



# *Innovative Technologies Main Findings*

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

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RESEARCH  
PROGRAM ON  
Forests, Trees and  
Agroforestry



Alliance



# 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

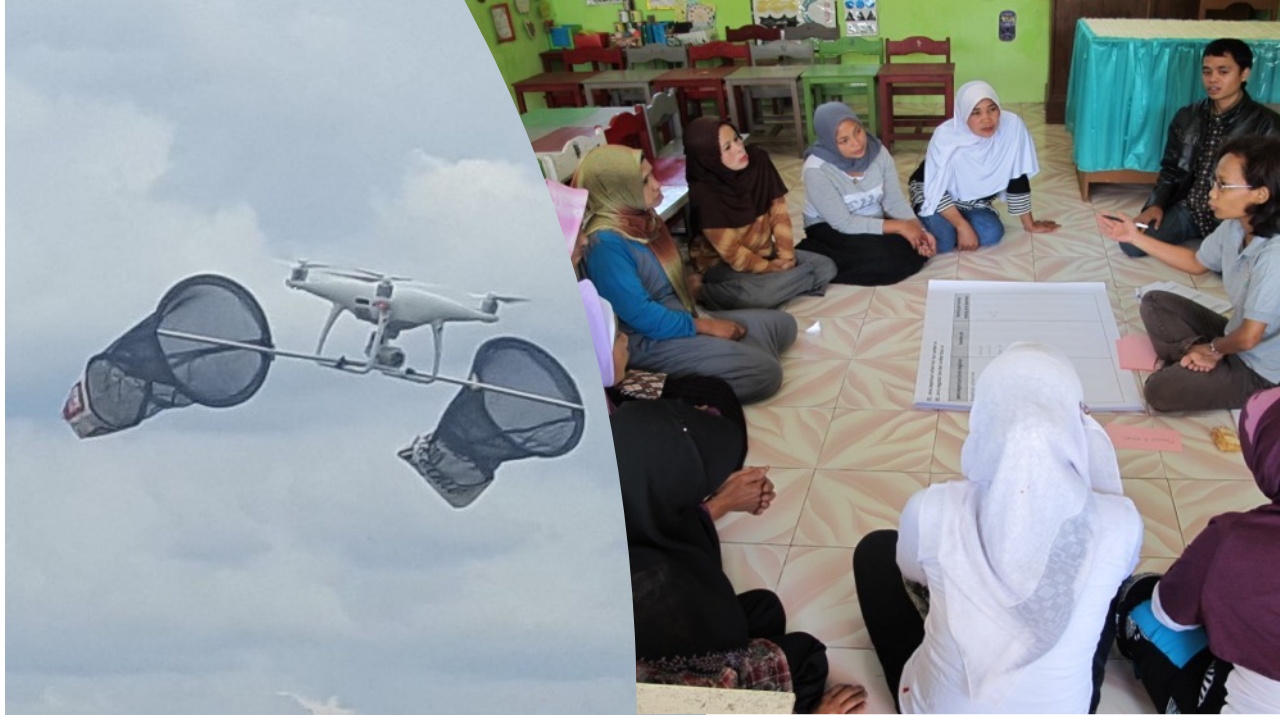
### Chapter 3 **Opportunities & Challenges in the Forest Sector – role of Innovative Technologies**

### 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



Photos: C. Roshetko, J Roshetko



# 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

**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**

**Actors**

Play a key role in



In collaboration with



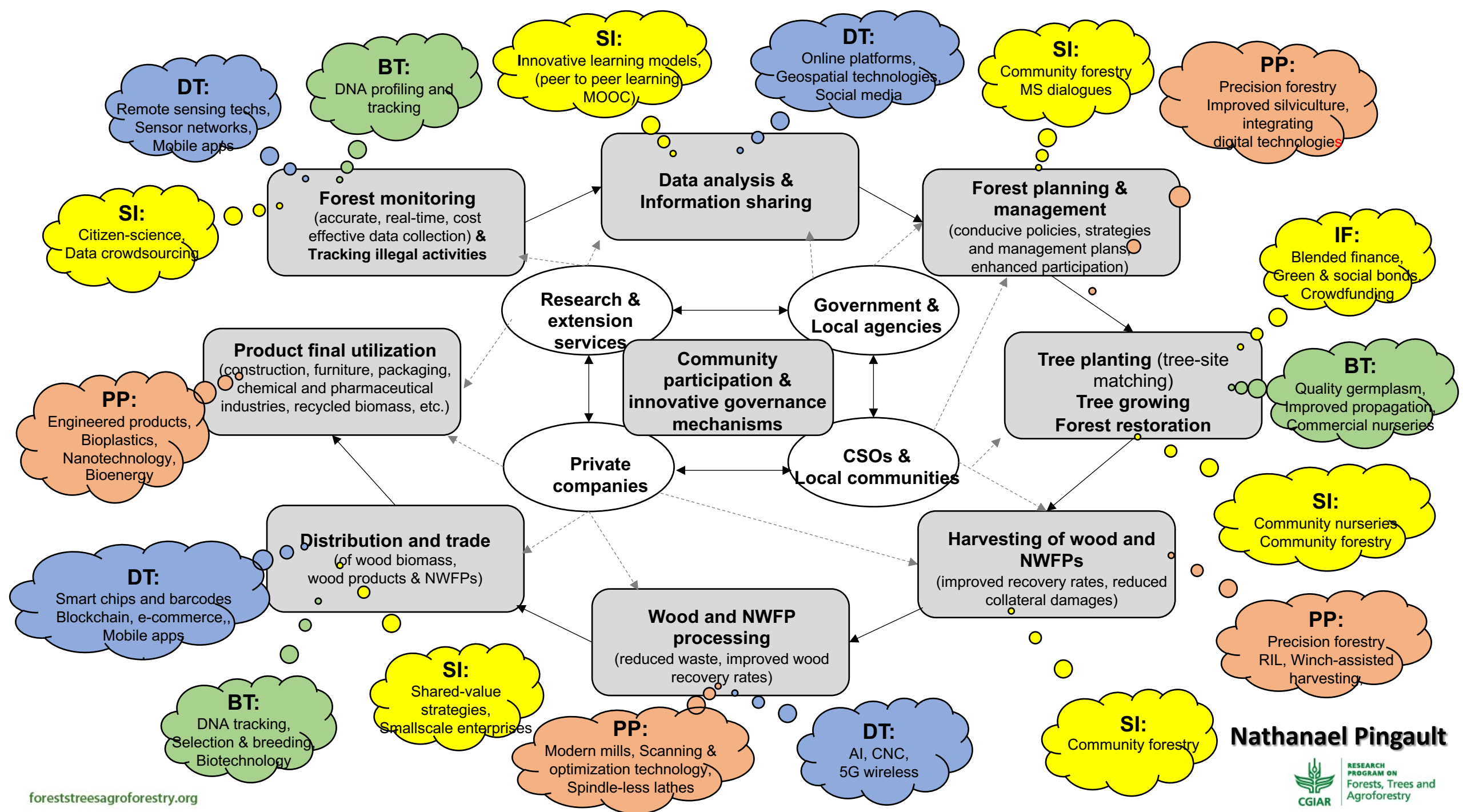
Digital technologies  
**DT**

Biological  
technologies  
**BT**

Process and product  
innovations  
**PP**

Innovative finance (**IF**)  
Social innovations (**SI**)







# 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



# Chapter 3. Opportunities & Challenges

Impacts	Economic	Social	Environmental
<b>Digital technology</b>	<p>(+) Enable efficient, accurate, cost-effective, real-time forest monitoring</p> <p>(+) Facilitate precision management of forests and value chains.</p> <p>(+) Improve productivity and profitability</p>	<p>(+) Facilitate data collection and analysis, info sharing, empower local communities &amp; marginalized groups</p> <p>(+) Enable citizen-science initiatives</p> <p>(+) Enhance transparency and participation in monitoring and reporting</p> <p>(+) Generate new skilled job opportunities, making the forest sector more attractive</p> <p>(-) Can lead to the destruction of local unskilled jobs</p>	<p>(+) Allow more reactive, flexible and efficient conservation strategies</p> <p>(+) Support forest landscape restoration (via monitoring and information sharing)</p> <p>(+) Track illegal activities</p> <p>(-) Can increase the risk of overexploitation and degradation of natural ecosystems</p>

Table 5, Chapter 3

# Chapter 3. Opportunities & Challenges

Impacts	Economic	Social	Environmental
<b>Bio- logical tech- nology</b>	(+) Improve productivity and profitability (+) Provide high-quality genetic material for multiple uses (+) Contribute to the development of a circular bioeconomy	(+) Increase traceability and transparency along forest product value chains (-) Can maintain or increase inequalities, further marginalize the most vulnerable groups and limit their access to natural resources and improved material (-) High costs may limit access by smallholders further increasing social inequalities	(+) Track illegal activities (+) Contribute to the development of a circular bioeconomy (-) High costs may restrict application to a few species (-) Genetic improvement may reduce intraspecific diversity (-) Access to improved genetic material & biotech products can be restricted (IPR & regulations) (-) Can lead to unexpected collateral damages on natural ecosystems and biodiversity

Table 5, Chapter 3



# Chapter 3. Opportunities & Challenges

Impacts	Economic	Social	Environmental
<b>Process &amp; Product tech- nology</b>	(+) 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 (+) Contribute to the development of a circular bioeconomy (-) Can increase the risk of overexploitation and degradation of natural ecosystems

Table 5, Chapter 3

# Chapter 3. Opportunities & Challenges

Impacts	Economic	Social	Environmental
<b>Finance &amp; Social inno- vation</b>	(+) 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 (-) Captured by local or external elites and perpetuate inequalities	(+) Contribute to SFM (e.g., community-forest management) (+) Support forest landscape restoration (through local empowerment and access to financial resources)

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 GI 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

# Chapter 4. Enabling Uptake & Scaling

## 4.2 – 4.3 **Key barriers** to technology uptake and scaling

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

# 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/envirom 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