How can global human development and environmental sustainability be aligned?

Heinz Schandl
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The global challenge

• 3 billion additional middle class consumers by 2030
• 80% rise in steel and cement demand by 2030
• Price rises in food, energy, materials and water
• Cost of extraction of oil and metals doubling
• Recycling potential for many metals underutilised
• Converging pressure points of supply security and climate change
• Large investment in resource systems needed to satisfy demand
• Housing, transport, energy and food may deliver 75% of savings
• Investment needs to be redirected to achieve human wellbeing at much lower environmental cost
Broadening the Compass for Decision Making

GDP
Employment rate
Inflation rate
Interest rate
Stock market

Stocks and flows of natural resources
- Materials and Waste
- Energy and Emissions
- Water and Land
Socio-economic metabolism approach

Whole life-cycle approach

Embodied Resource Use:
- Materials, t
- Energy, J
- Water, m³
- Land, ha

Stock Accumulation:
- Buildings, infrastructure, industrial and domestic capital

Output:
- Products and Services, $
- Waste, t
- Emissions, t
<table>
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<tr>
<th>Problem</th>
<th>Mechanism</th>
<th>Pressures</th>
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</thead>
<tbody>
<tr>
<td>Climate Change</td>
<td>CO\textsubscript{2}, N\textsubscript{2}O and CH\textsubscript{4}</td>
<td>Energy consumption, land use, material flows</td>
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<tr>
<td>Acidification</td>
<td>SO\textsubscript{2}, NH\textsubscript{4} and NO\textsubscript{x}</td>
<td>Energy consumption, land use</td>
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<td>Eutrophication</td>
<td>Bio-accessible phosphorus and nitrogen</td>
<td>Land use</td>
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<td>Biodiversity loss</td>
<td>Intensive agriculture and forestry</td>
<td>Land use, material flows, global trade</td>
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<td>Soil erosion</td>
<td>Agricultural and forestry practices</td>
<td>Land use</td>
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<td>Water protection</td>
<td>Industrial effluents and municipal waste water</td>
<td>Land use, energy consumption</td>
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<td>Waste problems</td>
<td>Manufacturing and households</td>
<td>Material flows</td>
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<td>Depletion of natural resources</td>
<td>Non-renewable and renewable</td>
<td>Material flows, energy use and land use</td>
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<td>Health risks</td>
<td>Toxic substances</td>
<td>Biological activity</td>
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</tbody>
</table>
Decoupling economic growth and environmental pressure/impact

Figure 1. Two aspects of ‘decoupling’

Source: UNEP 2011
Overall structure of material flow accounts
Economy, population and natural resource use are growing

Global summary indexed indicators, 1970=1 (except RME)

- GDP
- Population
- Domestic extraction
- Exports
- RME Exports

UNEP (forthcoming) Global Material Use and Resource Productivity
Global resource requirements at 80 billion tonnes

Global material extraction by material category, 1970 - 2010

- Non-metallic minerals
- Metal ores
- Fossil fuels
- Biomass

UNEP (forthcoming) Global Material Use and Resource Productivity
Wealthy countries use the most

Domestic material consumption per capita, by HDI level

UNEP (forthcoming) Global Material Use and Resource Productivity
Especially in terms of material footprint
Does the material use required for high human development decline over time?

- UNEP (forthcoming) Global Material Use and Resource Productivity
Drivers of material use, 2000 to 2010

-50%  0%  50%  100%  150%

Africa     45%
Asia + Pacific  88%
EECCA     25%
Europe     -3%
Latin America + Caribbean  35%
North America -15%
West Asia  101%
World     43%

Net Change % DMC

-75% -50% -25%  0%  25%  50%  75%  100%  125%

Africa      -19%  29%  34%
Asia + Pacific  15%  45%  28%
EECCA     -33%  0%  58%
Europe     -18%  8%
Latin America + Caribbean  15%  21%
North America -30%  9%
West Asia  47%  29%  26%
World     13%  29%  1%

Population  Affluence  Technological coefficient

UNEP (forthcoming) Global Material Use and Resource Productivity
Trade is growing fast

Exports, Global

- Non-metallic minerals
- Metal ores
- Fossil fuels
- Biomass

UNEP (forthcoming) Global Material Use and Resource Productivity
40% of all extraction is related to traded goods

UNEP (forthcoming) Global Material Use and Resource Productivity
Asia-Pacific main driver of global material use

Domestic Material Consumption (DMC) → waste equivalent

Source: UNEP 2011, West and Schandl 2013, UNEP 2015
Material intensity of the global economy increasing

Material intensity

- Asia and the Pacific
- ROW
- World

KG PER US$
Differences between territorial material use (DMC) and Material Footprint (MF)

Australia

Japan

China

Landing point
25-30 tonnes per capita

2050
9 billion people
270 billion tonnes of natural resource use
4 times of today

Source: Wiedmann, Schandl et al. 2015
<table>
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<th>Three main scenarios</th>
<th>Scenario settings</th>
<th>Three models (coupled)</th>
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<td>Base Case</td>
<td>No carbon price</td>
<td>Technology based physical stocks and flows model (MEFISTO)</td>
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<td>No investment in resource efficiency above business as usual</td>
<td>CSIRO Ecosystem Sciences</td>
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<td>Step Change in resource efficiency</td>
<td>25$ global carbon price (price induced change) Investment in resource efficiency to achieve technical potential in major sectors (non-price induced change)</td>
<td>Integrated Global Economy – Climate Model (GIAM) CSIRO Climate and Atmospheric sciences</td>
</tr>
<tr>
<td>Step Change in resource efficiency plus change in consumer behaviour</td>
<td>50$ carbon price Investment in resource efficiency and sustainable consumption Systems Innovation</td>
<td>Global, multi-regional input-output model (EORA) University of Sydney</td>
</tr>
</tbody>
</table>

Source: Schandl, Hatfield-Dodds et al. 2015
Global total primary energy supply (TPES), 1990 to 2050

Source: Schandl, Hatfield-Dodds et al. 2015
Global carbon dioxide emissions (CO2), 1990 to 2050

Source: Schandl, Hatfield-Dodds et al. 2015
Global material extraction (DE), 1990 to 2050

Source: Schandl, Hatfield-Dodds et al. 2054
A very small impact on economic growth

• Global inflation adjusted GDP, according to our modelling, is expected to grow strongly over the next four decades from 58 trillion US$ in 2010 to about 190 trillion US$ (at 2007 prices) in 2050.

• Strong abatement policies and high investment in resource efficiency technologies would see global wealth grow by US$3 trillion less, equivalent to a loss of only 1.6% of global output over 40 years.

• Cost of climate impacts and resource limits are not accounted for.

Source: Schandl, Hatfield-Dodds et al. 2015
Territorial carbon emissions and carbon footprint for United States, Japan, China and EU-25 in 2010, 2030, 2050 - two scenarios

Source: Schandl, Hatfield-Dodds et al. 2015
The protection and efficient use of natural resources is vital for sustainable development. We strive to improve resource efficiency, which we consider crucial for the competitiveness of industries, for economic growth and employment, and for the protection of the environment, climate and planet. Building on the “Kobe 3R Action Plan”, and on other existing initiatives, we will continue to take ambitious action to improve resource efficiency as part of broader strategies to promote sustainable materials management and material cycle societies. We are establishing the G7-Alliance on Resource Efficiency as a forum to share knowledge and create information networks on a voluntary basis.
First forum of ministers and environment authorities of Asia Pacific in Bangkok, May 2015

- The effect of **climate change and disasters** and increasing vulnerability of countries in Asia and the Pacific, which will continue to impose economic losses that could offset development gains, increase poverty and threaten water and food security.
- Deteriorating health and rising costs from **air, water and soil pollution** due to emissions, effluent and waste from industry, transport and agriculture.
- Threatened **food, water, and energy security** due to increasing population, rapid urbanization, changes in land use and widespread pollution.
- **Increasing resource use**, with little improvement in **resource efficiency**, causing degradation and loss of ecosystems services and additional financial burdens.
- **Gaps in scientific knowledge and evidence based** understanding of the causes of environmental degradation were adversely affecting the confidence of policy makers in taking timely and decisive action to safeguard the common environment.

Chair summary

[www.unep.org/roap/InformationMaterials/Events/ForumofMinistersEnvironmentAuthorities](http://www.unep.org/roap/InformationMaterials/Events/ForumofMinistersEnvironmentAuthorities)
Post-2015 development agenda and new Sustainable Development Goals

• GOAL 8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
  – 8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead

• GOAL 12 Ensure sustainable consumption and production patterns
  – 12.2 By 2030, achieve the sustainable management and efficient use of natural resources
  – 12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

Proposal for Sustainable Development Goals
Thank you

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