: A scenario map with the products/services layer added onto it.</p>
4 th Half-Day	50 mins.	7. Stakeholders	1. The group prepares a list of stakeholders; 2. The group maps the stakeholders on the two-axis stakeholder model; 3. The group maps the stakeholders on the event trees or connections of the scenario map where they are likely to be most influential.	<p>Outcome: The group gains an understanding of the current and future stakeholders, their intentions and possible influences along the innovation paths identified.</p> <p>Deliverable: A list of stakeholders, a stakeholder map and a scenario map with the products/services and stakeholders layers added onto it.</p>
	50 mins.	8. Action Plan	1. The group reviews the scenario map; 2. The group identifies actions to be taken in the following week, month, year; 3. For each action identified, a responsible person is allocated; 4. A follow-up meeting to review the scenario map is scheduled in a year's time.	<p>Outcome: The group identifies the immediate steps needed to be taken to realise the innovation paths towards system innovation for sustainability and commitment is established to the action plan developed.</p> <p>Deliverable: An action plan agreed upon by the participants and documented in written form.</p>

The results of the evaluation of the scenario method by the research participants provided evidence that the research participants, who are also potential users/facilitators of the scenario method, found the scenario method to be:

1. An effective way to aid product development teams to incorporate sustainability issues into their decision making;
2. Able to influence the business transformation which needs to take place as part of the societal transformation to achieve sustainability, and;
3. A worthwhile activity for their respective companies.

The results of the evaluation of the scenario method provided evidence that the scenario method effectively assists product development teams in:

1. Understanding the hierarchical irreversible relationships between the environment, society and economy and between their organisation and these three sub-systems;
2. Understanding the issues threatening the sustainability of the society (i.e. risks to sustainability of the society), the dynamic relationships among these issues and the implications of these on the business or their organisation;
3. Generating normative long-term societal visions within which the risks to sustainability were mitigated/managed/adapted to by the society through a combination of institutional, social/cultural, organisational and technological changes, and;
4. Developing scenario maps to link present to the long-term future visions of a sustainable society they developed enabling alternative innovation paths to be identified.

These results indicate that the scenario method can now be used in real life projects where product development teams would like to align their activities and decisions with longer-term wider-context requirements of sustainability.

4. Discussion and Closure

The lack of systemic understanding and the blind attachment to growth oriented policies and strategies are still prevailing in business models of companies. Nevertheless, in some companies a belief on a broader social purpose exists on a voluntary and long-term basis. There are also good reasons to believe that in some other companies such understanding will evolve shortly through crisis as a result of not being able to foresee the implications of long-term sustainability related trends on business (White, 2006). A recent study which investigated two cases of firm uptake of system innovation thinking emphasized the power of companies to influence system level change (Van Bakel et al., 2007). This study, on the basis of two cases investigated, concluded that even though companies realize the opportunities rising from identifying sustainability issues at societal level, they find managing all business activities with system innovation in mind very challenging and these companies generally run such strategies as 'shadow-track' strategies. The study also suggests that the core conditions of success for running these shadow track strategies are management support, time and funding and "a gradual attunement between the shadow-track and regular policy when ideas and innovations mature (p. 12)" as well as support at government level. Observations in New Zealand can also confirm a shift taking place in businesses towards a desire and effort to understand the implications of long-term sustainability risks on their businesses which is accelerated with the economic recession. The confusion on how to relate long-term sustainability requirements to their day to day decisions prevails as their primary problem due to the lack of models and tools. Therefore, it is believed that the scenario method is timely and it hopefully will contribute the ongoing dialogue about system level innovation in product development, business management and governance areas.

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