




The economics of irrigated rice in Thailand: what options for financing irrigation? Case studies

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Irrigation in Thailand: general information

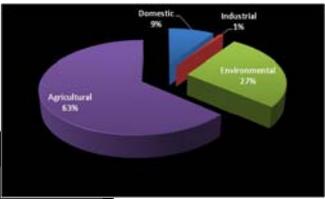
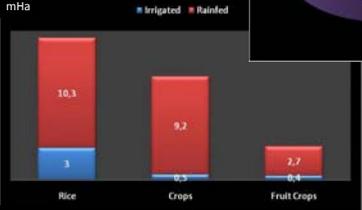
- Irrigable area: 5 million Ha
- Agricultural land use ratio : 40%
- Irrigation ratio in agricultural land: 24%
- Potential area for irrigation expansion: 9.6 mHa
- Main resource: raw surface water supplied by RID of MoAC, mostly through dam or reservoir storage / control
- Agriculture accounts for 9% of GDP, offers 38% of employment




Irrigation in Thailand: general information (2)

- Irrigation water use: 70% of all water storage capacity or 63% of allocation plan by RID ; in practice 90% of all extractions go to irrigation (with significant return flow)

Country	Water availability ratio (cm/cap/year)
Australia	25,700
Indonesia	13,400
Thailand	6,500
Japan	3,400
South Africa	1,150

2004 data




Map showing the land use from satellite landsat 5 in 2005

Thailand is among top producers and exporters for

- Rice (1st)
- Cassava (1st)
- Rubber (1st)
- Sugar cane
- Dairy products
- Poultry
- Tropical Fruits (fresh, dried, canned)
- Flowers
- Cashew nuts

Also exports

- Jute
- Cocoa
- Peanuts
- Soybeans
- Maize

Also produces Coconuts, Tobacco, Cotton, Vegetables, Coffee, Tea , Beans, Temperate Fruits and Citruses... mostly for domestic market





Irrigation in Thailand: general information (4)

- Number of irrigation schemes: 15,000
- Average size: 330ha ; average irrigation farm size: 4.7ha
- Broad typology:
 - ① • **Medium to large-scale public paddy irrigation systems (RID), N=788, 4800ha av.**
 - ② • Medium public irrigation systems (DoEDP, Royal initiative), N=4380, 200ha av.
 - ③ • Small diversified public irrigation systems (RID), N=11600, less than 10ha on av.
 - ④ • Small, diversified community managed irrigation systems in remote hilly regions (*muang fai*)
 - ⑤ • Medium commercial privately managed irrigation systems for local and export markets (e.g. fuelcrops, rubber, coffee)
 - ⑥ • Farm-scale, periurban individually managed irrigation systems for local markets (e.g. fresh vegetables)

All activities in RID-managed schemes are carried out by RID of MoAC (design, implementation, distribution, operation, maintenance, extension and technical advising, training)



Irrigation in Thailand: general information (5)

- Main features and issues:
 - **Low land productivity** (average 2.65t/ha, WS: 3.7, DS: 4.5; 4.48 Vn, 4.56 In, 6.06 Ch)
 - **Low inputs** (N fertilizer 86kg/ha, 285 Vn ; pesticides 1.1kg/ha, 2.9 world average)
 - Recent shifts: from large- to **small-scale irrigation** development , from rice to diversification (since 2008, rice is back)
 - A major issue: aging farmers and the **looming farm labour crisis** (soaring labour costs)
 - Rice = a strong sociocultural and economic fabric embedded across Thai society
 - Paddy fields and infrastructures (and recent soaring rice price): **hindrance** to crop diversification ; the pressure for land conversion (fuelcrops)
 - **Water management** in paddy fields also out of farmers' hands at times (regional floods)
 - Excess irrigation in ponding systems is not considered a problem since unused water forms **return flows**
 - Distinct conditions between **wet season** ('rainfed' in wetland-lowland areas - irrigated in dry areas) and **dry season** (irrigated in wetland-lowland areas ; fallow or rotation in dry areas)



Water Policy in Thailand: white elephant and paper tigers

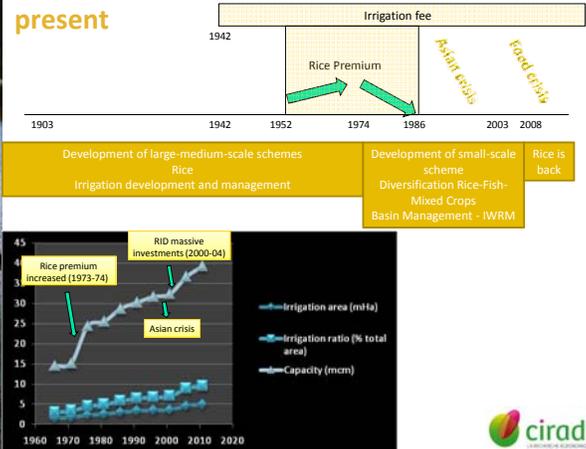
- Plenty of water, plenty of stakeholders, one big player
 - No National Water Act so far; many drafts over the years... (under quick political turn-

Financing irrigation in Thailand: mechanisms

- To cater for irrigation investment and O&M costs: a ridiculously low irrigation fee water (from 1942, +/- abandoned) + a massive unfair (yet defunct) so called rice premium system
- Rice premium: a specific export duty (based upon global rice price and volumes exported), a fiscal instrument, taxing all rice exports at 20 to 30% between 1956 and 1986 ; naturally export chain operators kept their share by putting the burden on farmers
- Rice premium applied to all export rice, while rice premium funds were re-invested in irrigation development and management.
- Certain years, RP represented about 25% of farmers income forgone
- A varying tax, due to volatile global rice prices ; after 1986, with sharp increase of rice price, RP system became unbearable
- Voices started to denounce the inequity and absurdity of RP system: irrigation development indeed, yet rural poverty and meager peasant livelihoods overall; plus rainfed rice farmers would pay for irrigation



Financing irrigation in Thailand: past and present



Demystifying some well-established ideas

- While there is no actual fee system, **farmers do pay for water supply** (private pumps are common)
- Farmers practices are **not the source of water waste** (overall reservoir and canal management is to blame)
- Although ridiculously low and not collected, **there is an official irrigation water fee**
- Farmers **do know the value of water**, and actually value it, as reflected by WTP and MVP figures ; in most circumstances, **they try to use it sparingly**
- Farmers are not wealthy**; irrigation rice farmer poverty is a reality



What the future holds

- Rice is not dead** (Thai white rice: 200\$ per ton in 2003; 376 in 2007; 963 in May 2008; +/- stable at 600 since mid 2008); less rainfed, more irrigation
- Fuelcrops development slows down** ; land grabbing with foreign investment made virtually impossible in Thailand by policy
- Land changes looming** (amalgamating farms, growing bigger), the labour crisis
- Sustainable intensification looming** (more mechanization, GAP-GMP-IPM trends), more environmental concerns (consumer pulling, certification, labeling, 'no-GMO' policy re-affirmed)
- Paddy rice ecosystems offer **many and massive ecosystem services to Thai society**, un-recognized, un-documented, not valued (not compensated for)
- Ideas and debates on a **revamped irrigation water fee and/or a new private-public joint system to finance irrigation** come back at times...



Irrigation economics: figures at scheme level

Prior works:

Comparing economic values, costs and prices in rice irrigation systems (around 2000)

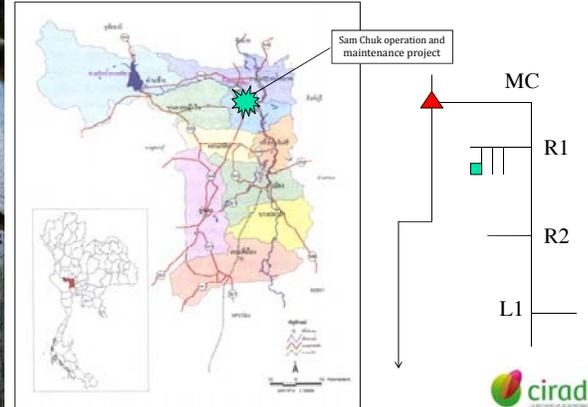
	US\$ per 1000cm	
Official fee	0,106	Royal Irrigation Act 1942
Proposed fee	2,55	ADB proposal 2001
WTP	5,1	Tiwari (1998)
Ability to Pay	15,3	"
O&M costs	5,1	"
MVP	18,4	"
MVP farmers	23,5	"
Opportunity cost	28,6	"
Marginal cost	34,7	"
Scarcity rent	18,4	"

Calculations made on the basis of 9800cm used per year over 2 cycles

- For this case study, 209 farmers surveyed; 12% paid some form of irrigation fee
- Small et al. (1989) estimated that rice premium amounted to 3 times the O&M costs, i.e. about 16 US\$ per 1000cm
- In 2000, net farm income in paddy cropping (2 cycles) was about 630 US\$ per ha per year (about 64 US\$ per 1000cm used)



A case study (work on-going): Sam Chuk



A case study (work on-going): climate

Month	Min Temp °C	Max Temp °C	Humidity %	Wind km/day	Sun hours
January	20.5	32.1	71	67	7.3
February	22.6	33.9	73	89	7.5
March	24.2	35.5	72	111	7.7
April	25.6	37.0	71	111	6.8
May	25.8	35.7	74		
June	25.5	34.6	75		
July	25.0	34.1	76		
August	24.9	34.0	77		
September	24.8	33.4	80		
October	24.5	32.3	80		
November	22.8	31.5	75		
December	20.0	30.8	70		
Average	23.9	33.7	75		

Month	Monthly Rainfall
January	6.5
February	7.3
March	18.3
April	59.1
May	120.6
June	100.2
July	106.0
August	127.2
September	253.9
October	209.3
November	42.2
December	9.3
Total	1,059.9



A case study (work on-going): cropping

- Sam Chuk Project in Saphan Buri Province, Central Plains, East
- A typical large scale, rice irrigation system managed by RID (type 1)
- About 7,300 farmers
- 58,653ha, of which 50,171ha are irrigable.

Year	Major crop (wet season)		Second crop (dry season)	
	Cultivated area (rai)	Cultivated area (ha)	Cultivated area (rai)	Cultivated area (ha)
1994	237,199.00	37,951.84	74,019.00	11,843.04
1995	216,110.00	34,577.60	142,543.00	22,806.88
1996	199,957.00	31,993.12	224,294.00	35,887.04
1997	231,725.00	37,076.00	204,191.00	32,670.56
1998	233,100.00	37,296.00	210,742.00	33,718.72
1999	226,330.00	36,212.80	203,800.00	32,608.00
2000	260,110.00	41,817.60	243,827.00	39,012.32
2001	233,183.00	37,309.28	245,225.00	39,236.00
2002	247,913.00	39,666.08	259,349.00	41,495.84
2003	247,917.00	39,666.72	242,168.00	38,746.88
2004	253,528.00	40,564.48	243,374.00	38,939.84
2005	251,926.00	40,308.16	256,398.00	41,023.68
2006	274,253.00	43,880.48	252,847.00	40,455.52
2007	248,240.00	39,718.40	269,682.00	43,149.12
2008	239,285.00	38,285.60	233,885.00	37,418.40
2009	215,987.00	34,557.92	271,979.00	43,516.64
2010	253,004.00	40,480.64	236,923.00	37,907.68



A case study (work on-going): irrigation

- Most of the command area is cropped and irrigated (about 40,000ha in both dry and wet (cropping intensity about 160%)
- 80% of land covered with paddy fields, plus some tree crops, shrimp-fish ponds, vegetables
- Rice yields range between 5 to 5.6 tons/ha (higher than CP average)
- Farm size: median is about 8ha; min: about 4ha; max: 15ha
- **Irrigation method:** water is pumped from tertiary canals which serve each banded paddy field. Ponding conditions: usually sustained throughout the cycle, with about 10 to 15cm of water kept in the paddy field via regular filling. Water is usually pumped / lifted from canals to fields, over the bunds, by small portable diesel pumps and short flexible pipes.
- **Water use** (at farm level, considering 70% field application efficiency):
15,400 cm/ha during dry season
7,918 cm/ha during wet season
- **Blue water content of rice is:**
2.87 cm/kg of paddy (dry season); 4.41 if all losses are considered (45% eff.)
1.50 cm/kg of paddy (wet season); 2.31...



A case study (work on-going): rice price

- Millers agreed to pay 8,675 THB/ton in both seasons for white rice at 14-15% m.c.
- Average selling price of raw paddy at farm gate at 24-25% m.c. is:
7,400 THB/ton for wet season 2010
7,800 THB/ton for dry season 2009-2010.
- Since Government guarantees a minimum price of 10,000 THB/ton for such rice, a subsidy of 10,000-8,675 = 1,325 THB/ton was given to farmers.
- So actually, subsidized farmers received 7,800+1,325 = 9,125 THB/ton in dry season, and 7,400+1,325 = 8,725 THB/ton.
- Calculations have taken into account such subsidy.

30 THB for 1 US\$



A case study (work on-going): crop-water data

(n = 20)	Unit	Dry season	Wet season
Output			
Yield	Ton/ha	5.35	5.26
Farmer's income	Baht/ha	48,847.86	45,903.26
Gross margin per area	Baht/ha	22,913.81	19,711.56
Gross margin per mass product	Baht/kg	4.26	3.72
Input expenditures			
Seeds	Baht/ha	3,367.19	3,265.63
Fertilizer	Baht/ha	2,870.31	2,969.53
Land rental	Baht/ha	6,374.58	6,369.58
Machinery	Baht/ha	5,863.10	5,863.10
Tools	Baht/ha	4,236.51	4,321.24
Pesticides	Baht/ha	2,672.17	2,861.90
Transport during production stage	Baht/ha	550.19	540.72
Total production costs	Baht/ha	25,934.05	26,191.69
Irrigation water use (Computed from CROPWAT 8.0 model)			
Irrigation water use (Crop Irrigation Water Requirements)	m ³ /ha	10,763.13	5,542.53
Gross water use (Ea: 70%; including losses during application)	m ³ /ha	15,375.89	7,917.89
Water productivity			
crop level	kg/m ³	0.50	0.96
farm level (Ea: 70%)	kg/m ³	0.35	0.67
VP (return to irrigation water)			
crop level	Baht/m ³	2.13	3.61
farm level (Ea: 70%)	Baht/m ³	1.49	2.53



A case study (work on-going): costs

- Costs are currently being investigated
- O&M costs and refurbishing / rehabilitation work costs are quite easy to assess
- Capital costs are more difficult (old age, lack of data, allocation of infrastructure that is common to several schemes, etc.)
- ICID cost approach tested by Perret & Geyser (2006) in SA will be used
- Combined cash flow and capital cost recovery factor approach

- Choice of a reference year (PV), actualization (inflation), then discounting approach

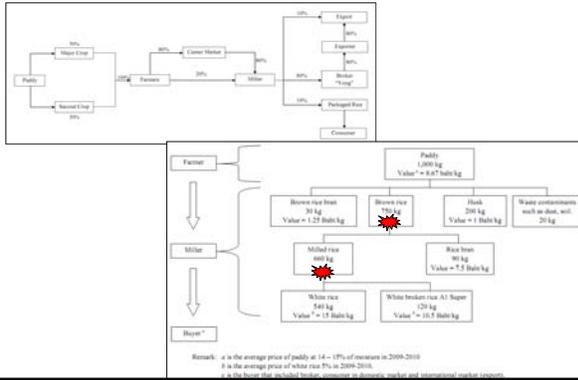
$$CRF = \frac{i \times (1 + i)^n}{(1 + i)^n - 1}$$





A case study (work on-going): rice values

- Added values and prices along the rice supply chain are currently being investigated



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