



**CSAM**

Centre for Sustainable  
Agricultural Mechanization



**NIAAM**

# 10<sup>th</sup> Regional Forum on Sustainable Agricultural Mechanization in Asia and the Pacific

*Gender Mainstreaming in Sustainable Agricultural Mechanization*

28-30 November 2023; Shanghai, China

**Designing Gender-Responsive Technologies and Empowering Women Engineers**

**Er. Sweeti Kumari, Scientist, ICAR-CIAE, Bhopal India**

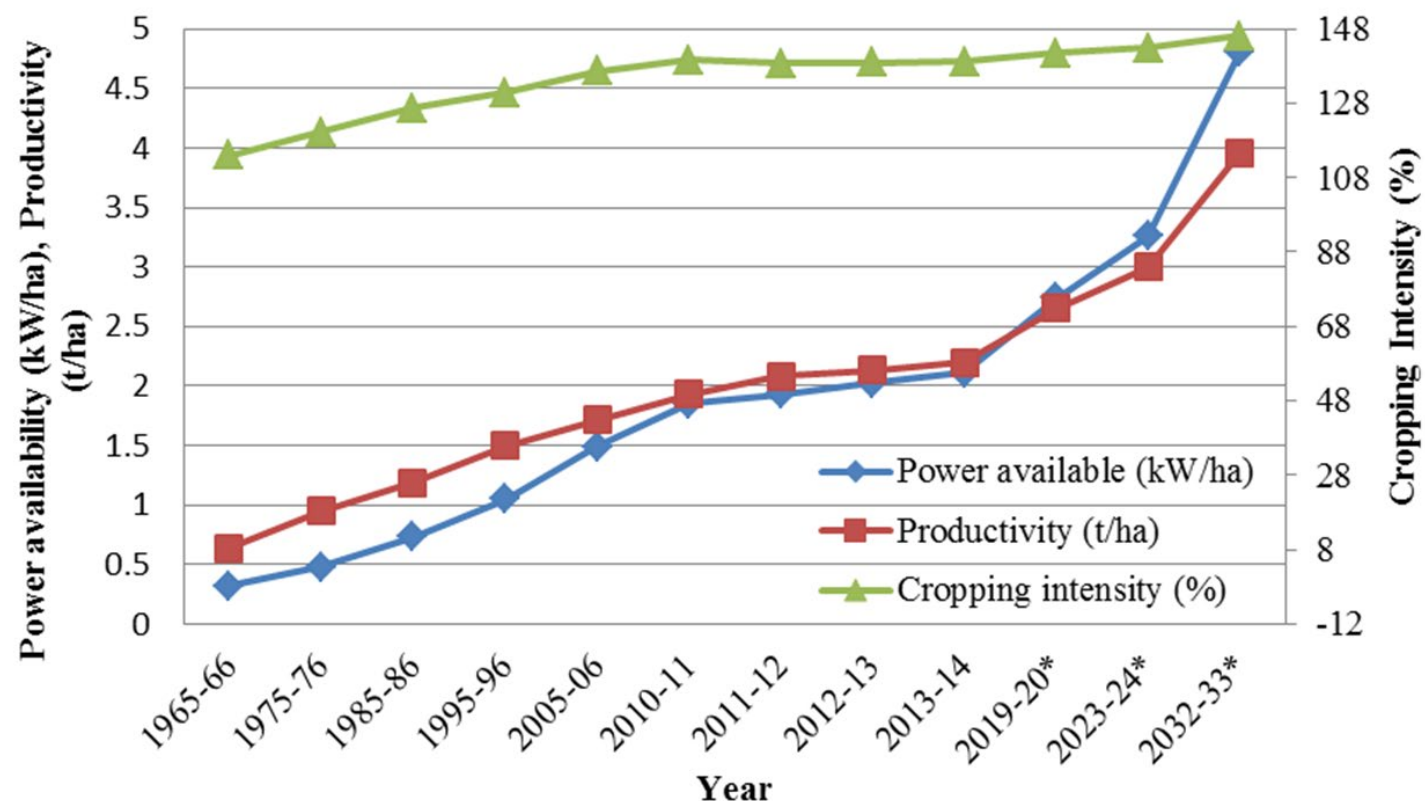
**Dr. K. P. Singh, ADG, FME, Indian council of Agricultural Research, New Delhi**

## Indian Agriculture

- Net Sown area - 140 million ha (42.6%)
- Agricultural workers - 230 million
- Employs about 52% of the work force
- Provides livelihood to about 60% of the population
- Yearly production – Food grains - 315.6 million tonnes (2021-22)  
Fruits – 107.5 million tonnes (2021-22)  
Vegetables – 209.1 million tonnes (2021-22)
- No. of land holdings - 138 million
- Contributes 18% to the Gross Domestic Product (GDP)



## Farm Mechanization Status



**Need of farm power would be  
4 kW/ha to meet the growing food demand by 2030**

\* Estimated values

Source: Tiwari PS; KK Singh; Sahni RK; Kumar V. 2019. Farm mechanization—trends and policy for its promotion in India. IJAS, 89 (10): 1555-1562.

## Farm Mechanization Level

Extent of Mechanization at  
Various Levels of the Value Chain



Soil working and seed  
bed preparation

**40**  
percent



Seeding and planting

**29**  
percent



Plant protection

**34**  
percent



Irrigation

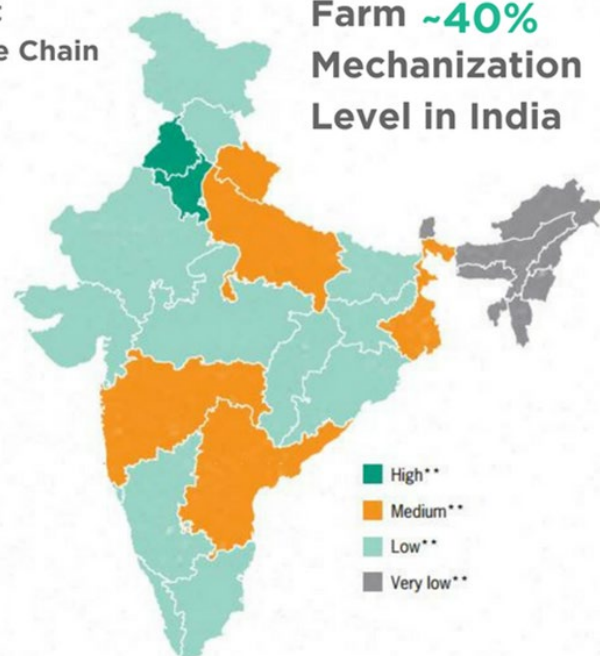
**37**  
percent



Harvesting and threshing

**60-70**  
percent for wheat and rice;  
<5 percent for others

Farm **~40%**  
Mechanization  
Level in India



■ High\*\*  
■ Medium\*\*  
■ Low\*\*  
■ Very low\*\*



Tractor accounts for most of the farm  
mechanization in India

India is the largest market in the  
world for tractors

TRRINGO

Farm mechanization level in India is 40-47% and lower in comparison to US (95%), Brazil (75%) and China (59.5%).

## Farm Machinery status of India

- 8 million tractors (5.4 million tractors are being used in agricultural activities)
- 0.59 million combines and self-propelled machines,
- 2.62 million levellers
- 1.2 million rotavators
- 1.83 million seed drill
- 0.103 million planters
- 0.952 million sprayers
- 9.432 million threshers
- 10 million other machines
- 450 million hand tools

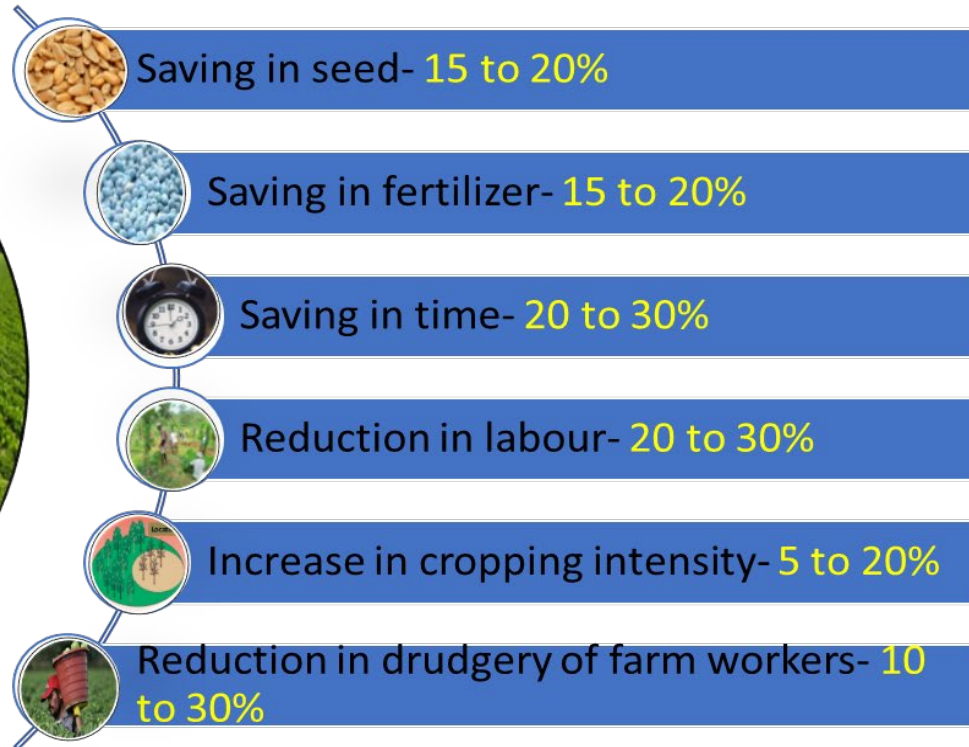
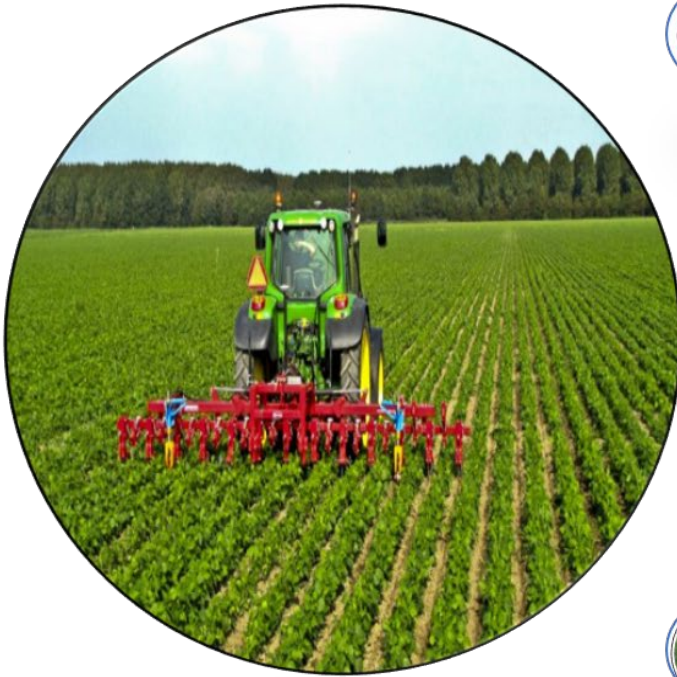
Source: Singh 2016, Data Book, Agriculture Mechanization in India

## **Total 118 R & D centres in India are working directly or indirectly for agriculture**

- **25 Centres under AICRP on FIM**
- **12 Centres under AICRP on ESA**
- **09 Centres under AICRP on UAE**
- **13 Centres under AICRP on Energy in Agriculture and Agro-based Industries**
- **30 Centres under AICRP on PHET**
- **13 Centres under AICRP on Women in Agriculture**
- **06 Centres under CRP on FMPF**
- **05 Centres under CRP on MIS**
- **05 Centres under CRP on EA**



## Advantage of Farm Mechanization



## Population Dynamics of Indian Agricultural Workers (No. in million)

S. No.	Particulars	2011	2020	2050*
1.	Country's Population	1211	1323	1612
2.	Total No. of Workers	482	566	693
3.	Total Workers as % of population	40	43	43
4	% of Agricultural Workers to total workers	55	41	26
5	No. of Agricultural Workers	263	230	202
	a) Men	165	126	101
	b) Women	98	104	101
6.	% of women in agricultural work force	37	45	50

\* Estimated values



## Women Workers in Indian Agriculture



**Upland cultivation**



**Wetland cultivation**



**Horticulture**



**Hill agriculture**



**Worker as a source of power**



**Worker as a machine operator**

## **Multifaceted Role of Women**

**Field operations in crop production**

**Sowing, transplanting, weeding, interculture, harvesting and threshing**

**Agro-processing activities**

**Cleaning/grading, drying, parboiling, milling, grinding, decortication and storage**

**Operations in commercial agriculture**

**Tea plucking, tobacco leaf harvesting, Lac cultivation and processing**

**Animal upkeep and dairy activities**

**Cattle management, fodder collection, milking etc.**

**Domestic: Cooking, child rearing, water collection, household maintenance etc.**

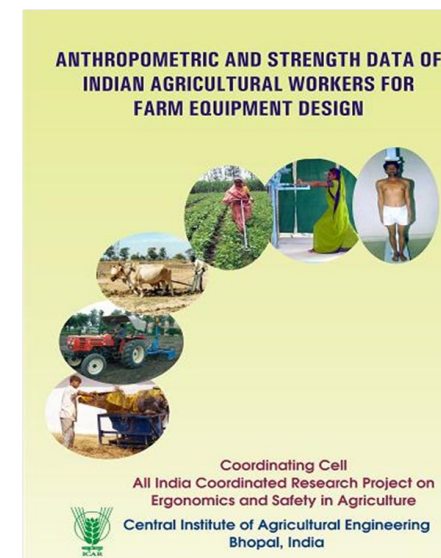
**United Nations FAO estimated that if women had equal access to productive resources as men, they would increase yield by 20-30%.**

## The major constraints in taking the technologies to farm women include :

- Illiteracy among farm women
- Social customs and taboos
- Shortage of women extension workers
- Insufficient funds for extension programmes for women
- Lack of infrastructural facilities for women extension programmes
- Lack of coordinated and concentrated efforts.

## Anthropometric & Strength Data of Indian Agricultural Workers

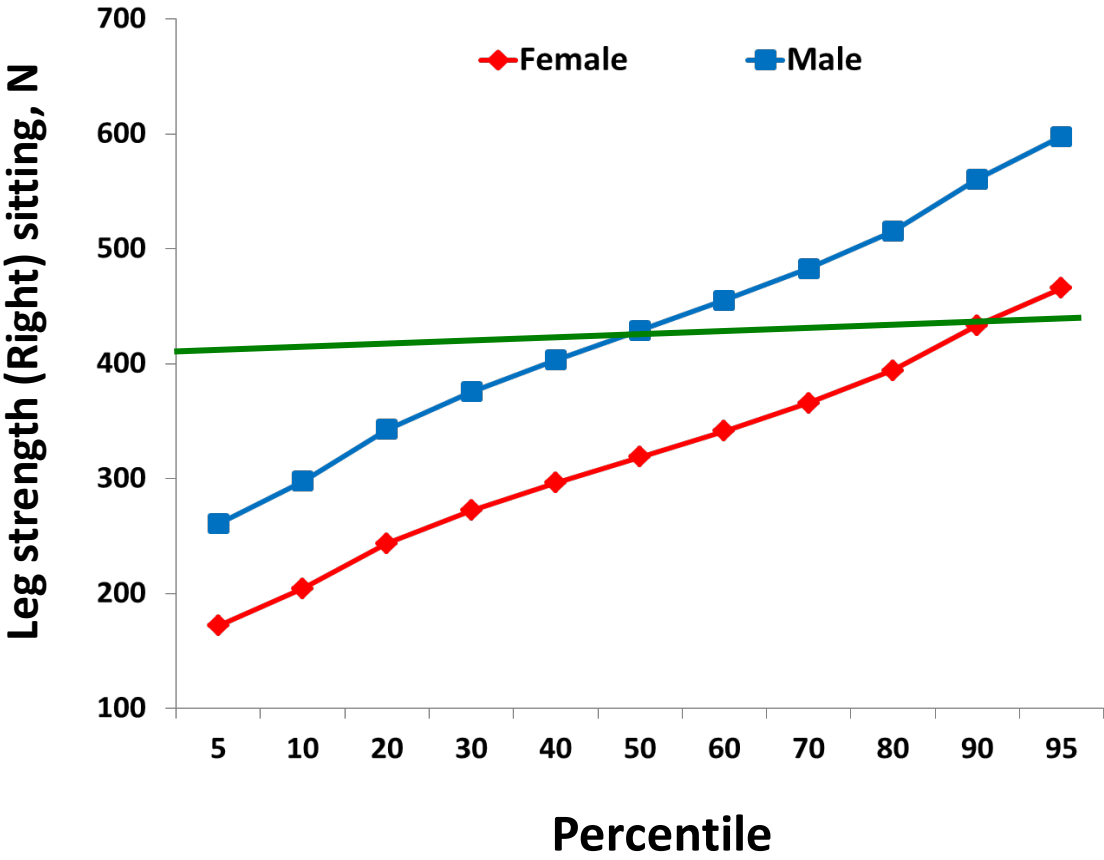
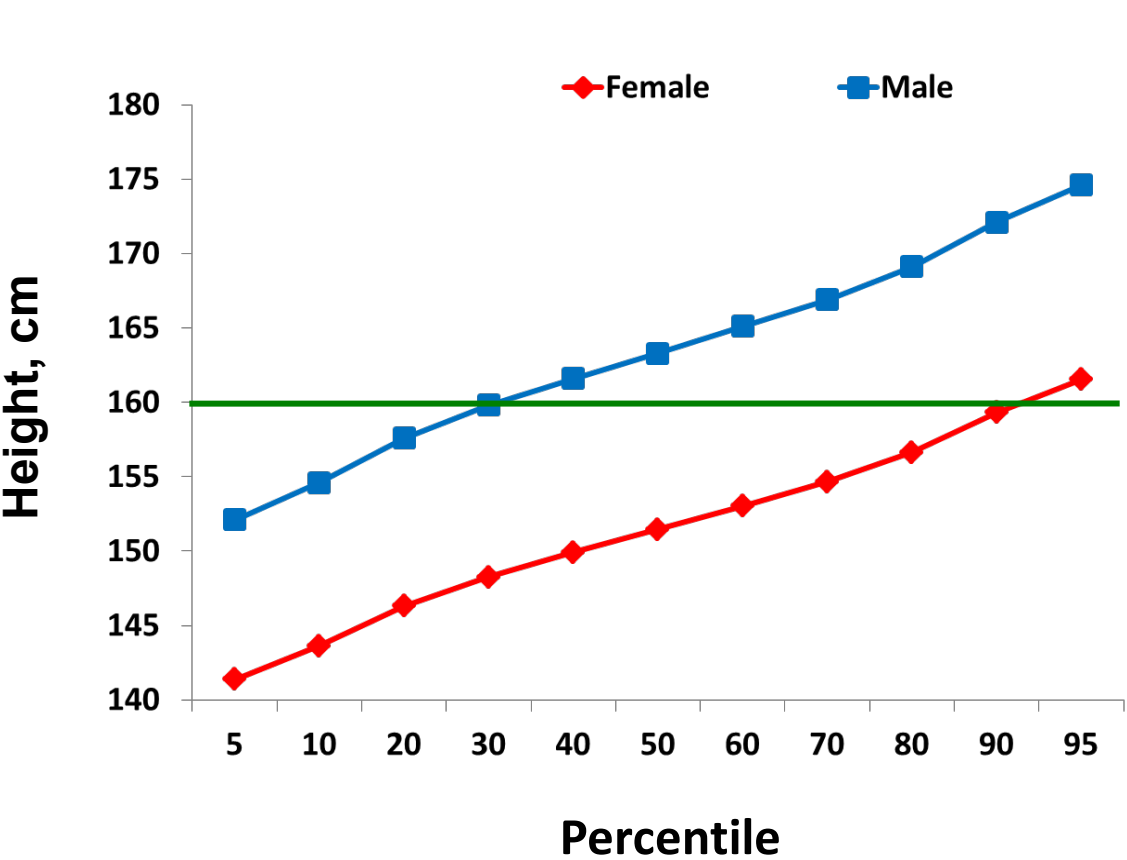
- Data on 79 body dimensions for 14618 (8970 male and 5648 female) agricultural workers and strength data on 16 parameters for 9515 (5570 male and 3945 female) workers.
- Data are being used in design of hand tools, farm machines, tractors etc.
- **Indian data is included in ISO:7205**



Parameters	Male	Female
Height, cm	163.3	151.5
Weight, kg	54.7	46.3
Push strength (both hand) standing, N	224	143
Pull strength (both hands) standing, N	218	158



### Anthropometric & Strength Data of Indian Agricultural Workers





## Empowering women through mechanization



**Naveen Dibbler**

Output: 0.015 ha/h  
Cost: Rs. 700/-



**Rotary Dibbler**

Output: 0.10 ha/h  
Cost: Rs. 2300/-



**3-Row Rice Transplanter**

Capacity: 150 m<sup>2</sup>/h  
Cost: Rs. 8,500/-



**4-row Direct Paddy Seeder**



**8-Row Rice Transplanter**



## Empowering women through mechanization



**Cono Weeder**

**Cost: Rs. 1900/-**

**Field capacity: 0.028 ha/h**



**Twin Wheel Hoe**

**Cost : Rs. 800/-**

**Field capacity: 0.015 ha/h**



**Pedal Operated Thresher (OUAT)**

**Cost : Rs. 5,500/-**

**Output capacity: 35-40 kg/h**



Cont...



**Tubular Maize Sheller**

**Cost : Rs. 60/-**

**Capacity: 27 kg/h**



**Rotary Maize Sheller**

**Cost: Rs. 8,000/-**

**Capacity: 77 kg/h**



**Arecanut dehusker**

**Cost: Rs.3,000/-**

**Output: 5 kg/h**



Cont...



**Paddy Winnower**

**Output : 170 kg/h**  
**Cost: Rs. 6000/-**



**Groundnut Decorticator**

**Capacity: 26-30 kg/h (sitting)**  
**:35-40 kg/h (standing)**  
**Cost: 2,400/-**



**Coconut tree climbing device**

**Cost – Rs. 3500/-**

**Output – 56 coconuts/h as against 28**  
**coconuts/h in conventional system**



Cont...

## Potato Peeler



**Capacity: 50-60 kg/h**  
**Cost: Rs. 17,000/-**

## Dal Mill



**Capacity: 100 kg/h**  
**Cost: Rs. 30,000/-**

## Portable briquetting machine



**Capacity: 40 kg/h**  
**Cost: Rs. 35,000/-**



## Manual fruit harvester



**Output – 200-300 oranges/h**  
**400- 600 apples/h**

## Platform Type Fruit Harvesting System



Ease in harvesting, pruning, spraying and canopy management operations in orchard

**Load carrying capacity : 200 kg**

**Cost : Rs. 6.75 lakh**

## Multi-crop thresher



### Capacity:

**Wheat: 90-100 kg/h**

**Paddy: 100-110 kg/h**

**Barnyard millet: 90-100 kg/h**

**Finger millet: 90-100 kg/h**

**Amaranth: 30-40 kg/h**

**Mustard: 95-100 kg/h**

**Radish: 80-90 kg/h**

**Pea: 60-80 kg/h**

**Masoor dal: 95-100 kg/h**

**Cost: Rs. 75,000/-**



## Recommendations and suggestions

- ✓ Design the tools/equipment keeping in view the anthropometric data of women workers
- ✓ Design of gender-friendly tools, equipment and self-propelled machines (like tractors, power tillers, transplanters, power weeders) suiting both men and women workers
- ✓ Testing the equipment with women workers
- ✓ Removing social taboos which makes women not to operate farm machines
- ✓ Organize demonstrations and trainings to rural women on various modern tools/equipment in proper and safe operation.
- ✓ Encourage manufacturers/entrepreneurs to fabricate improved tools and equipment – Policy intervention
- ✓ Make these tools and equipment available in rural areas for purchase by users
- ✓ Large scale demonstrations to create awareness about the improved tools/machines

## Recommendations and suggestions

- ☐ Building up of linkages with central/ state departments, NGOs, banks, and other stakeholders to promote the improved tools and equipment.
- ☐ The state agricultural departments should take lead role because they have functionaries at village level.
- ☐ The supply of improved tools and equipment need to be ensured at village level so that assured availability is ensured to the farm women as per their requirement.
- ☐ The rural women are more comfortable with women trainers and are able to express their views better to them.
- ☐ All the departments which are involved in transfer of technology to rural women should have enough number of women trainers to make technology transfer more successful.
- ☐ Assist farm women, after being duly trained to get loans from banks/ other organizations to procure various tools/equipment

- Our aim is to empower the women workers in agriculture through agricultural engineering technologies for
  - reducing drudgery,
  - higher work efficiency and output
  - increasing earnings, and
  - heightening their quality of life



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# Thank you



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