



Rice Mechanisation: Japan's Experience and CARD Initiative in Africa



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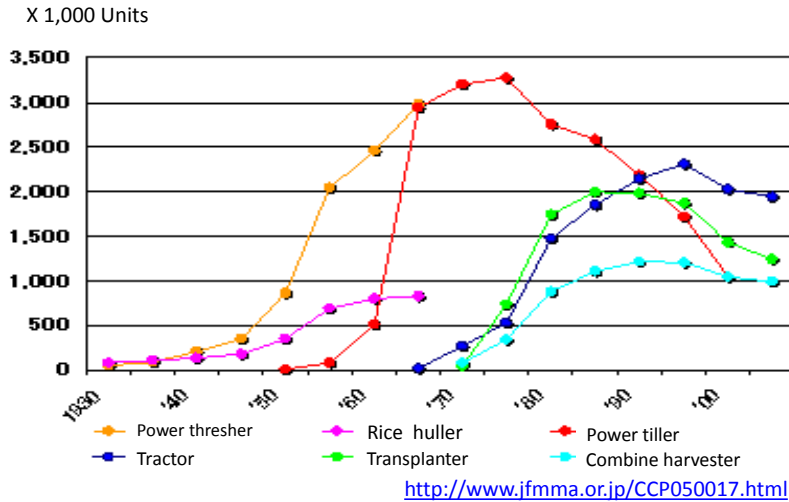


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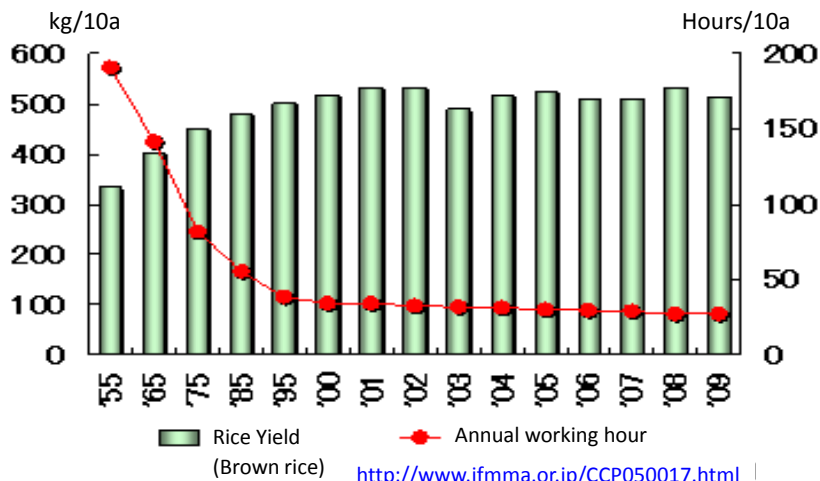


Trend of Major Agricultural Machinery on Farm in Japan



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Change of rice yield and annual working hours for 10 a



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Japanese History and Agricultural Administration

Year	Socio-economic movement in Japan	Agricultural Administration
1942		Stable Food Control Act
1945	End of World War II	
1947		Agricultural Cooperative Act
1949	Agrarian Reform and Food production increase	Land improvement Act
1952		Agricultural Land Act
1953		Agricultural Mechanization Promotion Act
1961		Agriculture Basic Act, Agricultural Modernization Fund Act
1964	Tokyo Olympics Over 1 million farm labor turnover	Self sufficiency of rice
1967		
1968	Japanese GNP became world No.2	Revised Land Act, Act on Establishment of Agricultural Promotion Regions
1969	Land price increase by Industrialization Depopulation in rural area	
1971	Nickson shock (floating exchange rate)	Controlling rice production (reduced area)
1974		Revised on Agricultural Promotion Regions
1993	GATT Uruguay Round Globalization	
1995		Abolition of Stable Food Act
1999		Food, Agriculture and Rural Areas Act ⁵



Japan's Experience (Agricultural Administration)

1. Agriculture Basic Act (1961)

1. Agricultural production
 2. Price and market control
 3. Agricultural structure adjustment
 4. Agricultural administration and concerned organizations
- Food, Agriculture and Rural Areas Basic Act (1999)

2. Agricultural Mechanization Promotion Act (1953)

1. Research and development
2. Finance
3. Type certification
4. Instruction to local government
5. Penalty against violation



3. Agricultural Modernization Fund Act (1961)

1. Low Interest rate and long term finance
2. Loan through agricultural cooperatives
3. Interest will be subsidized by central and local governments



Japan's Experience (continued)

4. Agricultural Land Act (1952)

1. Control of transfer and conversion of farm land by agricultural committee
2. Coordination for utilizing farm land and tenancy
3. Measures against idle farm land

5. Land Improvement Act (1949)

1. Improvement, development, conservation, and consolidation of agricultural land
2. Establishment of land improvement district (LID)
3. Subsidies to LID

6. Staple Food Control Act (1942)

1. Control of rice production, trading and consumption

Act on Stabilization of Supply, Demand and Prices of Staple Food (1995)

7. Agricultural Cooperatives Act (1947)

1. Establishment of agricultural cooperatives and its federation
2. Economic activities, credit and insurance

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Roles of Government in Implementing Agricultural Mechanization Promotion Act

1. National government
 1. Disclosure of agricultural machinery certified by IAM (BRAIN)
 2. Guidance of traded agricultural machinery through JA and National Agricultural Machinery Retailers Union
 3. Disseminate above information through regional offices to districts
 4. Coordination of selection process of machinery through regional offices
2. District government
 1. Form a meeting to disseminate information
 2. Instruction to farmers through JA and AMRU
 3. Coordination of selection of agricultural machinery
 1. Making 5-year agricultural machinery utilization plan
 4. Building capacity of instructors for safety use of machines
3. Municipality
 1. Provide access points for farmers and farm producer organization



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Institute of Agricultural Machinery (IAM, 1962) Bio-oriented Technology Research Advancement Institution (BRAIN, 1986)

- Specialised institute for research, development and improvement of agricultural machinery, and for testing and evaluation
 - It takes charge of the National Test, Safety Test, OECD Test, IAM Test (Group1 and 2)
1. Type certification
 1. Performance
 2. Structure
 3. Durability
 4. Controllability
 5. Safety inspection
 2. Safety Test
 1. Protection device
 2. Protection Structure



<http://www.naro.affrc.go.jp/english/brain/organization/department06/index.html>

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New Agricultural Mechanization Enhancement Co.,Ltd. (1994)

- Based on the Agricultural Machinery Promotion Act, it implements commercialization and promotion of high performance agricultural machinery
- Invested by BRAIN, private makers and agricultural organizations (Capital: 13 million dollars)

Description of business

1. Studies and researches
Standardization of mechanized cultural practices
2. Provision of facilities
 - Coordination of design for machines and production facility
 - Lease or sales of production facility
3. Provision of information
Provision of mechanized cultural practices manual
4. Other business related commercialization of machinery



<http://www.shinnouki.co.jp/pamph/index.html>

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Japan Agricultural Mechanization Association (since 1957)

Purpose: Contribution to sound agricultural development through improving farm management by agricultural mechanization

Members: Federation of agricultural cooperative association
Agricultural machinery manufacturers

1. Instruction to introduce and disseminate superior agricultural equipment and facilities
2. Promotion of safety measures to avoid farm accidents
3. Database of new agricultural machinery
4. Price information of secondhand machinery
5. Promotion of machinery rental service
6. **International technical cooperation**



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Japan Farm Machinery Manufacturer's Association



Purpose: Contributing to sound development of agriculture, through promotion of farm machinery by streamlining agricultural machinery industry

1. Lobbying promotion of agricultural mechanization
e.g. Reduction of taxation, tax exemption for research and development
2. Supporting machinery development and standardization
3. Statistical data on agricultural machinery
4. Promotion of model inspection and safety appraisal
5. Improvement of maintenance services and promotion of rationalized distribution of farm machines and spareparts
6. Promotion of external trade through **study on foreign markets and technical cooperation in developing countries**
7. Study on safety and environmental issues

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National Agricultural Machinery Retailers Union

Members: 1951 companies

1. Promotion of training of agricultural machinery technicians and certified technicians
2. Arrangement of materials for the test of agricultural machinery technicians
3. Provision of information and advertisement
4. Facilitation of agricultural machinery loan
5. Implimentation of agricultural machinery disability compensation
6. Group purchasing (Product development)
7. Fire and disaster insurance
8. Welfare and compensation
9. Promotion of pension system



Agricultural Machinery Bank

- A system to improve operating ratio by matching farm operation service provider with high performance machinery and farmers (model: MR in Germany)
1. Started with 8 banks in 1972, more than 700 in 1988
 2. Over 400 providers and average service area is about 500ha
 3. Major service providers are agricultural cooperatives to provide services to members
 4. Terminated banks (over 100)
 1. Difficulties to have operators
 2. Less agricultural land areas
 3. Less efficient management





Certification for agricultural machinery operators and technicians

1. Certified agricultural machinery operators
2. Certified agricultural machinery instructors
3. Certified agricultural machinery technicians (1st and 2nd grade)

Forum for Certified Agricultural Machinery Operators
Plowing contest
Seminar and training on farm safety



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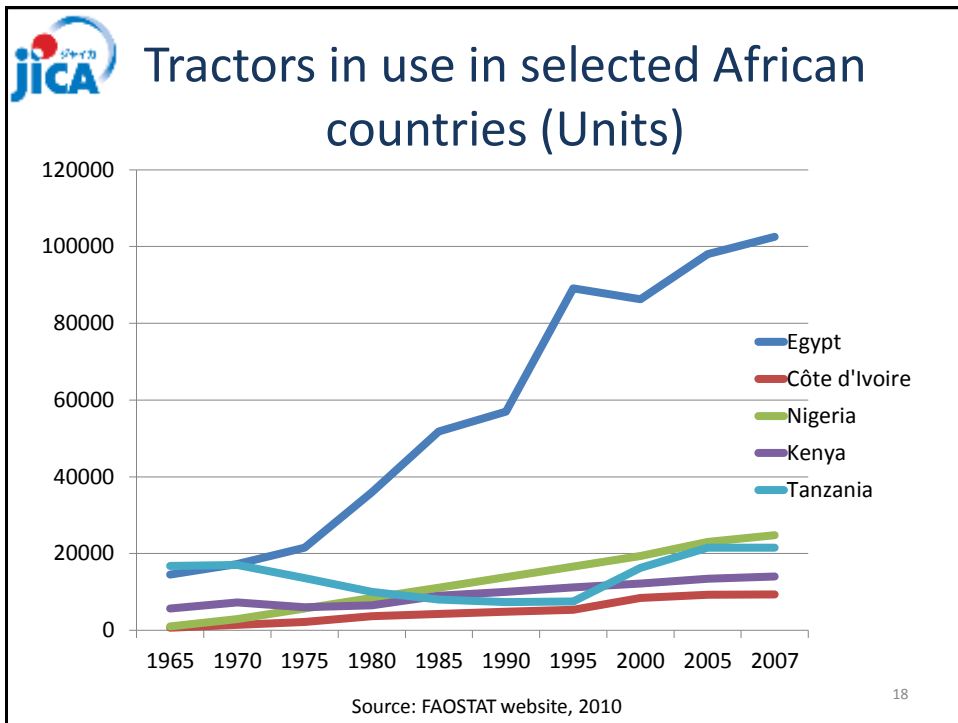
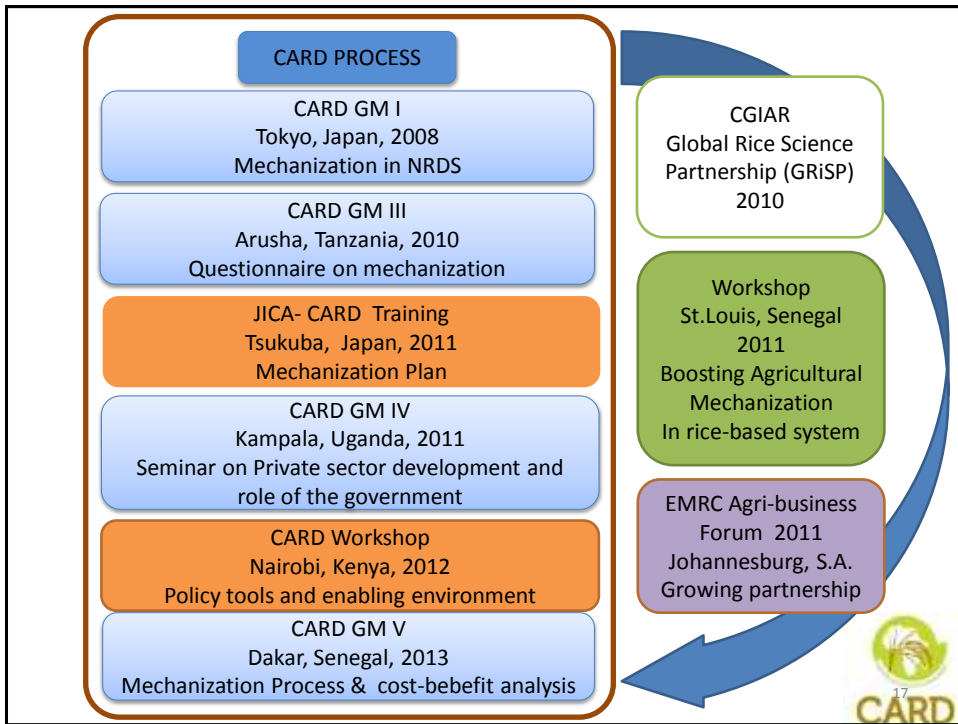
Regional Network for Agricultural Machinery, RNAM (1977)

- **ESCAP** (UN Economic and Social Commission for Asia and Pacific)
- Participating countries: Initially India, Indonesia, the Islamic Republic of Iran, Pakistan, the Philippines, the Republic of Korea, Sri Lanka and Thailand. Bangladesh and Nepal in 1987, China in 1990 and Viet Nam in 1994.
- Supporting countries: The Governments of **Japan**, Australia, Belgium, the Netherlands, the Republic of Korea, and **UNIDO**
- Development of infrastructural mechanism for agricultural mechanization, human resources development assistance in exchange of information, design, prototype of tested machines for commercialization and establishment of joint ventures.

Now: Regional Network for Agricultural Engineering and Machinery

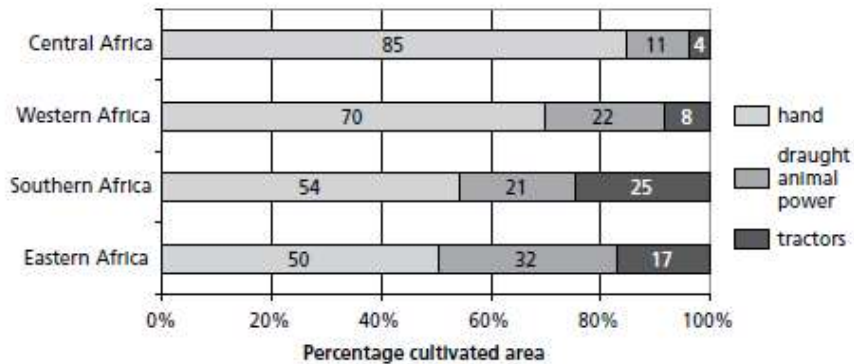


United Nations
ESCAP



Share of Power Sources in Africa

Figure 7 Estimates of areas cultivated by different power sources by subregion



Source: Bishop-Sambook (2001) based on FAO (2001), three-year average 1997–1999.

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Past interventions and experiences by governments and donors

- Subsidized delivery of machinery to farmers
- Importation of agricultural tools, implements and powered machines with tax exemptions
- Promotion of tractor hiring services
- Repair maintenance by machine dealers and entrepreneurs
- Development and production of simple machines
- Education and training of engineers, technicians, extension workers, operators and farmers
- Provision of commercial financing and soft loans
- Regulatory work and standardization

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National Strategy for Agricultural Mechanization

Country	Year	Effect.	Issues
Kenya	1994	No	No political commitment
Ghana	2008	No	Implementation plan needed
Tanzania	2006	On going	
Cameroon	2010	Not yet	
Rwanda	-	Drafted	
Benin	2008	On going	
Central Africa	2000	On going	
Core d'Ivoire	2006	On going	
Uganda	2008	No	Draft only
Sierra Leone	2006	No	To be implemented

Questionnaire during CARD GM III in Arusha , Tanzania , 2010

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Identified constraints

- Cost of equipment (double of that in Asia)
- Low volume of business
- Slow implementation of mechanization strategies
- Government taxes and duties on equipment
- Few credit for purchasing small equipment
- Low quality of locally produced machinery
- Poor supply of spareparts
- Poor operator techniques
- Equipment failure
- Poor repair and maintenance



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Lessons from agricultural mechanization in SSA

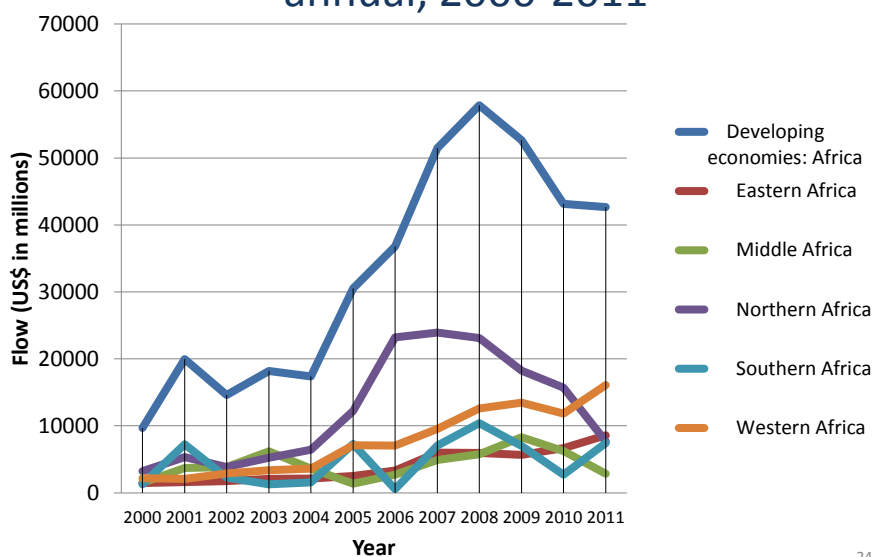
- Pre-conditions to Start Mechanization
 - Profitability
 - Technical feasibility
 - Functional machinery supply chain
 - Minimal business risks for investment
- Mechanization policy
 - Linked to competitive farming
 - Multi-use of machines
- Human resources on mechanization
 - Balanced human resources



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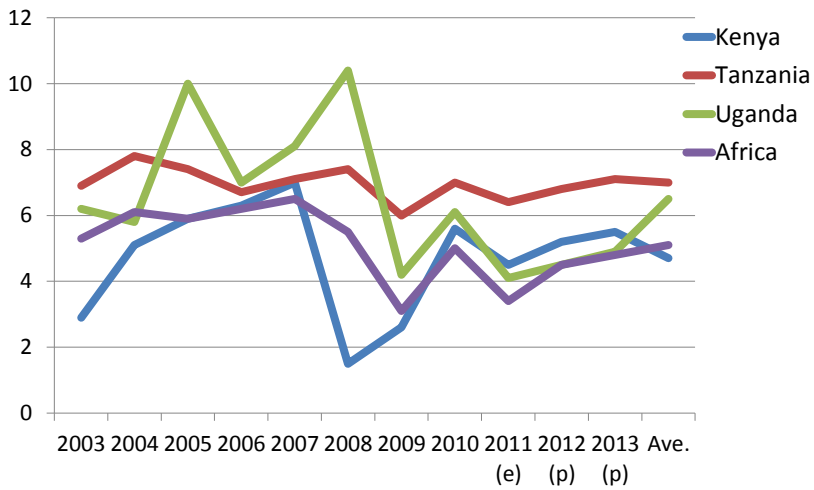


Inward foreign direct investment flows annual, 2000-2011



Source: UNCTAD-STAT, Inward and outward foreign direct investment flows, annual, 1970-2011

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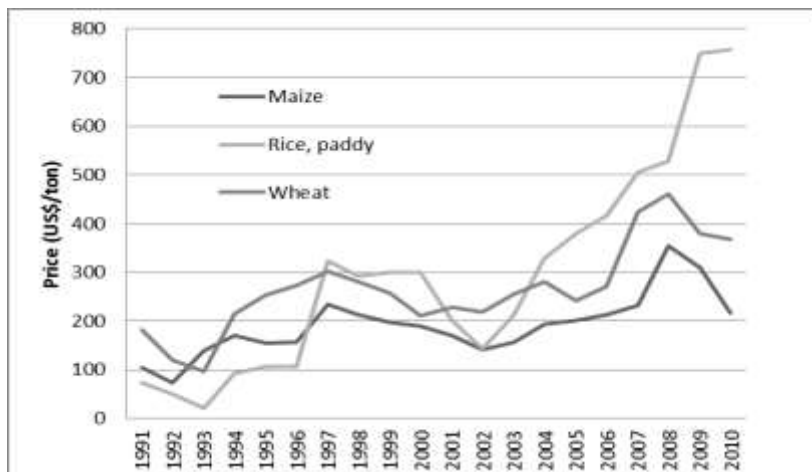
Real GDP Growth Rates (%), 2003-2013

Note: Fiscal year July (n-1)/June (n), Fiscal year (e) is estimation and Fiscal Year (p) is prediction.
 Sources: African Economic Outlook (African Development Bank Statistics Department, Various domestic authorities and AfDB estimates)

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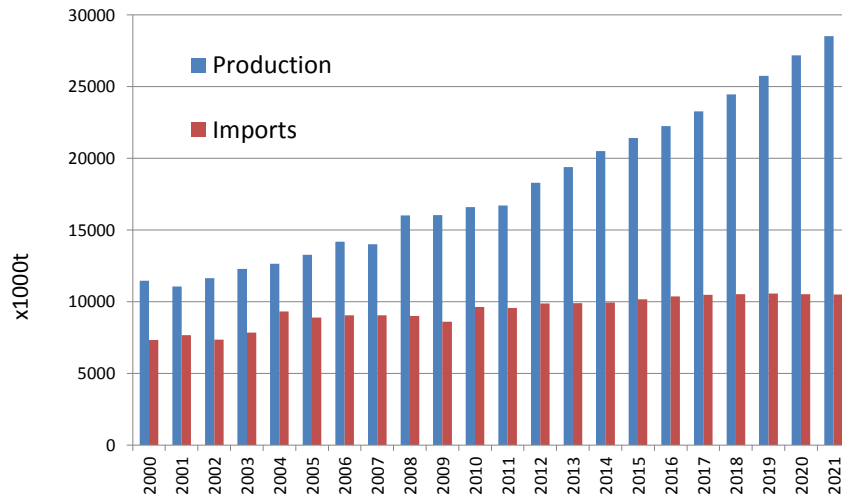
Producer price for major cereal crops in Kenya, 1991-2010



Source: FAO STAT 2012
<http://faostat.fao.org/site/703/DesktopDefault.aspx?PageID=703#ancor>

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Rice production and imports in Sub Saharan Africa



Source: OECD-FAO Agricultural Outlook 2012-2021

<http://stats.oecd.org/viewhtml.aspx?QueryId=36357&vh=0000&vf=0&i&il=blank&lang=en>

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Promoting Agricultural Mechanization under NRDS Implementation Process

- Pilot countries: Cameroon, Madagascar, Rwanda, Senegal, Tanzania, Uganda
- Agricultural mechanization stakeholders
- Government role to promote PPP
- Checklist for agricultural mechanization
 - Policy/Institutional
 - Infrastructure
 - Human resource capacity
 - Provision/support
 - Information/knowledge



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Proposed Farm Equipment Which Would Have Immediate Impacts

- 2-wheel tractors 12-15hp
- Small 4-wheel tractors fitted with rubber and steel wheels
- Mechanical threshers (1-2t/h capacity)
- Small combine harvesters (0.5ha/h)
- Two stage rice mills(250-500kg/h)
- Row seeders



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Enabling Environment to Promote Agricultural Mechanization

- Clear mechanization policy and strategy
 - Preferable subsidies with high quality machinery
 - Balance of imports and domestic products
 - Efficient and multiple use of farm engines and tractors
- Promotion of agricultural machinery industry
 - Human resource development
 - Improvement of infrastructure
 - Improvement of dealership and aftercare service
 - Networking of private sector for business scale-up
 - Financial support to private companies and farmers
- Quality assurance
 - Performance test and safety standard for certification
 - Warranty for consumer protection
- Creation of regional mechanization network
 - Knowledge bank and information sharing



<http://www.naro.affrc.go.jp/english/brain/organization/department06/index.html>

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Stakeholders and Enabling Environment

Stakeholders	what to do	Enabling environment needed	Enabling environment that government can provide
International makers	<ul style="list-style-type: none"> Quality assurance, including warranty on exported machinery Reliable supply of spare parts 	<ul style="list-style-type: none"> Large scale market Reliable dealerships 	<ul style="list-style-type: none"> Policy & strategy on mechanization (MOA) Test & evaluation, safety inspection and certification of quality of machinery (MOA) Tax incentives / reduced import tariffs (MOT)
Importing agents	<ul style="list-style-type: none"> Adequate stocks for immediate delivery Local assembling 	<ul style="list-style-type: none"> Quick issue of L/C Swift custom clearance 	<ul style="list-style-type: none"> Tax incentives (MOT) Swift custom clearance (MOT)
Domestic makers	<ul style="list-style-type: none"> Ability to produce machineries (engineering standard) at reasonable cost Quality control and warranty of products 	<ul style="list-style-type: none"> Reduced import duties for raw materials, Engineering standard Loans Delivery network 	<ul style="list-style-type: none"> Reduce/waive tariff for raw materials (MOT) Engineering standard (MOI) Industrial area for SME (MOI, Local Gov't) Provide Infrastructure (MOI, Local Gov't) Provide tax holidays for SME (MOI) Intellectual Property Rights (MOI) reduced Credit facilities for (MOC, MOI)
Dealers	<ul style="list-style-type: none"> Repair service Stocks of spare parts Operator training In-house credit 	<ul style="list-style-type: none"> Two step loans and soft loans Large scale market 	<ul style="list-style-type: none"> Soft loans (MOI, MOF) Mechanization promotion (MOA)

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Private-Public-Partnership (PPP) Role of Government

Actors on supply chain	Check list - what they have to do (related to capacity needs)
Ministry of Trade (MOT)	Import tariff exemption for agricultural machinery, spare parts and raw materials, Tax reduction on importers, Distribution network for spare parts
Ministry of Industry (MOI)	Engineering standard, Quality control, Training on technicians, SME promotion on agricultural machinery,
Ministry of Commerce (MOC)	Rice quality standard, Rice miller association, SME promotion on agricultural machinery
Ministry of Agriculture (MOA)	Policy & strategy on agricultural mechanization, Agricultural mechanization promotion act, Statistical data on agricultural machinery, Agricultural credit, Farmer organization, Agricultural input subsidies, Extension services, Operator training
Agricultural machinery R&D institute	Safety Inspection, Test & evaluation, Certification, Training for local artisans
Universities	Qualified agricultural engineers

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Don't Dos by the Government

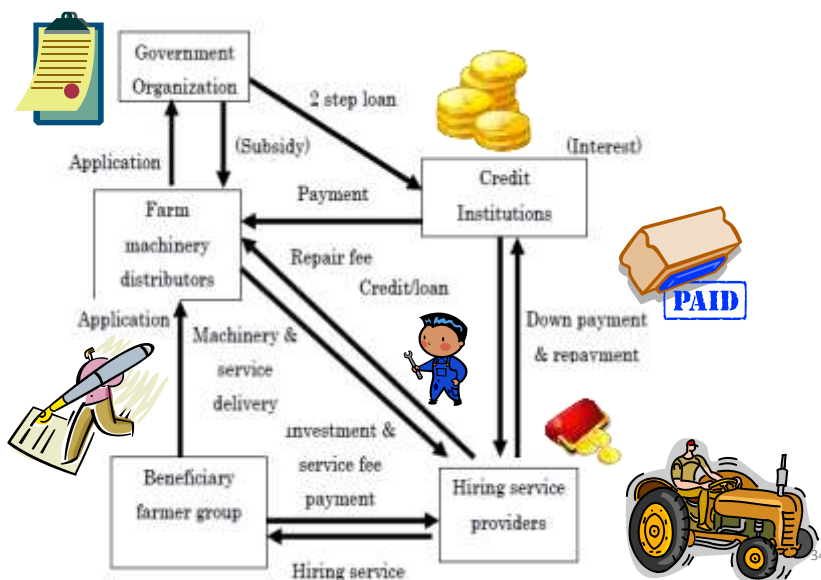
- Direct import of agricultural machinery by the government fund or ODA
- Free or subsidized distribution of agricultural machinery
- Support of machines to weak farmer organizations
- Promotion of machines with group ownership
- Importation of cheap poor quality agricultural machinery
- Importation of machines that can be produced domestically
- Protecting or regulating existing agricultural industry
- Any government support without exit strategy



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Mechanism to Promote Hire Service for Smallholders





Mechanizing Pre-harvest or Post-harvest Operations?

- The wage of farm labor is associated with those of non-farm labor regardless to its productivity.
- Preserving labor of low productivity to secure job opportunity cannot be realized.
- Co-existence of agriculture and other industries, farm operations will be mechanized.
- Mechanization of pre-harvest operations mainly improves labor productivity.
- Mechanization of post-harvest operations **improves quality of products** and labor productivity.
- The performance of equipment has decisive influence over the quality of products with economic value.
- Post-harvest mechanization occurs if there is a difference in rice economic value in its quality even the existence of abundant farm labor.

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How much are people willing to pay?

- How much can we earn from rice cleaning?

2\$/100kg → 2,000\$/100t

Can we buy a de-stoner, \$800?



- How much can we pay for head rice?

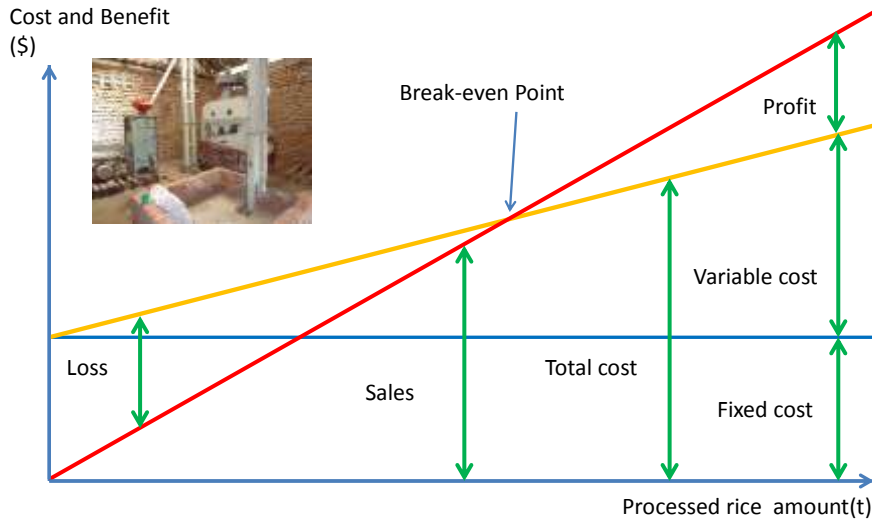


1700 UGX/kg for broken mixture 2000UGX/kg for head rice (June 2010)

Rice quality = Market driven requirements

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Is Rice Milling Profitable ?



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FIXED COST MATTERS

- Rice mill 500kg/h capacity
 - 2 Stage mill: 5,000 US\$
 - 20HP Engine: 2,000US\$
- Life span: 10 years Building: 10,000US\$
- Depreciation = $7,000\$/10 + 10,000\$/20 = 1,200\$/\text{year}$
- Maintenance cost 10% = 700\$/year
- Interest cost 20% = 1,400\$/year
- Management cost = 6,000\$/year **total fixed cost = 9,300\$/year**
- Working hours = 6 hours/day
- Fuel cost 2L/h = 3\$/h x 6h = 18\$/day**
- Labor cost 2\$/day x 4 persons = 8\$/day**
- Milling charge 0.04/kg = 0.04x500kgx6h=120\$/day**
- 120 x D - 26 x D = 9300 D=97 days**





Rice Industrialization by value addition

- Prices of commodities remain low unless being changed as food products.
 - Paddy is sold at almost same price regardless to the quality with different value.
- What can be changed if a farmer can sell milled rice to the market?
 - The farmer realizes the rice quality and value.
 - The farmer buys machines to improve quality.
 - The farmer obtains skills and knowledge.
 - The farmer improves farming practices.
- Quality awareness promotes rice industry.



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Large Scale Rice Farming

Tilda

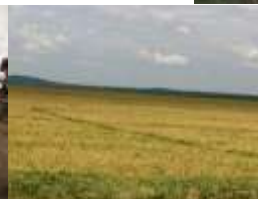
Rice Production in irrigated field 1200ha

Rice mill system with a color sorter

Processing and sales of products from
out growers

Employees: 200 permanent and 1200
part time

Tractors: 20 units, Combine 5 units





Estate Farming: Sugar factory

Kakira Sugar Ltd.
Established in 1930
Annual processing; 150,000t
Production area : 12,000ha + 20,000ha (out growers)
Employees : 7500
500HP tractor, harrow with 20 discs
Own trained operators
Own maintenance workshop



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Medium scale rice mill

Upland Rice Miller Co. Ltd. In Jinja
Established in 2007, Employees: 140
Annual processing amount: 7000t
Farmer customers: 10,000
Milling charge: 160UGX/kg
Free storage use by farmers
Share of NERICA: 30%



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Small rice mills

More than 600 millers in Uganda

Milling charge : 70~250UGX/kg

Most machines are made in China

N-70, N120, SB-10, SB-30, SB-50

Many owners started as maize mills

Difficulties in getting spare parts

Interruption by electricity supply



Agricultural Engineering and Appropriate Technology Research Centre (AEATREC)

Research, testing & evaluation, training,
fabrication, technical support

Engineers: 3 persons only

Member of taskforce on mechanization
of Africa Rice

Testing & evaluation:

Testing on field efficiency and handling

Tested items: Tractors, Power tillers, Ox-
plow, Reaper, Thresher





University Education

Busitema University

Diploma in Agric. Eng. since 1971

BSc. In Agric. Eng. Since 2007

Enrolment: 40 persons annually

Only ¼ of them graduate

Transfer from Diploma to Degree program

Internship for 10 weeks out of college

Student project (Fabrication of machines)



Large Scale Farming Enterprise

North Uganda Agricultural Centre

Farming: 600 ha

Tractor hire service

Sales of second hand machinery

Machinery repair service and parts sales

Agro-processing





Private tractor hiring services

Mr. Charles Rwansigazi
Studied agricultural machinery in India
Owns three second hand tractors
1976model 70HP 2million UGX in 1997
1960model 6million UGX in 1999
1975model 75HP 1.8million UGX in 2004
1982model 130HP 50million UGX in 2011
No-interest loan from his friend
Plowing fee: 130,000UGX/acre
80,000 UGX if over 100 acres
Variable price due to field conditions
Peak season: 2times a year
Operators: performance based payment
Machine repair and maintenance services



Introduction of Power tiller hire services

Supported by VECO East Africa (NGO)
Technically supported by AEATREC
Through Nankoma ACE
9units were sold to individual owners
Downpayment: 10millionUGX
Loan: 2years
More than 70 acres in the 1st year
Initial troubles: small breakage





Domestic farm machinery manufactures

Tonnet Agro Engineering Co. Ltd.

Established in 1995

Major machines: processing equipment for maize and cassava

Exported to neighboring countries

Machinery for rice: threshers

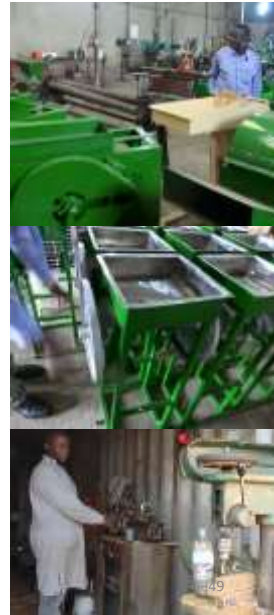
Lot production by WFP, and NAADS

Uganda small-scale Industries (USSIA)

Uganda Manufacturer Assoc.

Acceptance of internship from colleges

A franchised company



Agricultural Machinery Distributors

Cooper Motor Corporation (U) Ltd.

Case, New Holland, etc.

The largest machinery dealer

Sold more than 100units in the first 9month in 2013

Taskforce member of agricultural mechanization

Conducts operator training when purchased

Repair using mobile workshop

MOU for rehabilitation of NARO centers (maintenance workshop)





Components and Parts Supply Industry

Agric. machinery dealers

over 10 shops

Tools and hardware shops

several shops

Second hand machinery and parts

traded in markets

Motorcycle repair shops

scattered even in local towns

Black smith

several places

fabricated rotary blade from leaf springs



Discussion Points

1. What agricultural machines can we promote?
2. What machines can we locally produce and market?
3. What are enabling environments to promote farm mechanization in your country?
4. Who can promote farm mechanization?
5. What are the roles of government to promote farm mechanization?
6. When is the right time to promote farm mechanization?



Conclusion



1. Japanese experience in agricultural mechanization can be partly used in African context
2. Enabling environment to promote agricultural mechanization should be specified for each country, and actions on policy track and technical track should be followed
3. All stakeholders in the farm machinery supply chain should gain a certain profit for sustainability
4. Mechanization should be started from value-addition operations, then followed by field operations
5. Public sector has more important roles to lead agricultural mechanization with sound competitiveness in the private sector through PPP
6. Considering profitability and private sector involvement among others, long term vision is needed to promote agricultural mechanization in Africa

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For World Food Security



Mechanizing Agriculture in Africa

Japan International Cooperation Agency