Restructuring of smallholders' farming and implications for research

Some insight from China

Dr. Michel FOK michel.fok@cirad.fr
Outline

• Farm size and farm cotton area variations across the world
• Farm size: a factor of farm policy in China
  – Would small size farms disappear?
• Farm restructuring: which implications for research?
Farming varies in size

• Across the world, farm size varies a lot...
• Influenced by corporate farming opposed to family farming...
• But farm size varies a lot even within family farming
• And furthermore within a same country  
  – when both types of farming co-exists
Family farming, much dominating

• Estimation of 570 millions farms in the world
  – 530 millions of family farming
• Asia: essentially family farming
  – ≅ Collective farming ≈ over
  – But not exclusively
    • ≅ Emergence of corporate farming
• Of small if not tiny size
  • But some change observed (notably in China)
Would family farming ever prevail?

• What happens when corporate farming emerges and develops?
  – Agriculture better performing?
  – Family family farming disappears?
• The issue matters in terms of agri policy
Cotton farming varies in size

• The size of cotton growing varies among countries...

• Geographic shift of cotton production guided by larger size of cotton area per farm
  – Between countries
    • No crystal clear
  – Within a country
    • The shift is clearer
## Cotton farming in selected countries

<table>
<thead>
<tr>
<th>Country</th>
<th>No. farms</th>
<th>Area/Farm, ha</th>
<th>Lint yield, kg/ha</th>
<th>Farmer age</th>
<th>Data year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1,200</td>
<td>305</td>
<td>2,400</td>
<td>39</td>
<td>2018</td>
</tr>
<tr>
<td>USA</td>
<td>16,800</td>
<td>253</td>
<td>695</td>
<td>58</td>
<td>2018</td>
</tr>
<tr>
<td>Brazil (M.G.)</td>
<td>5,500*</td>
<td>136*</td>
<td>1,650</td>
<td></td>
<td>2018</td>
</tr>
<tr>
<td>Spain</td>
<td>5,900</td>
<td>90</td>
<td>656</td>
<td></td>
<td>2010</td>
</tr>
<tr>
<td>Turkey</td>
<td>80,000</td>
<td>7</td>
<td>1,450</td>
<td></td>
<td>2018</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>103,300</td>
<td>3.8</td>
<td>500</td>
<td>41</td>
<td>2018</td>
</tr>
<tr>
<td>Cameroon</td>
<td>152,600</td>
<td>1.3</td>
<td>630</td>
<td>43</td>
<td>2018</td>
</tr>
<tr>
<td>India</td>
<td>5,800,00</td>
<td>1.9</td>
<td>582</td>
<td></td>
<td>2017</td>
</tr>
<tr>
<td>Pakistan</td>
<td>1,300,000</td>
<td>2.5</td>
<td>810</td>
<td></td>
<td>2014</td>
</tr>
<tr>
<td>China (West)</td>
<td>600,000</td>
<td>3.0</td>
<td>1,900</td>
<td></td>
<td>2016</td>
</tr>
<tr>
<td>China (Else)</td>
<td>3,927,500</td>
<td>0.4</td>
<td>792</td>
<td></td>
<td>2016</td>
</tr>
</tbody>
</table>

Compilation: Michel FOK
Production shift in China: towards North-West

North-West = 55% of cotton area
Yield much higher in North-Western China: in larger farms and distinct cultivation techniques
Farming restructuring in China: not guided by performance at hectare basis

• Because
  – Yield is already of high level
  – Farm income depends on farm size
    • Lower income with smaller farms
  – Income gap between economic sectors could lead to abandon farming by some
    • Hence enabling others to get bigger
China: Income gaps at the expense of farmers

Yuan/capita

- Urban citizen
- Rural citizen

Nominal
Real 2002

Source: China Stats Yearbooks
...in spite of increasing share of off-farm income (%)
Anxiety about the future of farming

A big cereal producer claims that, for sure, he would not let his son farming

Who will farm in the future?
Farming restructuring in China

• Phenomenon dating back to 1990s
  – Mainly "market"-oriented
  – Farming abandon
    • By families not exploiting land being allocated
  – Land leased out to those keeping on farming
    • Figures on % of farmers having leased in land
Politically oriented restructuring: analysis underneath

• Limitations observed for small family farms?
  – Lack of economies of scale
  – Lack of connection to markets...

• Vision for a farming model where
  – farming equipment and machinery massively utilized
  – production costs lowered
  – efficiency raised
  – economies of scale realized
  – agricultural product branded in a viable way
    – (Wang Huijun, President of the Hebei Provincial Academy of Agriculture and Forestry Sciences)
Two-fold policy

• More recent integration into agri policy
  • Towards bigger size of farms
    • Support the land use by those most committed in farming
      – By a new generation of "family farmers"
      – By a new generation of "professional farmers"
  • Communication in a parallele session at ICAC Plenary in 2013
    – And towards cooperative or corporate farming
A farming company in Hengshui: illustration of investment and technology engaged

Hydroponic culture

Chinese-type greenhouse
Vertical cultivation
Chinese greenhouse is not small
Hearth wall
Drip irrigation inside
Strawberry production: much higher value in winter
Promotion of cooperatives taking over land from farmers

• Cooperative process dating back to late 1980s
  – Township and village enterprises (TVE)
  – Activities engaged:
    • consumer goods industries, such as transportation, construction, food processing, paper making and spinning
  – Shortfalls of TVE
    – associations are governmental operated
    – ➞ No right to take part directly in economic activities in the markets
  – TVE privatized in late 1990s
Cooperatives: a process of quantitative importance

• Nation-wide survey in 2009
  – in 2008, 208,000 village-based cooperatives
    • plus an additional 4000 registered at the county level
  – covering 21% of all Chinese villages
  – a total of 23.8 million member households (formal and informal)
    • or 9.5% of all Chinese rural households

• In 2012, China had 680,000 rural cooperatives
Would small family farming disappear in China?

• Issue worth being addressed
  – Chinese scholars in social sciences might be engaged

• My contribution
  – According to a research work in Hebei Province
  – Answer: Not in the short-mid term
Small size family farming not disappearing! Only 47% farmers plan for more off-farming

Our survey in Hebei province, China, in 2016

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Plan more off-farm activities?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Number of farmers</td>
<td>346</td>
<td>184</td>
</tr>
<tr>
<td>Age</td>
<td>49.2</td>
<td>50.3</td>
</tr>
<tr>
<td>Distribution according to age cohort</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-40</td>
<td>16.8</td>
<td>17.4</td>
</tr>
<tr>
<td>40-50</td>
<td>31.8</td>
<td>27.2</td>
</tr>
<tr>
<td>50-60</td>
<td>34.7</td>
<td>32.6</td>
</tr>
<tr>
<td>&gt;60</td>
<td>16.8</td>
<td>22.8</td>
</tr>
<tr>
<td>% Below high school level</td>
<td>85.5</td>
<td>85.3</td>
</tr>
<tr>
<td>Number of family members</td>
<td>3.7</td>
<td>3.5</td>
</tr>
<tr>
<td>Total area, ha</td>
<td>0.60</td>
<td>0.75</td>
</tr>
</tbody>
</table>
Small size family farming not disappearing! 2/2
Farming abandon still largely in minority

<table>
<thead>
<tr>
<th>Farmers' policy &amp; market expectations, %</th>
<th>All</th>
<th>Plan more off-farm activities?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Land transfer</td>
<td>7.2</td>
<td>8.5</td>
</tr>
<tr>
<td>Subsidy increase</td>
<td>31.7</td>
<td>32.8</td>
</tr>
<tr>
<td>Price increase of ag products</td>
<td>33.2</td>
<td>32.6</td>
</tr>
<tr>
<td>Price decrease of inputs</td>
<td>27.6</td>
<td>26.1</td>
</tr>
<tr>
<td>Price decrease of seeds</td>
<td>0.4</td>
<td>0.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Farmers' cultivation plan, %</th>
<th>All</th>
<th>Plan more off-farm activities?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Other measures</td>
<td>54.1</td>
<td>58.5</td>
</tr>
<tr>
<td>Reduce costs</td>
<td>24.3</td>
<td>21.8</td>
</tr>
<tr>
<td>Abandon farming</td>
<td>24.3</td>
<td>21.8</td>
</tr>
<tr>
<td>Plant other crops</td>
<td>0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Reduce yield</td>
<td>1.5</td>
<td>2.6</td>
</tr>
</tbody>
</table>
Implications of farming restructuring for research

• Factors to be considered
  – 2 types of farm size
    • Medium size: < 10-20 ha
    • Small size: < 3-5 ha
  – No large mono-cropping in sight
Domains of research implications

• Mechanization

• Agronomy
  – Cropping patterns & adjusted cultivation practices
  – Fertilizing related to allelopathic effects

• Genetics & breeding

• Crop protection

• Technology transfer
Research to adapt mechanization

• The process is already launched
  – Multiple models of tools for a same
  – Some commendable achievements
  – Some ingenious DIY

• Adapted scale of mechanical harvesting is challenging
  – Technically
  – ...and socially in countries like India and Pakistan
    where handpicking is women-friendly
Various types of seeders
Commendable achievement 1/2
Commendable achievement 2/2
New ways explored

Insecticide spraying by drone
Ingenious DIY

Seed spreader adapted on a motorbike
Conventional harvestors: dead end?

Not conclusive experiment of harvestors in Cameroon:

**Performance**

**US machine**
- 5 ha/day
- 15-20% unpicked cotton
- 600-1000 liters fuel
  + 2 barrels of grease for 10 ha

**Belarussian machine**
- 3 ha/day
- 30-40% unpicked cotton
- 150-250 liters fuel/ 10 ha
Agronomy Research: focus on new cropping patterns

- Farming size remains compatible with patterns alternative to mono-cropping
  - Relay cropping
  - Inter-cropping
- ...in line with the agro-ecological approach of farming
  - With expected positive environmental and economic effects
  - But assessment not simple
Various inter-cropping patterns in China

- Cotton and Wheat
- Cotton-wheat-water melon
- Cotton — green onion
Adapt cultivation practices to new cropping patterns

- to optimize interaction/competition/synergy of intercropped plants by adjusting
  - Optimize the period of co-presence of crops through
    - sowing dates
    - Plant densities
    - growth regulation of cotton plants
  - Optimize with regard to weed control

- Further invest the research area of allelopathy
Optimize fertilisation in new cropping patterns

• Optimized fertilizing $\approx$ allelopathic effect
• To consider in cropping patterns involving
  – annual crops
  – Or even perennial crops?
4 lines cotton & 6 lines peanut inter-cropping

Positive annual and multi-annual effects expected in yield and fertilizing albeit to be evaluated
Research to breed varieties adapted to cropping patterns

• Research work already engaged with positive outcome
  – Shorter cycle of varieties adapted to relay or intercropping in China
    • Transplanting replaced by sowing

• Exploitation of new traits?
  – Genetic diversity of photosynthetic capacity of non-leaf organs

• Exploitation of morpho. traits to control pest
Implication on Crop protection research

• An issue of taking landscape and canopy into account
Further integrate the reality of heterogeneous canopy/landscape

• Why?
  – Farming size variation
  – Cropping patterns ≠ systematic mono cotton

• Be guided by the agro-ecological approach
  – Already some involvement (push-pull)
  – Further embark the approach
    • Carry out new techniques
  – Engage assessment of effects
New crop protection techniques?

• New protection programmes for multi-cropping patterns
  – Assess pest infestation rate and adjust protection rules
  – Optimize protection programme with the safety concern of the food crop combined to cotton
New crop protection techniques?

• Adjust to some morphological traits
  – High gossypol, extreme hairiness, frego bract, red leaves, pronto okra leaves...
Adapted R&D

• To new acquisition modalities of machineries
  – Beyond individual ownership for expensive machineries
• To new service supplies
  – For mechanical operations
• To deliver technical information
  – in a context of mobile phone connected farming
  • Process already engaged
Conclusion

• Persisting small size of family farming in Asia
  – With emergence of some scale of medium size
• Research must be more oriented by this size specificity
  – Be less influenced by research for large size farming
• A lot to do
  – Research on allelopathy, multiple interactions to be enhanced
  – Assessment more demanding, more exciting
    • Albeit more complex
  – ⇒ research more attractive