‘Creativity’ covers a broad spectrum of ideas

**Artist and Imaginative**

- Creation out of nothing
- Concept lead
- ‘Blue Sky’ thinking
- Artistic

**Practical and Inventive**

- Dealing with challenges and opportunities the world and life presents
- Finding new, inventive and original solutions
- Scientific

**Creativity paradox**
new ideas are stimulated by constraint and disciplined process
Teaching is a form of time travel
What we can know about tasks we face in the 21st Century

Practical disciplines for mastering the tasks of the 21st Century

- Problem solving
- Design
- Lean thinking
- Systems thinking
- Future management
Time travel or what we can know about the future

<table>
<thead>
<tr>
<th></th>
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<tbody>
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<td>• A single view of the future</td>
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<td>• A range of possible future outcomes</td>
<td>• Not even a range of possible future outcomes</td>
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<tr>
<td>• Population growth</td>
<td>• Elections</td>
<td>• Rate and impact of climate change</td>
<td>• Major social, technological or economic discontinuities</td>
</tr>
<tr>
<td>• Relationship between population growth and resource consumption</td>
<td>• Regulatory changes</td>
<td>• Evolution of non-state conflicts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Wars between states</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Takeovers</td>
<td></td>
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</tr>
</tbody>
</table>

Source: Hugh Countey, *20/20 Foresight*
Tasks of the 21st Century

• The Quest for Intangibles
  • The Management of Scarcity
  • Navigating the Re-centring of the World
  • Preparing for the Arrival of the Black swan
Intangibles are where the value lies

Employment Growth in US (1990-2008 millions)

- Government and Health Care
- Other non-tradable
- Tradable eg professional service, manufacturing

Increase in value added per employee in the US (1990-2008)

- Value added
- Intangibles: • Design • Brand • Experiences • Networks • Relationships • Intellectual Property

Source: Michael Spence, *Foreign Affairs*
Apple’s intangibles: design, experience, networks, intellectual property
Brands are a highly valuable intangible

Platinum Int’l Brands Fund 287.3%

MSCI AC World (31.9%)

Source: Fact Sheet and Platinum
On our current trajectory the world is not educating enough people

Gap between demand and supply of workers by educational attainment, 2020E

<table>
<thead>
<tr>
<th>Shortages</th>
<th>Medium-skill workers</th>
<th>High-skill workers</th>
<th>Low-skill workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>In China</td>
<td>23</td>
<td>38-41</td>
<td>89-94</td>
</tr>
<tr>
<td>In Young Developing economies³</td>
<td>31</td>
<td>13</td>
<td>58</td>
</tr>
<tr>
<td>In India</td>
<td>13</td>
<td>16-18</td>
<td>32-35</td>
</tr>
<tr>
<td>Total shortage</td>
<td>45</td>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>

**Surpluses**

<table>
<thead>
<tr>
<th>Surpluses</th>
<th>Medium-skill workers</th>
<th>High-skill workers</th>
<th>Low-skill workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>In India</td>
<td>10</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td>In Young Developing economies³</td>
<td>10</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Total surplus</td>
<td>15</td>
<td>94</td>
<td>89</td>
</tr>
</tbody>
</table>

**SOURCE:** McKinsey Report The World at Work: Jobs, pay, and skills for 3.5 billion people | McKinsey Global Institute analysis

1 Low-skill defined in advanced economies as no post-secondary education; in developing, low skill is primary education or less.
2 25 countries from the analysed set of 70 countries, that have GDP per capita greater than US$ 20,000 at 2005 purchasing power parity (PPP) levels in 2010.
3 11 countries from the analysed set of 70 countries, from South Asia and sub-Saharan Africa, with GDP per capita less than $3,000 at 2005 PPP levels in 2010.
Countries who are globalising more successfully are also becoming more unequal

Average annual change in real household income, mid-1980s to late 2000s

Countries with faster income growth in top income decile:
- Sweden
- UK
- New Zealand
- Norway
- Australia
- Spain
- Ireland

Countries with faster income growth in bottom income decile:
- Japan
- Italy
- Germany
- Netherlands
- Austria
- US
- Finland

Organisation for Economic Co-Operation and Development (OECD)
Tasks of the 21st Century

• The Quest for Intangibles

• The Management of Scarcity

• Navigating the Re-centring of the World

• Preparing for the Arrival of the Black swan
As incomes grow demand for all resources inexorably grows

Industrial development and apparent steel consumption
(kilogram per capita)

GDP per capita
(US$'000, real 2005 PPP)

Demand index

CISA; WSA; Global Insight; JBS; BHP Billiton
Source: World Bank; Brook Hunt; CRU; IISI; Global Insight; CISA; world steel; JBS; IEA; BHP Billiton analysis.
1. Steel consumption on a crude steel equivalent basis.
2. The demand intensity index represents the volume consumption per capita consumption, 1968 as 100 for each of the commodities, based on the USA experience.

Alberto Calderon, Chief Executive Aluminium, Nickel and Corporate Development, 10 February 2012
Supply is constrained: resources are harder to find and more expensive to obtain

Number of ore discoveries¹

<table>
<thead>
<tr>
<th>Year</th>
<th>World-class</th>
<th>Major</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>98</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>99</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>2000</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>01</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>02</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>03</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>04</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>05</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2006</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Exploration expenditure

$ billion, real

SOURCE: BHP Billiton; USGS; MEG Minerals 2009, McKinsey

¹ All metal and mining materials; latest data available to 2006.
The same picture is true for water

Demand with no productivity

Historical improvements in water productivity 20%

Remaining gap 60%

Increase in supply under business-as-usual 20%

Existing accessible, reliable supply

Today

2030

1 Based on historical agricultural yield growth rates from 1990-2004 from FAQSTAT, agricultural and industrial efficiency improvements from IFPRI
2 Total increased capture of raw water through infrastructure build-out, excluding unsustainable extraction
3 Supply shown at 90% reliability and includes infrastructure investments scheduled and funded through 2010. Current 90%-reliable supply does not meet average demand.
SOURCE: 2030 Water Recourses Group-Global Water Supply and Demand model; IFPRI; FAOSTAT
Scarcity has to be managed on many fronts

Cost efficiency of investment
$ spent for implementation per $ total resource benefit

Tasks of the 21st Century

- The Quest for Intangibles
- The Management of Scarcity
- Navigating the Re-centring of the World
- Preparing for the Arrival of the Black swan
The world is rapidly re-centring to Asia

Evolution of the earth’s economic centre of gravity
AD 1 to 2025

Economic centre of gravity is calculated by weighting locations by GDP in three dimensions and projected to the nearest point on the earth’s surface. The surface of the centre of gravity shifts north over the course of the century reflecting the fact that in three-dimensional space America and Asia are not only ‘next’ to each other, but also ‘across’ from each other.

Source: McKinsey Global Institute Report | Urban World: Cities and the rise of the consuming class | McKinsey Global Institute using data from Angus Maddison; University of Groningen
Interdependence
Global trade has gone from $2.4 trillion in 1980 ...
Interdependence
... to global trade of $13.5 trillion in 2005

Source: Global Insight; IMF; McKinsey Global Institute Capital Flows Database
Tasks of the 21st Century

• The Quest for Intangibles
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• Navigating the Re-centring of the World
• Preparing for the Arrival of the Black Swan
Nassim Talib

A Black Swan: the results of Mohamed Bouaziz’s self-immolation in Tunisa
Economic losses from climate-related disasters have increased

Source: IDCC Report | Data from Munich Re, 2011,
What we can know about tasks we face in the 21st Century

Practical disciplines for mastering the tasks of the 21st Century

- Problem solving
- Design
- Lean thinking
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- Future management

20/20
Organisations developing the practical disciplines for the 21st Century mind

McKinsey & Company

ARUP

Toyota

BCG

The Boston Consulting Group

GE

IDEO

Goldman Sachs

Cabinet Office
Practical disciplines for the 21st Century Mind

- Structured problem solving
- Design
- Lean Thinking
- Systems Thinking
- Future management
International testing shows improving problem solving skills is a key priority.

Source: The Adult Literacy and Life Skills (ALL) Survey: Overview and International Comparisons research Division Ministry of Education New Zealand | Adult Literacy and Life Skills Survey (2006)
PROBLEM SOLVING LOOP

1. Think impact: What does the client need to know?
2. Think disaggregation and early hypothesis: What could be the key elements of the problem?
3. Think speed: Which issues are most important to the problem?

Define problem
1. Think evidence: What are we trying to prove/disprove?
2. Think efficiency: Where and how should the team spend its time?

Structure problem
1. Think potential solution: What should the client do?
2. Think “so what”: What implications do our findings have for the client?

Prioritize issues
1. Think next iteration: What are the client's next priorities?
2. Think buy-in: How should you connect to the client in every step?

Develop issue analysis and work plan
1. Develop recommendation
2. Synthesize findings
3. Conduct analyses

Communicate
**PROBLEM DEFINITION WORKSHEET**

<table>
<thead>
<tr>
<th>Basic question to be resolved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Perspective/context</td>
</tr>
<tr>
<td>2 Criteria for success</td>
</tr>
<tr>
<td>3 Decision makers</td>
</tr>
<tr>
<td>4 Other key study stakeholders</td>
</tr>
<tr>
<td>5 Constraints within solution space</td>
</tr>
<tr>
<td>6 Scope of solution space</td>
</tr>
</tbody>
</table>

- **S**pecific
- **M**easurable
- **A**ction-oriented
- **R**elevant (to the key problem)
- **T**ime-bound
QUALITY LOGIC TREES ARE CONSISTENT, RELEVANT, AND MECE

* From Problem Definition Worksheet
TWO MAIN TYPES OF LOGIC TREES

**Issue tree**
Use when your client's problem is entirely new to you

**Hypothesis-driven tree**
Use when you can propose a hypothetical solution to your client's problem based on experience with the client or similar projects

“**What?**” or “**How?**”

“**Why?**”
ISSUE ANALYSIS SETS THE STAGE FOR ACTION

Logic tree
(after prioritization of issues)

Analyses

TO DOs
Mon Tue Wed Thu Fri
## ISSUE ANALYSIS WORKSHEET

<table>
<thead>
<tr>
<th>Issue</th>
<th>Hypothesis</th>
<th>Supporting rationale</th>
<th>Information/ Analysis</th>
<th>Source/ Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key issue or unresolved question that elicits a “yes” or “no” answer and on which a specific action depends</td>
<td>Statement of the likely resolution of the issue; it includes the reason for answering “yes” or “no”</td>
<td>Arguments that are necessary and sufficient to support the hypothesis</td>
<td>Analyses that should be conducted to either confirm or refute the hypothesis, and thus resolve the issue</td>
<td>Likely location and means of obtaining data for analyses</td>
</tr>
</tbody>
</table>
Practical disciplines for the 21\textsuperscript{st} Century Mind

• Structured problem solving

- Design

• Lean Thinking

• Systems Thinking

• Future management
### IDEO Human Centre Design Process

<table>
<thead>
<tr>
<th>Hear</th>
<th>Create</th>
<th>Deliver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Choose research methods</td>
<td>Step 1: Develop the Approach</td>
<td>Step 1: Develop a sustainable revenue model</td>
</tr>
<tr>
<td>Step 2: Develop an interview approach</td>
<td>Step 2: Share Stories</td>
<td>Step 2: Identify capabilities for delivering solutions</td>
</tr>
<tr>
<td>Step 3: Develop your mindset</td>
<td>Step 3: Identify Patterns</td>
<td>Step 3: Plan a pipeline of solutions</td>
</tr>
<tr>
<td></td>
<td>Step 4: Create opportunity Areas</td>
<td>Step 4: Create an implementation timeline</td>
</tr>
<tr>
<td></td>
<td>Step 5: Brainstorm new solutions</td>
<td>Step 5: Plan mini-pilots and iteration</td>
</tr>
<tr>
<td></td>
<td>Step 6: Make ideas real</td>
<td>Step 6: Create a learning plan</td>
</tr>
<tr>
<td></td>
<td>Step 7: Gather feedback</td>
<td></td>
</tr>
</tbody>
</table>
Practical disciplines for the 21st Century Mind

• Structured problem solving
• Design
• Lean Thinking
• Systems Thinking
• Future management
Lean thinking: how to do more with less
## Lean Toolkit - examples

<table>
<thead>
<tr>
<th>To</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Types of Waste analysis</td>
<td>Finding all the different ways we waste time</td>
</tr>
<tr>
<td>Capacity Scheduling</td>
<td>How well matched is our capacity or resources and the use of them e.g. School use</td>
</tr>
<tr>
<td>Touch Time Analysis</td>
<td>How much time do we actually spend working on something rather than it sitting around in an ‘in tray’ or inventory e.g. Admissions</td>
</tr>
<tr>
<td>5 S</td>
<td>How well organised is our work place e.g. Emergency rooms in hospitals</td>
</tr>
<tr>
<td>Visual Management</td>
<td>Visibly track waste and have conversations about how to reduce it e.g. Kitchen waste</td>
</tr>
<tr>
<td>Poke Yoke</td>
<td>Stopping the whole process to prevent errors continuing</td>
</tr>
</tbody>
</table>
### 8 types of waste

<table>
<thead>
<tr>
<th>Type of Waste</th>
<th>What it is</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Overproduction</td>
<td>Producing too much, or producing too soon</td>
</tr>
<tr>
<td>2. Over processing</td>
<td>Excessive processing of same item, task</td>
</tr>
<tr>
<td>3. Inventory</td>
<td>More work in progress than is required to complete tasks, meet obligations</td>
</tr>
<tr>
<td>4. Waiting</td>
<td>Waiting for parts, documents, or a machine to finish a cycle</td>
</tr>
<tr>
<td>5. Transportation/ handling</td>
<td>Non-essential transport</td>
</tr>
<tr>
<td>6. Correction/rework</td>
<td>Rework, errors, leading to scrap</td>
</tr>
<tr>
<td>7. Motion</td>
<td>Excessive motion that does not add value</td>
</tr>
<tr>
<td>8. Intellect</td>
<td>Failure to utilize the time and talents of people</td>
</tr>
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</table>
Practical disciplines for the 21st Century Mind

• Structured problem solving
• Design
• Lean Thinking
• Systems Thinking
• Future management
We all manage systems everyday

Managing life is about managing systems

I am most concerned about Reinforcing Loop: Vicious and virtuous spiral.

But nothing ever grows forever …

Balancing Loop:

I form a partnership for growth, but end up feeling betrayed.…

But my growth seems to lead to decline.…

Success to the successful:

My capacity is my limit. Therefore, my capacity isn’t large enough.…

I have more than one limit and can’t address all of them equally.…

…so if we’re all up against the same limit.

Limits to Growth:

I have more than one limit and can’t address all of them equally.…

Fixes that backfire:

…but because I’m not getting at the real underlying cause…

While waiting for my fix to take hold, to relieve the tension, become satisfied with less…

But my fix comes back to haunt me.

Escalation:

Drifting Goals:

The drifting goals undermine my long-term growth.…

Shifting the Burden:

…but there’s a temptation to let my standards slip instead.

Growth and Underinvestment (drifting standards):

Growth and Underinvestment (fixed standards):

The attractiveness Principle:

Accidental Adversaries:

But my fix is your nightmare….
Simulations are a powerful way to build systems thinking skills
Practical disciplines for the 21st Century Mind

• Structured problem solving
• Design
• Lean Thinking
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• Future management
## Determine the type of future

<table>
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### Situation analysis tools
- **Traditional tools:**
  - Porter’s five forces
  - Market research
  - Cost benchmarks
  - SWOT analysis
  - Core competencies diagnostics
  - Discounted cash flow/ NPV valuation needs
- **Traditional tools plus:**
  - Decision or event trees
  - Scenario-planning exercises
  - Game theory
  - Decision-tree ROV techniques
- **Traditional tools plus:**
  - Decision or event trees
  - Scenario-planning exercises
  - Game theory
  - System dynamics models
  - Real Option value techniques
  - Working backwards to beliefs that would support a given strategy
  - Analogies and reference cases
  - Management flight simulators

### End products
- **Point forecasts of key value drivers and how each changes them**
- **DCF model to value alternative strategies**
- **Complete description of MECE set of scenarios**
- **Assessment of how each potential strategy changes probability of each scenario and payoffs to company**
- **Complete description of a representative set of scenarios**
- **Assessment of how each strategy affects likelihood of outcomes**
- **Complete statement of beliefs supporting different strategies**
- **Supporting analogies and reference cases**
- **Key market indicators**

### Decision making model
- **Choosing strategy that maximises company’s objective**
- **Direction analysis**
- **Qualitative decision analysis**
- **Getting comfortable with beliefs that support strategy**

Source: Hugh Countey, *20/20 Foresight*
Consequence and likelihood determine risk level

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Fatalities</th>
<th>Casualties</th>
<th>Economic impact $</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Catastrophic</td>
<td>1,000+</td>
<td>10,000s</td>
<td>Tens of Billions</td>
</tr>
<tr>
<td>4. Major</td>
<td>101-1,000</td>
<td>1,000s</td>
<td>Billion</td>
</tr>
<tr>
<td>3. Significant</td>
<td>51-100</td>
<td>100s</td>
<td>Hundreds of millions</td>
</tr>
<tr>
<td>2. Moderate</td>
<td>10-50</td>
<td>10s</td>
<td>Tens of millions</td>
</tr>
<tr>
<td>1. Limited</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>Millions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Likelihood of event within 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Highly likely</td>
<td>Expected to occur in the time period: roughly 1 in 2 chance</td>
</tr>
<tr>
<td>4. Likely</td>
<td>Reasonable chance it will occur in the time period: roughly 1 in 20 chance</td>
</tr>
<tr>
<td>3. Possible</td>
<td>Might possibly occur in the time period: roughly 1 in 200 chance</td>
</tr>
<tr>
<td>2. Unlikely</td>
<td>Could occur in the time period: roughly 1 in 2,000 chance</td>
</tr>
<tr>
<td>1. Remote</td>
<td>May occur only in exceptional circumstance: roughly 1 in 20,000 chance</td>
</tr>
</tbody>
</table>
Risk matrix identifies the risk level

<table>
<thead>
<tr>
<th>Consequences</th>
<th>Likelihood</th>
<th>Unlikely (2)</th>
<th>Possible (3)</th>
<th>Likely (4)</th>
<th>Highly Likely (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catastrophic (5)</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Extreme</td>
<td>Extreme</td>
</tr>
<tr>
<td>Major (4)</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>Extreme</td>
<td>Extreme</td>
</tr>
<tr>
<td>Significant (3)</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Moderate (2)</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Limited (1)</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
## Response plans

<table>
<thead>
<tr>
<th>Risk rating</th>
<th>Action required</th>
</tr>
</thead>
</table>
| Extreme     | - Make significant investment of resources to reduce the likelihood  
             - Have detailed contingency plans and clear accountabilities and resources that are immediately available to manage the event  
             - Have ‘stand by’ capacity to manage the consequences |
| High        | - Make investment in prevention that is proportionate to the risk  
             - Have a detailed contingency plan and clear accountabilities to manage the event  
             - Have a specific plan to prioritise existing resources to manage consequences |
| Moderate    | - Make investment in prevention that is proportionate to the risk  
             - Rather than a specific event plan, have a resilience plan to ensure a system’s normal mechanism for coping with events, as well as the level of harm posed by similar risks in this category  
             - Identify any types of threat or harm that the system isn’t set-up to deal with that may require specific measures |
| Low         | - Rely on resilience plan for moderate risks  
             - Identify any types of threat or harm that the system isn’t set up to deal with that may require specific measures |
Cognitive biases particularly affect our ability to judge risk

**Cognitive basis**

- **Misjudging ‘long-tail’ risks** — people are not strong at accurately assessing high-impact, low-probability risk
- **Anchoring** — people tend to adjust initial estimates insufficiently from an initial value
- **Discounting** — the significance of future gains/losses
- **Investigating** — people give undue weight to information that is more readily drawn to mind and more prominently displayed
How to incorporate the practical disciplines in our curriculum

**Include and evolve rather than add**

- In existing subjects include explicit problem solving methodology and complexity thinking
- Make more use of practical projects, which provide greater opportunities for lean thinking and future management tools
- Problem based learning