Transnational linkages in Asian sustainability experiments

Conference on technological pathways to low carbon
Rob Raven

GDI, Bonn, April 7
Outline

- Background
- Experiments and transnational linkages
- Database and examples
- Concluding remarks
Rapid, unprecedented changes in Asian region

GDP growth

Poverty alleviation

Resource depletion

Waste and pollution

Inequalities

Climate change

Poverty alleviation
If Asia economically dominates the world by 2050, key question is:
  - Will Asia follow the same development pathways as US, Europe, Japan; what kind of consequences for SD?
  - Traditional growth models (Rostow) predict economic convergence and catch-up
    - Depends on absorptive capacity, foreign capital, access to global markets, national policies and institutions (Abramovitz, Gerschenkron)
  - Economic convergence mirrored in environmental convergence (Kuznet)
    - But: limited resources and time (climate change!)
    - Environmental leapfrogging
Investments in renewable energy

FIGURE 14: FINANCIAL NEW INVESTMENT IN RENEWABLE ENERGY BY REGION, 2004-2010, $BN

New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals. This comparison does not include small-scale projects.
Key-question and approach

• Where do greener development models and the required technological innovations come from?

• Approach: sustainability transitions, socio-technical transitions, multi-level perspective (Geels, 2002)

• Focus on ‘sustainability experiments’ in the context of increasing globalization (Berkhout et al., 2010)

• Sustainability experiments as innovative local nodes, but transnationally networked (Raven et al., 2012)
Multilevel perspective on system innovation

Geels, 2002; Raven, et al, 2012

Globalisation: new contexts & pressure on environmental quality through global value chain, regulation, international institutions

Regimes are dynamic, new regimes next to old ones, transnational

Many sustainability experiments & abundant opportunities for new niches, transnational
Sustainability experiments: seeds of sustainable change?

- Sustainability experiments: planned initiatives that embody a highly-novel socio-technical configuration likely to lead to substantial (environmental) sustainability gain (Berkhout et al., 2010)

1. Can we empirically show that sustainability experiments do occur in the context of late comer countries?
2. Can we demonstrate that these experiments constitute nodes in transnational networks rather than local projects in national contexts?
3. How to assess their sustainability in an inclusive way?

- Database, case-studies, sustainability assessment workshops
Typology of transnational linkages

• **Actors**
  - foreign training, education abroad, recruitment of foreign HR resources, overseas visits, joining international networks

• **Institutions**
  - certificates, policy & business models, EMAS (e.g.: ISO 9001, 14001), standards, audits, monitoring systems, regulations, awards, endorsements, prizes

• **Technology**
  - technology transfer, licensing, ownership acquisition

• **Knowledge**
  - know-how, technical consultancy, R&D, technical collaboration, blueprints and recipes, production licenses

• **Financial**
  - FDI, R&D funding, private equity, VC, technical cooperation grants

Wieczorek, Raven and Berkhout, 2014
The database

- **Factual information**
- **Triggers**
  - Type & geo origin
- **Actors linkages**
  - Type, geo origin, role
- **Knowledge linkages**
  - Education, work experience
- **Technology linkages**
  - Technology used, type, geo origin, owner and its geo origin
- **Financial linkages**
  - Budget, type, geo origin
- **Institutional linkages**
  - Type, geo origin

- **Outcomes**
  - Replicated (new experiments)
  - Expanded, e.g.
    - Quantitatively (customers)
    - Net impact (more value)
    - Organizationally (employees)
    - Functionally (new products, services)
  - Continued with goals achieved
  - downscaled (less benef., or value)
  - Terminated with(out) net loss
Cases and scope

- Solar PV and urban road mobility, India and Thailand
- Scope: 2000-now, past and ongoing
- Following actor categories:
  - National and state governments
  - Int. Organisations
  - Nat. NGO’s
  - Industry:
  - Knowledge Institutes
  - Directories of projects
- Limitations:
  - Internet: major source, but complemented with case studies
  - Mostly success stories
  - Outcomes: difficult to judge
Database example: Aurore SHS/light, Tamil Nadu, India

- **Triggers (local):**
  - To replace the use of ca 1,750 l/y of diesel, brighter and safer light, to replace kerosene lamps and candles avoiding about 1,300 t/y CO2

- **Actor-network (int/nat):**
  - Auroville Foundation (Aurore) NGO Nat Initiator
  - Local governments
  - WIPRO (software delivery) Industry SME Nat Owner of tech
  - SREI Kolkata (infrastructure) Industry SME Na Owner of tech
  - IFCL Chennai Financial organisation Loc
  - MNRE (IREDA) Gov Nat Sponsor
  - Six NGOs incl. Greenpeace NGO Int
  - Bharat Heavy Electricals Ltd Industry MN Nat Owner of tech
  - Tata BP Solar Industry MN Int Owner of tech

- **Knowledge: (int/nat)**
  - embedded in actors, no consultancy

- **Technology: Tata BP (int/nat)**

- **Institutions: (int)**
  - 2004 Ashden Award, UNDP recognised,

- **Capital: (nat)**
  - MNRE

- **Outcomes:**
  - replicated, expanded quantitatively
Database example: DelHy-3W hydrogen-powered auto-rickshaw

- **Triggers (local/nat):**
  - Sustainable mobility solutions
  - Lower fuel consumption - 1 kg of H = +/- 80 km of mileage
  - Lower GHG emissions

- **Actor-network (int/nat):**
  - UNIDO Istanbul, Turkey, Gov. Int. Sponsor
  - Int Centre for Hydrogen Energy Technologies (UNIDO-ICHET) Knowledge institute International Owner of technology
  - Mahindra and Mahindra, Industry MN Inte Initiator
  - Indian Institute of Technology, Delhi (IITD) Knowledge institute National Owner of the project
  - India Trade Promotion Organization (ITPO)/ Gov agency / Nat
  - MNRE Government National Other
  - Air Products, Pennsylvania, USA Industry SME Int, Sponsor

- **Knowledge: (int/nat)**
  - embedded in actors, no consultancy

- **Capital: (int)**
  - USD 1 Million (0.5U$ from ICHET) and Air Products Pennsylvania US

- **Technology: (inter)**
  - International Centre for Hydrogen Energy Technologies, International and Mahindra & Mahindra International

- **Outcomes:**
  - continued
Case example: BRT in global South

Sengers, 2014
Operational system sites vs. codified knowledge production sites. Sengers, 2014

Case example: BRT in global South

Bangkok

Bogota

Delhi
## Key actors in transnational diffusion of BRT

<table>
<thead>
<tr>
<th>Actor category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>local implementing agencies</td>
<td>“the city administrative and political layer, the transport operators, ministries of transport in a specific country, the transport engineers”</td>
</tr>
<tr>
<td>knowledge transfer programs</td>
<td>“for example the UE COST initiative, TRB in the USA, the World Bank”</td>
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<tr>
<td>development partners</td>
<td>“the likes of the World Bank, ADB, AFD, IDB are supporting projects around the world”</td>
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<tr>
<td>international NGOs</td>
<td>“in the domain of BRT we see EMBARQ, ITDP and SUTP very much in the front” “one of the biggest instigators are NGOs like ITDP and EMBARQ … I can guarantee you that 75% of the projects out there probably owe their existence of those organizations”</td>
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<tr>
<td>core consultants</td>
<td>“a core group of consultants who work on BRT and have been very influential - the Brazilian firm Logit, the British firm Steer Davis Gleave, a couple of Spanish firms. It’s just a handful”</td>
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<tr>
<td>university researchers</td>
<td>“classic examples are the university of Capetown, the university in Santiago de Chile”</td>
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<td>implementation partners</td>
<td>“the university or research institute sometimes becomes a technical partner to the implementers”</td>
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<tr>
<td>preachers</td>
<td>“individuals like Enrique Penalosa, the former mayor of Bogota, and Jamey Lerner, the former mayor of Curitiba”</td>
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Transnational linkages in Thai BRT systems
More than 200 SPV and 150 mobility experiments in Indian database

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Transnational linkage:</th>
<th>Actors</th>
<th>Technology</th>
<th>Knowledge</th>
<th>Finances</th>
<th>Institutions</th>
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<tbody>
<tr>
<td>Low-GHG emitting rolling stock cars in N. Delhi metro</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
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<td>DelHy 3W- HyAlfa Hydrogen Fuelled Hy-Alfa 3 Wheeler</td>
<td>✓ ✓ ✓ ✓ x</td>
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<tr>
<td>Engine Mgmt System for Petrol Powered Small Vehicles (TIFAC)</td>
<td>✓ x ✓ ✓ x</td>
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<tr>
<td>Revolo hybrid car</td>
<td>✓ x ✓ ✓ ✓</td>
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<tr>
<td>Hydrogen-powered auto rickshaws</td>
<td>✓ ✓ ✓ ✓ x</td>
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<tr>
<td>Bajaj</td>
<td>✓ ✓ ✓ ✓ x</td>
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<tr>
<td>STADIUM: smart transport applicat. for large events</td>
<td>✓ ✓ ✓ ✓ ✓</td>
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<tr>
<td>LABL (Lighting a Billion Lives), India</td>
<td>✓ x ✓ ✓ ✓</td>
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<tr>
<td>Christian Aid d-Light Solar project</td>
<td>✓ ✓ ✓ ✓ ✓</td>
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<tr>
<td>1 MW Grid Interactive Solar PV Power Generation Project of MSPGCL, Chandrapur</td>
<td>x x x x ✓</td>
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<tr>
<td>Selco SHS Bangalore</td>
<td>✓ x ✓ ✓ ✓</td>
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<tr>
<td>Rooftop Grid Connect Home power system, Ahemedabad, Gujrat</td>
<td>✓ x ✓ ✓ x</td>
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<tr>
<td>Indira nagar micro grid solar project Rajasthan</td>
<td>✓ x ✓ ✓ ✓</td>
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Emerging areas of increased experimentation: SPV

Lanterns

SHS

Micro grids

Solar city

Power plants

Roof top
Emerging areas of increased experimentation: MOBILITY

Car part innovations
Public transport: BRT
Walking

Alternatively fuelled cars (electric)
Alternatively fuelled cars: (CNG)
Cycling
Transnational linkages in SPV experiments

India

- Actors: 25%
- Institutions: 23%
- Knowledge: 26%
- Capital: 15%
- Technology: 11%

Bar chart showing the distribution of transnational linkages across different categories:
- All experiments
- Grid connected
- Lighting
- Micro-grid
- Off-grid power plant
- SHS
- Roof top
- Solar city
- Other

Legend:
- Actors
- Technology
- Institutions
- Knowledge
- Capital

TU/e Technische Universiteit Eindhoven University of Technology
Transnational linkages in urban mobility experiments in India

Actors 26%
Knowledge 27%
Technology 15%
Capital 19%
Institutions 13%

Wieczorek, Raven and Berkhout, 2014
Initiators of SPV experiments in India

Grid connected Lighting Micro-grid Off grid power plan
SHS Roof top Solar city
Internationa l 22%
National and local 78%

Initiators of mobility experiments in India

- Alternative powered vehicles: CNG, hybrid and hydro experiments
- Cycling
- Public transport innovations
- Vehicle parts innovations
- Walking

- National and local: 78%
- International: 22%

Types of Initiators:
- International NGOs
- National NGOs
- Local NGOs
- National and local SMEs
- National and local government
- National and local universities
Sustainability appraisal of emerging pathways

- Sustainability - a contested, ambiguous concept
- No agreed list of indicators, criteria
- Most of evaluations – only monitoring and traditional ranking of sustainability impacts

Brundtland report

CIRCLES OF SUSTAINABILITY

Living in the donut

Technische Universiteit Eindhoven
University of Technology
Multicriteria Mapping

- Efforts to assert single definitive ‘truth’ or ‘best’ are counterproductive
- Aims instead to ‘open up’ debate through mapping of different views and exploring uncertainties

Stirling, 1999, 2005
Variety of criteria

- Affordability
- Demand driven
- Pay back period
- Independent of regulatory framework
- Transparency
- Employment generation
- Quality of life
- Ease of maintenance
- Cost to consumer
- Corruption
- Energy security
- Return on investment
- Availability of financial support
- Accessibility
- Availability of financial support
- Financial viability
- Inclusiveness
- Pollution reduction
- Gender parity
- Resource conservation
- Usability
- Employment generation
- Affordability
- Reduction of fossil fuel use
- GHG emission reduction
- CO2 red potential
- Land use and change prevention
- Health and environment
- Climate mitigation potential
- Air pollution reduction
- Robustness of the value chain
- Waste minimisation
- Profitability
- Co-existence
- Practicability
- Service availability
- Profitability
- Demand driven
- Independent of regulatory framework
- Transparency
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Sustainability of mobility pathways in India

- Public transport innovations: BRT
- Alternatively fuelled vehicles
- Cycling
- Electric Vehicles
- Car parts innovations
- Walking
Concluding remarks

• About 150 mobility and 200 SPV experiments per country
  • Transnationally embedded

• Still key role for local/regional/national governments

• Sustainability not an intrinsic feature of technologies
  • Need for inclusive ways for sustainability assessment, acknowledging diversity

• Important implications for theories of system innovations/transition