Innovative Technologies
Main Findings

James M Roshetko, CIFOR-ICRAF & FTA

Roadmaps for Primary Forests Conservation and Innovative Forest Technologies in Asia and the Pacific

23 November 2021
Background

Third Asia-Pacific Forest Sector Outlook Study launched June 2019 at the Asia-Pacific Forestry Week in Seoul (ROK) emphasized:

• innovative technologies create both huge opportunities and challenges for sustainable forest management in the Asia-Pacific region

• 300 students & young professionals (30 countries) stated that uptake of new technologies was slow and called for more opportunities for youth in the forest sector
Roadmap

FAO and CIFOR-ICRAF implemented the roadmap on *innovative technologies* in forest sector of the Asia-Pacific region.

- Online inception workshop (30 July 2020)
- Web- and email-based survey - technical input (Aug-Dec 2020)
- Expert interviews - technical input (Aug-Dec 2020)
- Online IT workshop - discussion-technical input (30 Nov-3 Dec 2020)
- Youth contribution – IT for SFM in the future – call for abstracts, research volume, & a session at GLF Climate Conference (5 Nov 2021)
- Validation workshop *(today’s event)*
- ‘*Innovative technologies paper*’ under peer review *(ongoing)*

350 stakeholders have contributed
Contents of the IT Technical Paper

Introduction - Background

Chapter 1  Framing: Concept & Definitions
Define: Geographic Scope, Forestry & SFM in Global Context, SFM (thus IT) are relevant to SDGs, Categories of Innovation

Chapter 2  Innovative Technologies in the Forest Sector
4 clusters: i) Digital technologies, ii) Biological technologies; iii) Process & product tech; & iv) Finance & social innovations

Chapter 3  Opportunities & Challenges in the Forest Sector – role of Innovative Technologies

Chapter 4  Enabling Uptake & Scaling-up of Innovative Technologies for sustainable forestry

Chapter 5  Recommendations
Digital Technologies

- Satellites, LIDAR, GPS, GIS
- Drones and UAVs
- Online platforms – EOS, SEPAL, Google Earth Engine, ... global tree planting tools
- Geo spatial info for planning & manage
- Timber tracking, certification, monitoring
- Sensor networks – acoustic, optical, camera – focus on conservation
- Social media, video-conferencing
- Mobile phones & apps
- Crowd Sourcing & Citizen Science
- Artificial intelligence, machine learning, digital twin replica
Biological Technologies

• Genetic resources & germplasm
  - quality & quantity priority species
  - cutting garden, tissue culture techniques ... broadly adopted
  - low-input & tree diversity breeding
  - collaboration with farmers, communities, civil society
  - effective germplasm dissemination
  - nursery & germplasm enterprises

• Commercial species remain a focus
  ... expand to local priorities

• Biotechnology – genetically modified material

• DNA identification & tracking tech
Processes & Products Innovations

• Improved planning & management
• ‘Precision forestry’, IPTIM & Heureka software packages - using geospatial tech
• Aerial sowing ... right conditions
• RIL & other improved harvesting methods
• Improved processing - using 5G, CNC, AI (improve efficiency, recovery, ...)
• Engineered wood products – CLT, mass timbers, MDF, OSB, particleboards, ...
• Bamboo products (repl. wood & plastics)
• Bioplastics, biochemicals, pharmaceuticals
• Bioenergy products (resources, species)
• Nanotechnology
Innovative Finance & Social Innovations

- Blended finance
- Green, social and climate bonds
- Crowdfunding
- PES mechanisms
- Impact & responsible investments
- ICT-enabled banking & E-commerce
- Community Forestry & CBFM
  - local forest govern. & management
  - local involvement in forest monitoring
  - gender and minority advocacy (inclusive rights)
  - market & enterprise development
### Roles in Innovative Finance (example Blended Finance)

| Public sector | - Leveraging private finance to achieve SDGs and related goals  
| - Enabling business environment for private investors (reduce risks, transaction costs, etc.)  
| - Technical capacity-building  
| - Co-funding, co-financing and in-kind support of commercial and development activities  
| - Dissemination, uptake and scaling-up of technology (general and innovative) |

| Private sector | - Soft loans (with below-market interest rates)  
| - Preferred market access, premium price for quality commodity production  
| - Business training and enterprise development  
| - Targeted technical training to enhance commodity production  
| - Development and dissemination of innovative technologies |

| Development Cooperation (multi- & bi-lateral, foundations) | - Infrastructure and human development, assistance to government  
| - Technical and business planning, marketing and financial literacy capacity-building  
| - Supporting international development goals (SDGs, other development & environmental goals)  
| - Development and strengthening of SMEs (small- and medium-sized enterprises)  
| - Promotion and adoption of innovative technology |

| Other Stakeholders (environmental, social, etc) | - Community advocacy and agrarian transformation  
| - Facilitate engagement with public and private sectors  
| - Land access and land tenure  
| - Environmental, socio-cultural and livelihoods objectives  
| - Promotion and adoption of innovative technology |

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*Table 2, Chapter 2*
Forest Functions along forest value chain

- Data analysis & information sharing
- Forest planning & management
- Forest monitoring
- Tree planting & forest restoration
- Harvesting wood & NWFPs
- Processing wood & NWFPs
- Distribution & Trade
- Product Utilization

Based on Table 3, Chapter 2
Chapter 3. Opportunities & Challenges

Broad assumption that innovations are inherently beneficial, with advantages outweighing the disadvantages.

However, there are risks of negative social, economic and environmental impacts.

Chapter main positive and negative impacts in the forest value chains.
Chapter 3. Opportunities & Challenges

3.1 Shifts in the wood demand and forest value chains. Expanding role of region in forest resources/products supply.
3.2 Contributing to the circular bioeconomy
3.3 Enhancing monitoring & reporting
3.4 Facilitating improvement in forest management
3.5 Improving resource-use efficiency
3.6 Addressing the high quality & diverse planting material
3.7 Creating employment and livelihood opportunities
3.8 Considering all potential impacts of innovative technologies
<table>
<thead>
<tr>
<th>Impacts</th>
<th>Economic</th>
<th>Social</th>
<th>Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital tech-</td>
<td>(+) Enable efficient, accurate, cost-effective, real-time forest</td>
<td>(+) Facilitate data collection and analysis, info sharing, empower local communities &amp;</td>
<td>(+) Allow more reactive, flexible and efficient conservation strategies</td>
</tr>
<tr>
<td>nology</td>
<td>monitoring</td>
<td>marginalized groups</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(+) Facilitate precision management of forests and value chains.</td>
<td>(+) Enable citizen-science initiatives</td>
<td>(+) Support forest landscape restoration (via monitoring and information sharing)</td>
</tr>
<tr>
<td></td>
<td>(+) Improve productivity and profitability</td>
<td>(+) Enhance transparency and participation in monitoring and reporting</td>
<td>(+) Track illegal activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(+) Generate new skilled job opportunities, making the forest sector more attractive</td>
<td>(-) Can increase the risk of overexploitation and degradation of natural ecosystems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-) Can lead to the destruction of local unskilled jobs</td>
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**Table 5, Chapter 3**
## Chapter 3. Opportunities & Challenges

### Impacts
- **Biological technology**
  - (+) Improve productivity and profitability
  - (+) Provide high-quality genetic material for multiple uses
  - (+) Contribute to the development of a circular bioeconomy

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<td>(+) Improve productivity and profitability</td>
<td>(+) Increase traceability and transparency along forest product value chains</td>
<td>(+) Track illegal activities</td>
<td>(+) Track illegal activities</td>
</tr>
<tr>
<td>(+) Provide high-quality genetic material for multiple uses</td>
<td>(-) Can maintain or increase inequalities, further marginalize the most vulnerable groups and limit their access to natural resources and improved material</td>
<td>(+) Contribute to the development of a circular bioeconomy</td>
<td>(-) High costs may restrict application to a few species</td>
</tr>
<tr>
<td>(+) Contribute to the development of a circular bioeconomy</td>
<td>(-) High costs may limit access by smallholders further increasing social inequalities</td>
<td>(-) Genetic improvement may reduce intraspecific diversity</td>
<td>(-) Access to improved genetic material &amp; biotech products can be restricted (IPR &amp; regulations</td>
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<td></td>
<td></td>
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<td>(-) Can lead to unexpected collateral damages on natural ecosystems and biodiversity</td>
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*Table 5, Chapter 3*
## Chapter 3. Opportunities & Challenges

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</table>
| **Process & Product technology** | (+) Reduce operational costs  
(+) Reduce waste and increase resource-use efficiency  
(+) Improve productivity and profitability  
(+) Provide new products and services or develop new uses for forest products  
(+) Contribute to the development of a circular bioeconomy  
(-) Direct and indirect costs of adoption (equipment, training, loss of productivity, etc) | (+) Generate new skilled jobs and new income opportunities, making the forest sector more attractive  
(-) Can lead to the destruction of local unskilled jobs  
(-) Can maintain or increase inequalities, further marginalize the most vulnerable groups and limit their access to natural resources | (+) Increase wood recovery rate, thus reducing pressure on natural forests  
(-) Can increase the risk of overexploitation and degradation of natural ecosystems |

Table 5, Chapter 3
### Chapter 3. Opportunities & Challenges

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| **Finance & Social innovation** | (+) Improve smallholder access to credit and markets  
(+) Facilitate resource mobilization and investments in the forest sector  
(+) Support livelihoods and enterprise development | (+) Support local communities’ livelihoods and resilience  
(+) Enhance traceability and transparency  
(+) Support capacity-building and awareness raising  
(+) Foster participatory governance, empower farmers, communities, and marginalized  
(+) Enable innovative and inclusive governance and investment models | (+) Contribute to SFM (e.g., community-forest management)  
(+) Support forest landscape restoration (through local empowerment and access to financial resources) |
|  | | | (-) Captured by local or external elites and perpetuate inequalities |

Table 5, Chapter 3
Chapter 4. Enabling Uptake & Scaling

4.1 Status of Innovation in Asia and the Pacific

• GDP growth in the region twice as high as global average
• 55% of the top 20 WIPO patent offices are in Asia-Pacific
• WIPO Global Innovation Index (GII) – Asia-Pacific shows steady increase in GII during the last 10 years
• Higher internet access, use & capacity than global average
• Forestry graduates highest in Asia (ROK, Viet Nam, China)

• **Proxy measures** ... shows high innovative capacity / potential

World Intellectual Property Organization –
GII based on 80 indicators - economics, political environ., education, infrastructure & general knowledge
## 4.2 – 4.3 Key barriers to technology uptake and scaling

<table>
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<th>Constraints</th>
</tr>
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<tbody>
<tr>
<td>Human capital</td>
<td>Lack of skills, knowledge &amp; experience; wariness of ‘new’ technologies</td>
</tr>
<tr>
<td>Natural capital</td>
<td>Limited access to forests, land, natural resources; &amp; their assets &amp; products</td>
</tr>
<tr>
<td>Physical capital</td>
<td>Lack of infrastructure – roads, markets, electrical power, internet, etc – &amp; suitable equipment and innovations to scale technologies to all stakeholders</td>
</tr>
<tr>
<td>Financial capital</td>
<td>Limited access to capital, credit, and value-chains</td>
</tr>
<tr>
<td>Social capital</td>
<td>Restrictive governance &amp; tenure rights to forests, land, natural resources and their assets/products; &amp; limited access to institutions, networks and information</td>
</tr>
<tr>
<td>Policies</td>
<td>Absent, weak or restrictive legal &amp; regulatory frameworks; inappropriate application or enforcement of those legal &amp; regulatory frameworks</td>
</tr>
</tbody>
</table>

Table 6, Chapter 4
Chapter 4. Enabling Uptake & Scaling

4.4 Capacity-building, education & training

• Training in use and adoption of innovative technologies ... also

• Institutional management, leadership, language proficiency, indigenous-tech knowledge, value-chains, business operations

• Demonstrations of the technologies

• Collaboration between government, private sector, civil society, communities and donors to address these issues

• Opportunities should be prioritized for those negatively impacted by IT, women, rural residents, poor, & minorities

*Big plus: youth tech savvy, & strong forestry/environ education*
Chapter 4. Enabling Uptake & Scaling

4.5 Value chains: increasing access to credit & markets

• Forest sector often considered high risk – innovative finance very important for private sector to local communities

• Shared-value business strategies – mutual beneficial linkage between private sector and farmers-communities-SMEs ... reduce transaction costs, shorten value-chains, increase margins

• ICT-enabled banking & E-commerce (marketing) ... reduce transaction costs, shorten value-chains, increasing margins
Chapter 4. Enabling Uptake & Scaling

4.6 Forest sector governance & land tenure: improved transparency and participation

• DT – drones, GPS, GIC, mobile phones, apps, online platforms greatly enhance community & civil society involvement

• DNA identification & tracking – conservation & law enforcement

• Blended finance, social & green bonds, crowdfunding, impact investment, PES … can/do specific local participation & develop.

• Community Forestry – facilitates governance & management (Asia leader in CF); environment & cultural conservation; inclusive rights (gender, poor, minorities) … evolving stronger emphasis commodity products, enterprise develop., & market integration
Chapter 4. Enabling Uptake & Scaling

4.7 Supportive Policies, Regulations & Policy Environment

• Policies regarding IT ... absent, weak or inappropriate

• Lag-behind quick innovation development & focus macro conditions

• Policymakers proactive ... policies conducive to IT adoption ... & considering what’s required to include farmers, civil society & SMEs

• Role for private sector, civil society to support the process (input to Gov)

• Ex Policy voids – i) drone & data use, regs not applicable & used to restrict use & application for multiple reasons, conflicting regs; ii) forest regs restrict local timber trade & germplasm business

• Ex Dynamic environments – i) Nepal CF regs; ii) Viet Nam & China promote IT in processing industries; iii) Malaysia space agency support NR sector; iv) forest R&D agencies support smallholder nursery sector
Thank you!!

Photos: J Roshetko