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Centre for Sustainable Agricultural Mechanization

National Priorities in Sustainable Mechanization in Bhutan

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Climate-smart Agricultural Mechanization for Sustainable Crop Residue Management and Resilient Agrifood Systems
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National mechanization overview and needs

National mechanization overview

- **Only 2.9%** of total geographical area is under agriculture (about 250,000 acres)
- **About 60%** of agricultural land is on difficult terrain where modern mechanization is not feasible
- Landholdings are on difficult terrain and fragmented, with small farm sizes limiting the use of large machinery
- **About 28%** of the feasible land is under farm mechanization
- Agriculture employs **43.5%** of the population (more than **52%** are female)
- Farm labour shortage

Needs

- Smaller machines that suit our terrain
- Women-friendly machines for mechanization
- Multipurpose machines for land preparation, weeding and harvesting



The challenge: steep, sloping terrain makes farm mechanization difficult

National Initiatives/Solutions in relation to climate resilience, crop residue management, and/or conservation agriculture

Climate resilient agriculture

- Sustainable Land Management (SLM)
- Protected agriculture
- Climate-smart irrigation
- Organic agriculture
- Regulated use of chemical fertilizers and pesticides
- Application of IoT and drone technology
- National crop and livestock insurance schemes



Protected agriculture

National Initiatives/Solutions in relation to climate resilience, crop residue management, and/or conservation agriculture

Crop residue management

- Incorporation of crop stubble back into the land
- Crop residues fed as animal feed
- Crop residues used for farmyard manure (FYM)
- Crop residues used as raw material for vermicompost
- Used for mushroom production
- Used for biochar production
- Burning of crop stubble is restricted by all local government rules



Crop residues collected for reuse



Transporting crop residues

National Initiatives/Solutions in relation to climate resilience, crop residue management, and/or conservation agriculture

Conservation agriculture

Producing food without much impact on soil health, water and the productive capacity of the land

- Sustainable land development programme to prevent soil erosion
- Chemical fertilizer and pesticide use is highly regulated
- Use of crop mulches
- Extensive use of micro-irrigation systems
- Minimum tillage, as no machines are used for ploughing sloping dry lands



Sustainable land development

Opportunities for regional cooperation

1. Smart Mechanization & Digital Agriculture: From Data to Innovation

- **Innovative Technologies:** Transfer of modern, terrain-appropriate machinery and smart farming solutions.
- **Digital Intelligence:** GIS-based mechanization suitability mapping, remote sensing, and precision agriculture.
- **Quality & Standards:** Strengthening machinery testing, performance evaluation, and certification.
- **Skills & Knowledge:** Technical training, expert exchange, and institutional capacity-building.
- **Innovation to Impact:** Joint research, pilot demonstrations, and digital decision-support systems for efficient, climate-resilient farming.

Opportunities for regional cooperation

2. Climate-Smart and Climate-Resilient Agriculture

- Sharing of climate-resilient technologies and best practices, particularly focused on mountain agriculture.
- Support for climate-risk mapping, early-warning systems, and efficient irrigation.
- Collaboration on sustainable crop protection and responsible pesticide management.

Opportunities for regional cooperation

3. Agricultural Waste Management and Organic Agriculture

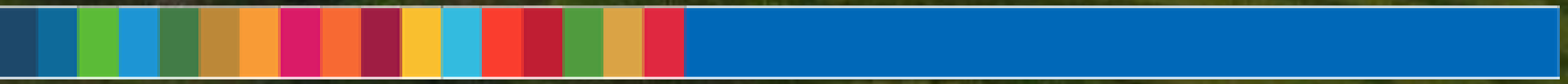
- Technology transfer for composting, biochar, and crop residue utilization.
- Support for organic input production, certification, and quality assurance.
- Knowledge exchange on organic farming systems and market development.

Opportunities for regional cooperation

4. Capacity Development and Research

- Training, study visits, and technical exchanges.
- Joint research and pilot projects (agri-tech startups).
- Support for funding, technology transfer, and public–private partnerships.

Thank you for your attention



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