

Research Findings

**How sustainable is commercial banana
production in Laos?**

A case study

Policy Think Tank

National Agriculture and Forestry Research Institute

31 March 2016

Presentation Outline

- I. Introduction and background
- II. Banana trade and market
- III. Literature & policy review
- IV. Impacts
- V. Conclusion & Policy Recommendations

I. Introduction and background

Research Objectives

1. To understand how bananas are currently produced and what are the relationships between the stakeholders (including government agencies) in the banana value chains.
2. To assess socio-economic, agro-ecological and environmental impacts of commercial banana production on rural communities and land-based resources.
3. To understand and document global and regional banana markets and to identifying opportunities for value addition (e.g., through post-harvest and processing activities)
4. To evaluate a set of policy options for further consideration by the government related to commercial production of bananas.

Research Methodology

- **Research framework**

- Qualitative and quantitative methods
- Target provinces: Phongsaly, Oudomxay, Luangnamtha, Bolikhamxay and Saravane

- **Data collection methods**

- **Literature/desk review** of relevant policies and market trends at the national, regional and international levels
- **Interviews of key stakeholders** (farmers, entrepreneurs, etc.) to understand perceptions, plans on banana plantation
- Household surveys
- **Field observations** on banana plantations.
- **Case studies** from three regions in Laos.

Data collection strategy

1. **Preparation** of interview guidelines and closed questionnaires.
2. **Literature/Desk review:** research reports/paper focusing on Laos, relevant laws, regulations, instructions and guidelines
3. **Scoping missions** in five target provinces.
4. **Interviews** of provincial and district authorities:
Phongsaly (Samphanh) – Oudomxay – Luangnamtha – Bolikhamxay (Paksan) – Saravane (Laongam, TaOiy)
5. **Household surveys** (59 banana smallholders, 110 land-lease farmers, 128 banana workers) and border checkpoints.
6. **IWMI follow-up work [coming]**

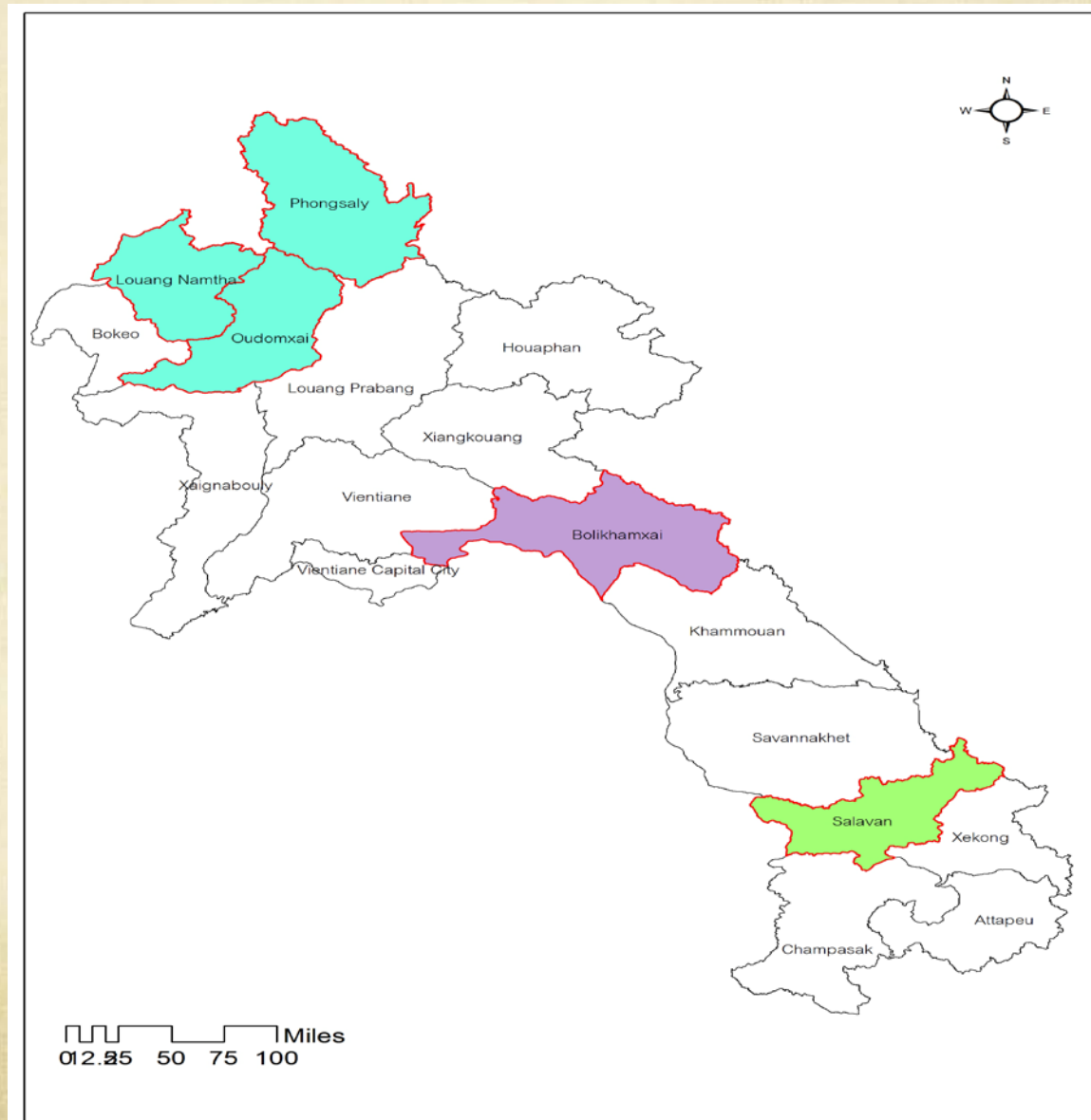
Banana

- Banana requires special care and is sensitive to diseases especially link to soil and air quality
- There are 1000 types/species of bananas. Thomas H. Spreen identified two key types of banana: *Musa acuminata* and *Musa balbisiana*. Currently, there are lots of improved banana varieties. The most common variety is Cavendish desert, Red Cubans, Lactatans and Manzanos (apple flavored) and Burros (lemon flavored). Chinese varieties: Cavendish Baxijiao, Dajiao, Guangfen No.1, Fenzha No.1, Gongjiao, Haigongjiao.
- In Laos, traditional bananas “*Kuay Nam*” while “Cavendish bananas are mainly grown for commercialization.
- Bananas are rich in potassium and other nutrients. Nutrition value: (1) Energy – banana contains healthy carbs; (2) Nutrients – banana is considered as an excellent source of potassium and vitamin B6 and C; (3) Digestion – banana is a good source of dietary fiber. In addition, banana help in balancing body system, relieve stress and create happiness.

Banana plantations in Laos

- Commercial banana production started in **Luang Namtha** province in 2005.
- Different **business models** coexist [1+4, 2+3, concessions].
- In **2014**, banana production covered a total area of 22,920 ha, while banana exports reached 260,000 tons (total value: 45 million US\$).
- ADS (2015-2020) identifies banana as an agricultural product for export.
- Banana plantations may contribute to the **livelihoods** of the poor, especially in rural areas (income generation).
- However, there are deep concerns about the **environmental and social impacts** of banana plantations as a result of below standard management and monitoring systems, especially plantation companies

Map of banana plantations



Business models

No	Province	Planted by household	Contract farming 1+4	Land concession	Total
1	Phongsaly	57	7,876		7,933
2	Oudomxay	13	6,223		6,236
3	Luangnamtha	45	4,073	237	4,355
4	Bolikhamxay	1,046		192	1,238
5	Saravane	7,781		154	7,935

Source: PAFO (2015),

Production process

Site selection

1. **Site selection:** good soil, near river
2. **Variety:** Caven-dish, plant tissue
3. **Planting season:** Oct-Nov
4. **Land preparation & plantation:** dig hole, pit size: 30 cm deep, 40x40 cm wide & space 2.5x1.5 cm

Plantation

1. **Watering:** using water pipe & spray water 1/w
2. **Fertilizing:** fruit 3/y, nutrient, disease protection & insecticiding 12/y
3. **Weeding:** 1st y: 3 times, 2nd y: 2 times, next y: 1 time
4. **Prevention & insecticide:** fruit attack, fungi, etc.

Harvesting

1. **Harvesting:** labor for sorting fruit 90-120 days
2. **Processing:** sorting, cutting from bunches, washing, ripening process
3. **Packing:** 15 kg/box
4. **Shipping:** ship them all at the same time to Chinese market 100%

Post-harvest



Source: Ling, 2015

Note: bananas should be washed to remove all chemicals before consumption

Issues regarding the use of chemicals

- Chemicals –herbicides, fertilizers, nutrients, insecticides, additives – are used throughout the production process (around 40 times/production season).
- Estimated usages of 105-140 chemical substances for banana plantation
- Different chemical substances are mixed and sprayed together, increasing the degree of harm.
- Farmers know little about how these substances should be handled and used. They rarely follow the instructions regarding the use of protective equipment when spraying, or how to spray (against the wind).
- No proper management of chemical boxes/containers after usage.

Main pests & diseases, 2015

Amount

- young leaves
- Leaves
- Leaves, banana
- Leaf

•	+++
•	++
•	++
•	++
•	++
•	++
•	+++
•	++



Note: ++ Medium harm, +++ Very harmful

II. Banana Trade & Markets

Banana exports by Asian countries, 2011-2015 (tonnes)



aos

11,910

Banana exports/imports by Lao PDR, 2011-2015

Fresh or dried
banana



Imports (US\$)

Source: *figures from MOIC, 2016, the rest are from ITC, 2016

Banana exports to neighboring countries

- Traditional bananas (*kuay nam*) (Saravan province) mainly exported to Thailand and sold on the domestic market
- Cavendish (*kuay houn*) mainly exported to China
 - Mainly informal exports
 - 2013: Lao PDR (MAF) and China (Management, quality control, and food safety organization) signed an agreement on Lao banana exports to China.
- Statistics
 - **ITC** (2016): in 2015, Lao PDR's formal banana exports reached 14,294 tons (value = 3.05 Mn US\$)
 - **MOIC** (2016): in 2015, the total volume of exports reached 216,861 tons (39.94 Mn US\$). 88% exported to China and 12% exported to Thailand. Actual export figures might be higher as some exports went through traditional border

III. Literature & Policy Review

Banana Research in the Lao PDR

Researcher/ organization	Year	Title of research	Target areas	Conclusion
NERI	2015	The Impact of Contract Farming on Poverty and the Environment in Lao PDR	Tonphuang district – Bokeo Prov.	Income generation, but many problems identified regarding the environment and health
Satomi Higashi, Mekong Watch	2015	Impacts on Regional Land Use from Investment in Banana Contract Farming by Chinese Companies	Namorn, Hoon, Bang, Xay Districts, Oudomxay Prov.	Impact of chemical use on soil & water. Need for participatory land use planning
Stuart Ling	2015	The Use of Remittances by Circular Hmong Migrants to Chinese Banana Plantations	Tonphuang District – Bokeo Prov.	Proper management regulation and support for labor in banana plantation

Other relevant banana research

Researcher/ organization	Year	Title of research	Target areas	Conculsion
Ekong J. 2015, (IITA/CGIAR)	2015	Putting banana- coffee intercropping research into action	Uganda	Growing coffee and banana together generates >50% more income for smallholder farmers and can help cope with the effects of climate change
FAO (2014)	2014	Banana Market Review and Banana Statistics 2012- 2013	Global & regional market	Ranking top ten countries for banana exports & imports
Institute of Strategic Planning and Policy Studies	2013	Assessing benefits and costs of commercial banana production	Philippines	Although income and employment are high in banana plantations, potentially high health and environmental costs

Relevant regulations, guidelines & laws



Why are Chinese investors attracted to the Lao PDR?

PULL FACTORS (LAOS)

- Low land rental fee: 6-18 Mn LAK/ha (three times lower than in China!)
- Low labor costs.
- Good quality of soil with high yields and suitable weather.
- Perceived flexibility in the use/control of chemical substances.
- Good political and economic relations.
- Harvesting period matches peak market demand (Chinese New year)
- Due to political conflicts with Vietnam and Philippines, cannot invest in these countries.
- Belief that Lao products are natural / “green”

PUSH FACTORS (CHINA)

- Poor soil quality.
- Spreading of banana diseases.
- Restrictions in the use of chemicals & “green” production standards.
- High production costs.

Due to political conflicts with Vietnam and Philippines, cannot invest in these countries



Policy review – Challenges (1/5)

Investment policy (1)

- Lack of enforcement of existing regulations law in the approval process (e.g. lack of environmental management plan, no review of production techniques or use of chemicals)
- Changes in investment purposes: conflict between approved investment and actual operations e.g. While sugarcane or citrus plantation was approved, banana is planted
- No involvement of the district or the village in the approval process. However, once the investment is approved, they are in charge of the land survey and are responsible for acquiring the land for the company and are asked to monitor the actual implementation of the agreement !

Relevant policy review – Challenges (2/5)

Investment policy (2)

- Mismatch between crop production cycle and length of business approval. E.g. banana can be planted from 5-7 years but business was approved for 30-35 years.
- Benefits from income and employment seem to be lower than environmental costs – land concession fee US\$5-10/ha/y.
- District lacks the capacity to manage/monitor companies due to poor understanding of investment conditions, production techniques, etc.
- No systematic coordination mechanism between the different levels (central-province-district) for the approval, monitoring and management of businesses.
- Lack of scientific evidence on alternative income generation options for poor households / farmers willing to drop banana production;

Relevant policy review – Challenges (3/5)

Trade and market policies

- Domestic and imported goods should have a label describing their content in Lao language before selling
- Issues of banana exports
 - Some provinces do not issue a “Certificate of Origin”.
 - Informal banana exports through traditional border checkpoints.
 - Lao banana is not identified/recognized by global & regional markets
 - Lack of value-added for Lao banana: banana are packed in foreign language
- Difficult to export bananas through neighboring countries (against WTO rules).

Instruction on product description in Lao language



Relevant policy review – Challenges (4/5)

Production and pesticide policies

- Ban on banana production in rice fields: less land is available for the expansion of rice fields → increase of slash-and-burn by farmers who lost land to banana plantations.
- Need for a stronger control / management of the imported chemical substances (insecticides, herbicides or others)
- Existing list of fake insecticides and banned pesticides in Lao PDR:
 - 29 insecticides, 7 fungicides, 2 rodent control, 5 herbicides, 2 spray insecticides, and other 3 pesticides.
 - Laos signed the Rotterdam Agreement.

Some chemical substances used on banana plantations in the North of Lao PDR

Chemical substances	Estimated amount	Examples of chemical substances used
Chemical fertilizer	8-10	46-00-00, 15-5-22, 13-5-27, 15-15-15, 16-16-16, 17-17-17, 14-16-15, 12-6-24, 14-11-20...
Herbicide	10-15	Glyphosate ammonium, Glyphosate 48, Bentazon, PROchloraz, Baicaoku...
Diseases and Fungicides	30-40	Pyraclostrobin, Kresoxim-methyl, Thiophanate Methyl, Tebuconazole, ChloroThalanil, Propiconazol, Meothrin, Topsin...
Insecticide	40-50	Alpha-cypermethrin, Flufenoxuron, Fenpropathrin, Imidacloprid, Propargite, Fendona...
Nutrient	15-20	Unikel Edta, Iprodione, Plantafol, Compo...
Ripening & Additives	3-5	Gengreen, Baolixian...

Relevant policy review – Challenges (5/5)

Environmental policies

- Contradiction between market demand and environment.
- Lack of information and evidence on negative environmental and social impacts – why banana products can be accepted & imported by other countries?
- Lack of scientific evidence on environment (soil & water) and health (labor) impacts especially, need for long-term research and testing.
- Low enforcement of existing environmental regulations and guidelines. Lack of appropriate monitoring system.

IV. Impacts

Negative Economic Impacts

- Lost opportunities in land use for other crops, suitable land for agriculture production expansion or other investment,
- Estimated costs for removing banana corm, root, ploughing land: 5.5 million kip/ha (excluding costs of soil improvement)
- No added value for Lao products through processing.
- High production costs: infrastructure (road, water system), fertilizers and intensive water consumption.
- Banana production pushes up the price of other crops, especially rice.
- Several failures (Bolikhamxay), because of attacks from diseases and insects.

Estimated economic returns from long-term land concession (South)

	LAK/ha	LAK/ha
Concession fee	40,000 ^a	80,000 ^b
Duration of concession	30	30
Expenditures	5,550,000	5,550,000
Discount rate ^c	6.130%	6.130%
Net present value	(5,006,982)	(4,463,963)

^a - Concession fee: 5 USD/ha/year

^b - Concession fee: 10 USD/ha/year

^c - Based on the long term interest rate (1 year),



Estimated economic returns from land lease

	Duration of lease (years)	Term of payment	Rental fee (Mn LAK/ha)	Present value of rental fee (Mn LAK/ha)	Present value of expenditures (Mn LAK/ha)	Net present value (Mn LAK/ha)	Internal Rate of Return
Phongsaly	3	Yearly	10.00	26.67	4.64	22.02	171.1%
	3	Yearly	6.56	17.50	4.64	12.86	104.4%
	5	Yearly	10.00	41.98	4.12	37.85	179.1%
Luang Namtha	3	Yearly	12.50	33.33	4.64	28.69	218.2%
	3	Yearly	16.25	43.33	4.64	38.69	287.8%
	5	Yearly	18.75	78.70	4.12	74.58	337.6%
	6	Twice / period	10.00	34.61	3.88	30.73	341.9%
	10	Yearly	12.08	88.34	3.06	85.28	217.6%
Oudomxay	5	Yearly	10.00	41.98	4.12	37.85	179.1%
	5	Yearly	10.00	41.98	4.12	37.85	179.1%
	10	Yearly	8.00	58.52	3.06	55.46	144.1%
	10	Yearly	6.00	43.89	3.06	40.83	108.0%
	10	Yearly	8.00	58.52	3.06	55.46	144.1%
	10	Yearly	10.00	73.15	3.06	70.09	180.2%
	15	Yearly	6.00	55.01	2.27	52.74	108.1%
	10	Yearly	10.00	73.15	3.06	70.09	180.2%

Estimated economic returns from smallholder banana plantation

Province	Variety	Fixed production cost <i>(Mn LAK/ha)</i>	Variable production costs <i>(Mn LAK/ha)</i>	Return <i>(Mn LAK/ha)</i>	Profit <i>(Mn LAK/ha)</i>	Benefit-Cost Ratio <i>(Mn LAK/ha)</i>	Internal Rate of Return
PGY	Cavendish	0.86	13.57	30.07	15.64	108.4%	305.2%
LN	Cavendish	0.92	15.12	36.20	20.15	125.6%	356.3%
BXY	<i>Kluay nam</i>	0.25	1.27	6.47	4.95	325.6%	91.3%
SVN	<i>Kluay nam</i>	0.24	1.16	5.43	4.03	288.4%	75.6%

** Based on estimated cost of land clearing and preparation of 5.5 Mn LAK/ha (every 5 years)

Economic returns for wage workers

Province	Annual Income (Million Kip)		
	Lowest	Highest	Average
Phongsaly	8.76	30.00	17.98
Luang Namtha	7.50	25.00	13.21
Udomxay	NA	NA	NA

Province	Daily wage (Million Kip)			Monthly salary (Million Kip)			Annual Income (Million Kip)		
	Low	High	Ave.	Low	High	Ave.	Low	High	Ave.
Bolikhamxay	0.040	0.130	0.056	0.600	0.600	0.600	3.000	7.200	4.933
Saravanh	0.040	0.040	0.040	-	-	-	0.48	5.60	1.758

Positive Social Impacts (1/2)

- Companies invest in infrastructure: road access, electricity, health care centers.
- Companies contribute to social activities at the village/district level, e.g. to support meeting, social events, etc.
- Creates job opportunities and reduces labor migration (labor from plantation areas).



Positive Social Impacts (2/2)

- **Some perspectives of smallholding banana farmers:**
 - 90% agreed on higher income generation from planting banana
 - 80% agreed on major contribution from banana plantation to support the education of family members
 - 68% agreed on income from banana plantation provided funds for other agricultural crops
- **Some perspectives of farmers renting their land to banana companies:**
 - 75% agreed on an increase in household's income from land rental fee
 - 80% identified major contribution from land rental fee on the education of family members
 - 50% agreed that land lease provided fund for agriculture production

Negative Social Impacts (1/3)

- **Less agriculture land for rice** and other crops might reduce the ability to reach national targets on food security.
- **Livelihood changes:** lower access to and collection of NTFPs
- Foreign workers do not follow laws & regulations → management difficulties and social unrest.
- Income from banana plantation is **unsustainable.**



Negative Social Impacts (2/3)



- **Conflicts** over land use between:
 - Banana plantation companies and local people surrounding the plantation
 - Banana plantation company and companies producing other crops
- **Poor health of plantation workers** (unsafe handling of chemicals).
- **Excessive use of chemicals** during the production process
→ contaminated bananas maybe dangerous for consumption.
- **Children** in plantation areas:
 - do not go to school: impact on school attendance rates;
 - stay with their parents on the plantation: impact on health.

Negative Social Impacts (3/3)

○ **Sickness/illness of smallholding banana farmers**

- 8% of banana farmers/families in the North reported having been sick over the past 6 months.
- Average frequency and duration of sickness (4 times, 4 days each time) but could continue to work.

○ **Sickness/illness of workers/families at banana plantations**

- 63% of workers in the North & 35% in the Centre/South reported having been sick/ill over the past 6 months.
- Main symptoms reported: dizziness (34%), headaches (24%)
- 12% of workers in the Northern provinces have their own treatment/care, 84% bought medicine and 39% received a treatment from the hospital.
- 66% requested the banana company to provide necessary protection equipment, 22% wanted to have medical support fund

○ **Banana workers's sickness/illness (Houn District hospital)**

- 2014-2015: 15 cases came for receive treatment, 8 cases are severe and need to recover at hospital more than a week, 1 death of pregnant worker

Positive Environmental Impacts

- Some people view banana plantations as a way to convert fallow land to productive land.
- Some consider banana plantations as a good way to increase soil coverage.



Negative Environmental Impacts (1/3)

- Poor soil quality and soil degradation due to heavy use of chemicals, and soil erosion.
- Contaminated run-off water and empty chemical containers → waterways (rivers, canals and ponds) → River pollution, loss of fish species, contaminated water for livestock and human needs.



Negative Environmental Impacts (2/3)

- **Some perspectives of smallholding banana farmers on environmental impacts from heavy use of chemical substances:**
 - 80% agreed on an increase of water contamination
 - 71% agreed on a decrease of fishes in surrounding areas
 - 80% agreed on an increase in soil contamination
- **Some perspectives of banana plantation workers on environmental impacts from heavy use of chemical substances**
 - 82% agreed on an increase of water contamination
 - 66% agreed on a decrease of fishes
 - 76% agreed on an increase of soil contamination

Negative Environmental Impacts (3/3)

- The strong smell of some chemical fertilizers creates negative externalities for those who live within 200-300 m of the plantations. Symptoms include headaches and dizziness during the spraying period
- After planting bananas, the land cannot be used for other crops without soil improvement (e.g., taking out banana corm, roots)
- The heavy use of water in the banana plantation might reduce water levels in nearby streams/rivers.

V. Conclusions & Policy Recommendations

Key messages

- Heavy use of chemical substances in commercial banana plantations.
- Potentially high health and environmental costs (difficult to measure) from banana plantations may outweigh their benefits (income generation, employment opportunities).
- Economic returns from land lease fees are higher than those of long-term concessions.
- Based on economic analysis, 100% concessions provide lower benefits
- Banana plantation workers are from very poor and vulnerable communities,
- Laws & regulations exist... but are not enforced.

Policy recommendations (1/3)

No.	Recommendations	Who and How to	Timeframe	Remarks
1	Formulate appropriate market policy in order to avoid risks on failing prices	MOFA & MOIC: Conduct trade negotiations - ASEAN, WTO, bilateral negotiations	Schedule/ agenda of existing platforms	Beyond provincial and district authority.
2	Policy implementation: Enforcement of environmental law on available of environmental management plan and/or assessment before approving business	MONRE/PONRE/DONRE: Check during business approval process for agribusiness; periodic field inspections by DONRE	Immediate	Existing environmental laws and regulations
3	Policy implementation: Instruction to enforce the use of environmental friendly production inputs and management of chemical containers	PONRE/DONRE: Enforcement of recycling of bags used to cover banana bunches CST/NAFRI: Introduce cheap appropriate technology to destroy plastic bag and chemical containers	1-2 year	Increasing production costs
4	Advanced payment for recovering and improvement of natural resources (soil, water quality, etc.)	DOA/DALaM: 5.5 million kips/ha for removing banana corm, root and clearing land	1 year	Some province already implement similar practice

Policy recommendations (2/3)

No.	Recommendations	Who and How to	Timeframe	Remarks
5	Establish provincial committee to screen and register chemical (pesticides, herbicides, etc.) used for agriculture production	NAFRI/DOA/PAFO: Request SWGARD for consideration to establish SSWG or Task Force	1-2 year	DoA could act as the secretariat
6	Improve or revise and enforce list of banned chemical use in Lao PDR	DOA/MONRE/PAFO/PONRE: Based on identified 16 chemical use that considered harmful and ban under the Rotterdam Convention (formally, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade)	1 year	Rotterdam Convention identified list of banned chemical
7	Build capacity for district authorities for implementation, monitoring and management of business	MOIC/TPPD/LNCCI & MAF/DOPC: Advocate, train, disseminate and provide on the-job-training on relevant law, regulation, guidelines, manual	Immediate action	Available law, regulation, guidelines, manual
8	Establish mechanism to involve village and district authority for the agribusiness/concession approval process	MPI/MAF and Provincial Office of Planning and Investment & PAFO: Issue instruction or guideline by provincial authority	Immediate action	Based on Sam Sang

Policy recommendations (3/3)

No	Recommendations	Who and How to	Timeframe	Remarks
9	Build capacity (based on role and mandate of each department) for provincial investment committee who are considered as the technical secretariat and assurance for provincial governor on investment approval process	Ministry of Justice/ MONRE/MAF/DOPC: Advocate, train, disseminate and provide on the-job-training on relevant law, regulation, guidelines, manual	1-2 year	Available law, regulation, guidelines, manual
10	Stop banana plantations that create environmental and social impacts. At the same time, promote and recognize good practices to improve banana plantation sector	MAF: DOPC/DAEC/ Department of Inspection: Conduct sector assessment	1-2 year	Banana plantation audit committee who was appointed by MAF
11	Suspend 100% concession for banana plantation	PAFO/DAFO: Promote household/ farmers to plant bananas using contract farming based on GOL standards DAEC/PAFO/DAFO: Promote traditional banana (Kuay Nam)	Immediately	100% seems to be easier to regulate and manage Based on economic analysis, 100% provide minimum benefits
12	Allocate budget for research/study to identify technical measurement/ standard and production techniques to be used as basis for approval process, and to test long-term impact (health impact, environmental impact)	MAF: Allocate budget from government, donors/development projects, private sector	1 year	Establish GAP for banana production based on ASEAN/GAP and standards acceptable to China and other regional and international markets

Next steps

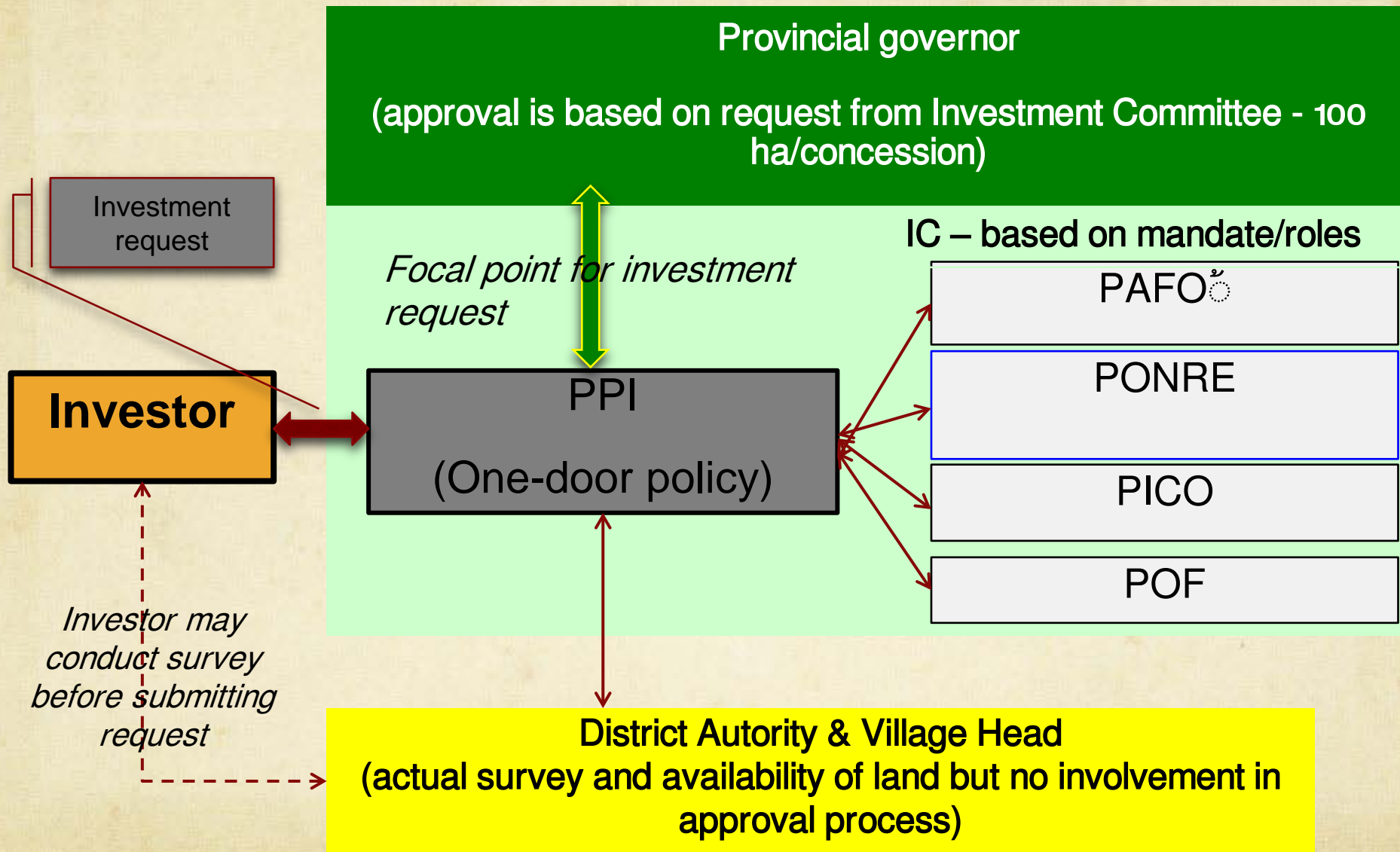
- Policy brief on commercial banana production in the Lao PDR
- Further research areas:
 - Detailed assessment of the impact of banana plantations on soil and water / IWMI

At the catchment scale (Sibounheuang village cluster, Houn District, Oudomxay). Soil and water samples will be taken during the dry/wet seasons and analyzed in the laboratory to quantify concentrations of pesticides and soil nutrient content.
 - Assessment of the impact of banana production on health / LURAS?
 - Alternative income generation options for poor households/farmers in areas surrounding plantations

Thank you

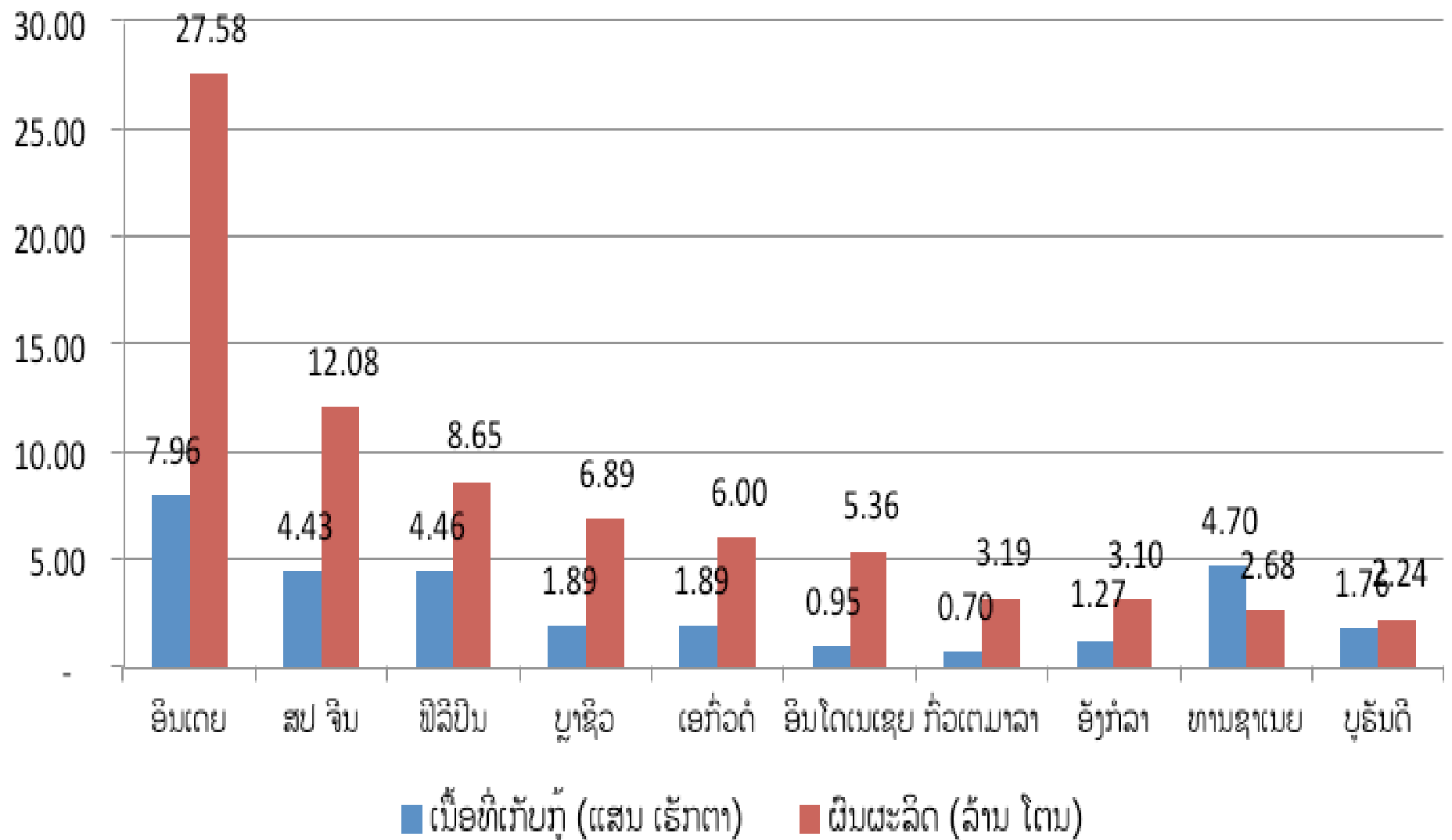


Approval process for banana plantation



Note: lack of follow up or monitoring system after approval process

Top 10 banana export countries



International agreement (Rotterdam Convention Pesticides)

- Rotterdam convention identified international chemical trade and list of banned pesticides.
- 1989, Rotterdam convention was initiated by FAO and UNEP and it was implemented in 2004
- 154 member countries who agreed on imports, exports and ban those hazardous chemical substances
- List of 47 banned chemical substances including 33 pesticides (3 chemical substance are considered as highly hazardous) and 14 chemical substances for industry.
- 2015, 7th meeting for members (COP7) considered adding 4 chemical substances: [Chrysotile asbestos](#), [Fenthion](#), [Liquid formulations](#), [Trichlorfon](#).
- Some chemical substances used in banana plantation considered as moderate or highly hazardous are banned such as Glyphosate ammonium, Paraquat, Baicaoku, Methyl