CAMBODIAN RICE SECTOR ECONOMIC OBSERVATORY

Based on data for wet season 2016 and dry season 2017 *Bulletin N°1 March 2018*

EXECUTIVE SUMMARY

Rice policy formulation shows the need for monitoring the evolution of Cambodia's rice sector with up-to date and consistent information for observing and assessing the impact of policy decisions, which take into account changes in input and output market of paddy and rice production at the national, regional, and international level.

The availability of shared and validated information on costs and incomes along the rice value-chains is a basic requirement for building a policy consensus among private and public stakeholders in the rice industry confronted by various policy trade-offs. Hence, the Cambodia Rice Sector Economic Observatory (CRSEO) Bulletin is developed to serve as a tool for policy dialogues among policy decision makers and stakeholders in the Cambodian rice sector.

REPRESENTATIVE SYSTEMS

Thirteen rice-value-chain models or systems have been established by combining different types of agents (farmer, collector, miller, and retailer) fulfilling production, collection, milling and retailing functions. They represent early wet season non-fragrant, wet-season non-fragrant and photosensitive fragrant, and dry season fragrant and non-fragrant. There are one early-wet-season non-fragrant system, four wet-season photosensitive fragrant systems, three wet-season non-fragrant systems, three dry-season fragrant systems, and two dry-season non-fragrant systems.

FINDINGS

- **Farmer Performance** Total farming cost per ha varied from KHR 1.41 million to KHR 2.82 million. Chemical input, service, and seed were the three highest components of farming. Farmer's profit varied from KHR 542,000 to KHR 931,000, while the return to family labor varied from KHR 21,200 to KHR 42,000 per day. Early-wet-season and dry-season non- fragrant systems consumed highest chemical inputs, which post concern about impact on wellbeing of farmer, consumer, and environment.

- **Miller Performance** Total milling cost per one ton of milled rice varied from KHR 185,000 to KHR 370,000. Fixed asset, energy, and financial costs were the three highest components of the milling cost structure for all the milling systems. The return to capital varied from 1.8 % to 13.9%.

- **Value Chain Performance** On average, the value added was created between USD 107 to USD 408 per ton of milled rice. Rice farming, on average, shared approximately 50% of the total value added created in the rice value chains and the analysis shows that the higher the value added created, the higher proportion goes to farmers. Of the total value added generated, 23% went to millers, 18% to retailers, and 9% to collectors.

Our analysis indicate that the well-performance systems were either wet-season or dry-season fragrant variety with farming owning machine (tractor and hand-tractor, essentially). These systems also operated by large millers (10T/hour), which mill fragrant rice for export market. We also observed that the early-wet season non-fragrant and dry-season fragrant rice value chains, which mostly exported raw paddy to other countries, had the lowest profitability.

CONTENT

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RECOMMENDATIONS

- **Bringing down cost of chemical input** The key determinants of farmer's profitability, at a given price, are the costs of fertilizer, services (machinery), and seed. To bring down cost of chemical input, this bulletin suggests the government to consider 1) Increasing interventions that bring down the cost of fertilizer and seeds, along with agricultural extension activities to farmers with focus on cost-effective use of chemical inputs and 2) Promoting adoption of Good Agricultural Practice and Sustainable Rice Platform for farmers to find niche markets for high value.

- **Maximizing milling capacity utilization** Millin shared approximately 23% of total value added on average. Ensuring a level of milling capacity utilization (above 30% of the total capacity) is a key determinant of the miller's profitability and the value chain competitiveness.

To encourage miller to maximize milling capacity utilization, this bulletin suggests government consider continuing to increase loans to millers, and improving electricity supply. The downward trend in international price until June 2017 showed the fierce competition that prevailed on the international market even for fragrant price that is highly valued. With the threat of losing a privileged access to the European market, the need for diversifying export destination is a major challenge and a high priority for the Cambodian rice sector.

1. Introduction

The analysis of rice-value-chain systems is based on representative budgets developed for the different groups of stakeholders and for the different sub-value chains. These representative budgets present detailed costs structure for each of these groups of stakeholders, the distribution of the added value, and indicators such as ***cost structure, profit, added value, return to cash, added value and return to investment.***

Sensitivity analysis is also incorporated in the bulletin in order to assess the relative impact of possible variation of various key factors on the profitability and distribution of added value, deemed particularly useful for policy decision makers in order to focus on measures with higher impact.

Thirteen rice-value-chain models or systems have been established by combining different types of agents (farmer, collector, miller, and retailers) fulfilling production, collection, milling and retailing functions. They are representative of wet-season's photosensitive fragrant and non-fragrant, early wet season non-fragrant, and dry season non-fragrant.

Figure 1: Wet season systems

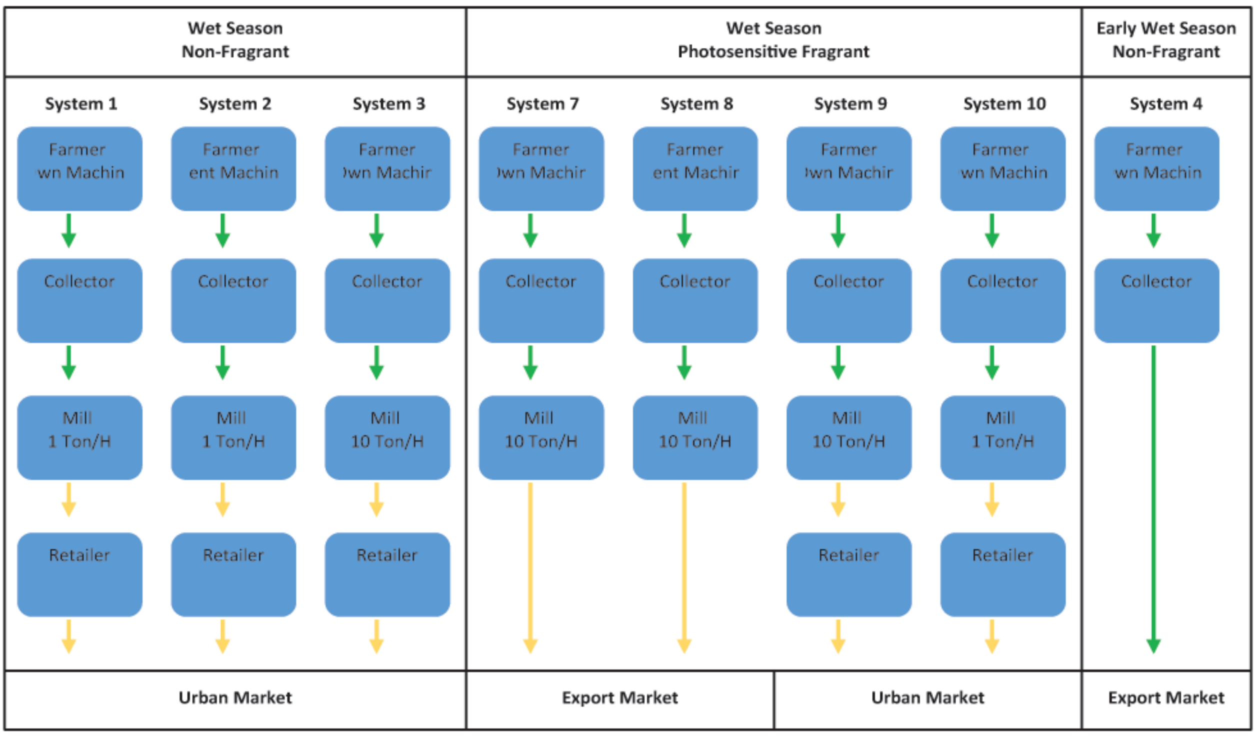
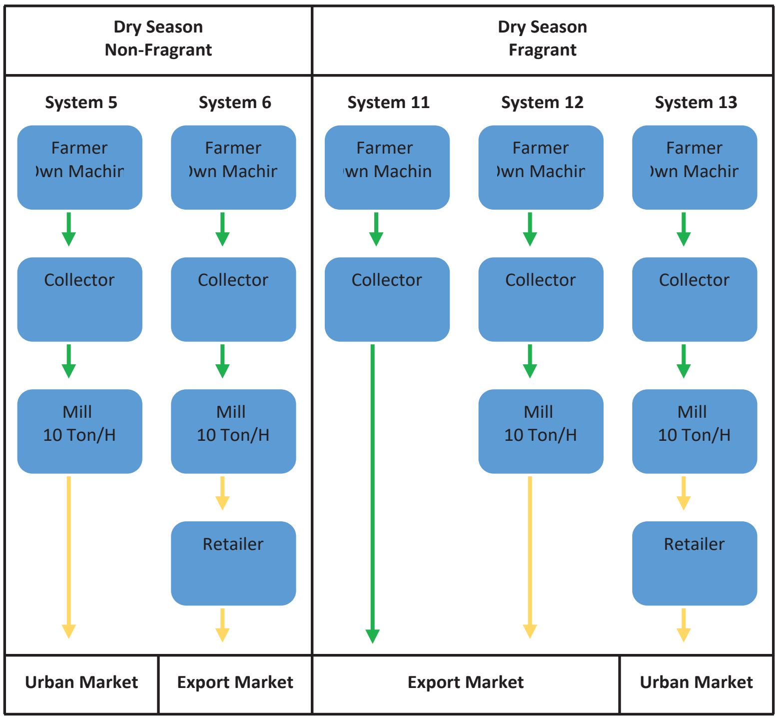


Figure 2: Dry season systems



2. Analysis

2. 1. Farmer Performance

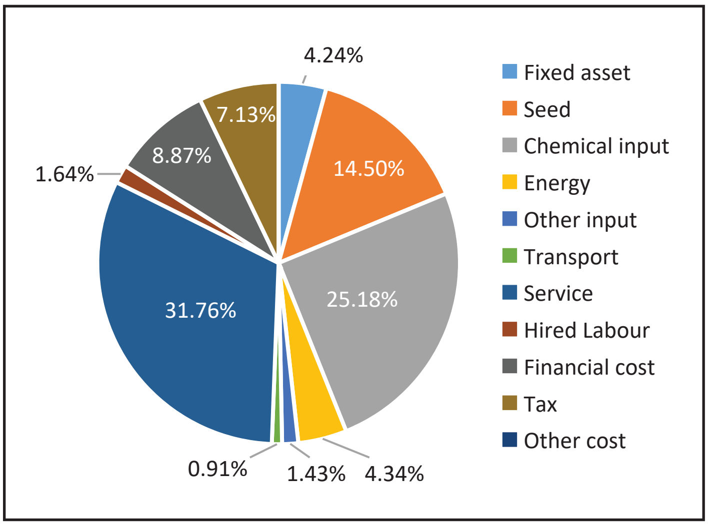
2.1.1. Farming Cost

The analysis indicates that total farming cost varied from KHR 1.41 million to KHR 2.82 million per ha. On average, total farming cost was KHR 1.88 million per ha. *Service*[1], *Chemical input*[2], and *seed* were the three highest components of farming cost structure for all cropping systems (See Figure 3).

2.1.2. Net-income (Profit)

Figure 4 shows profit varied from KHR 542,000 to KHR 931,000 without taking into account the land cost. On average, the land cost could take around KHR 40,000 per ha per season. Farmer producing early-wet-son non-fragrant variety and own-machine (F3) earned the most from one ha of land, as compared to all cropping systems. However, this system was chemical-input intensive, as discussed earlier.

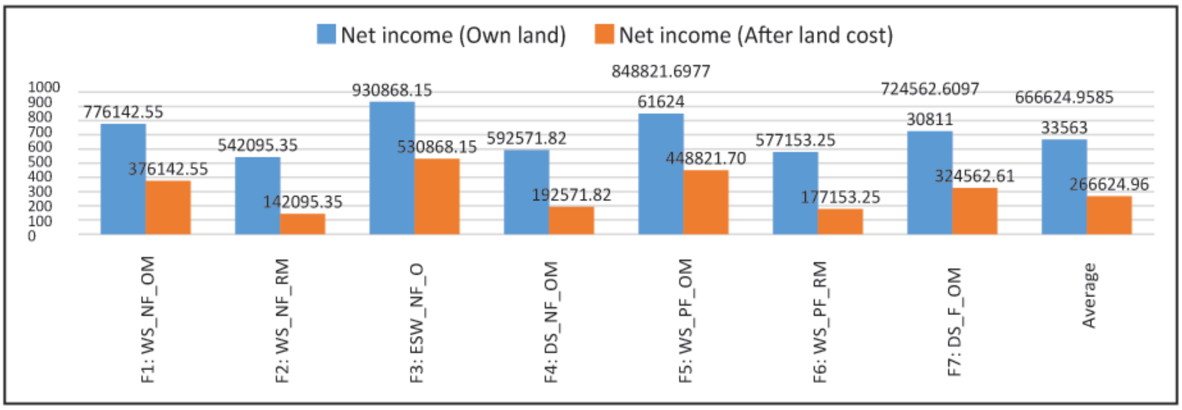
Figure 3: Share of farming cost structure (%)



Source: Authors' computation for CRSEO Bulletin

1. Service cost includes land preparation, plant management, harvesting, tractor maintenance, pump maintenance, and irrigation.
2. Chemical input cost includes fertilizer, pesticide, and herbicide.

Figure 4: Paddy farmer's net-income per ha of land (Thousand KHR/Ha)



Source: Authors' computation for CRSEO Bulletin

Note: **WS:** Wet Season **DS:** Dry Season **NF:** Non Fragrant **F:** Fragrant **OM:** Own Machine

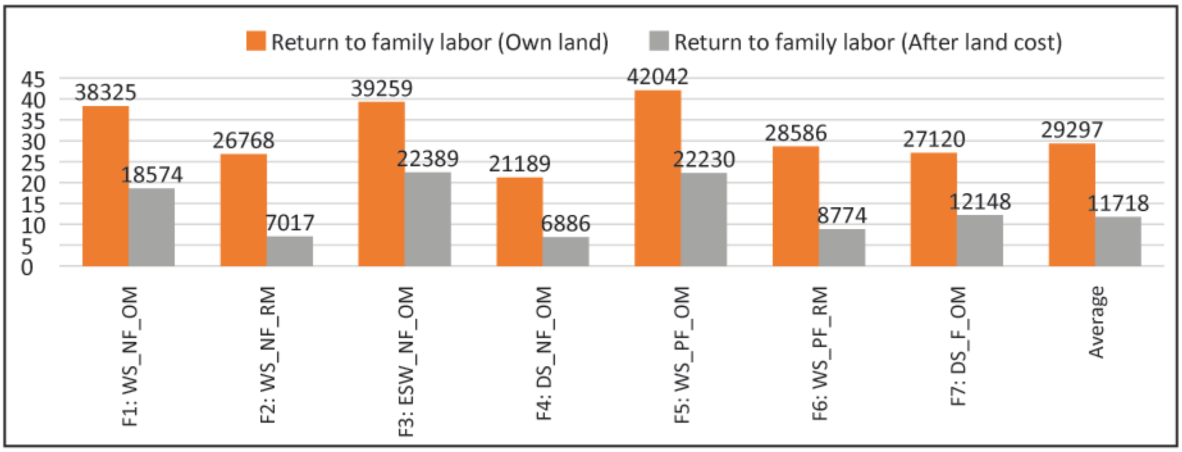
EWS: Early Wet Season **PF:** Photosensitive Fragrant **RM:** Rent Machine

2.1.2. Net-income (Profit)

On average, farmer spent 23 days of family labor for one ha of land. The amounts of family labour used for wet-season systems were 20 days, early-wet-season system was 24 days, and dry-season systems were 27 days.

On average, paddy farmer owning land earned KHR 29,300 per day from one ha of land. F5: Wet- season Non-Photosensitive Fragrant is the cropping system with high Return to Family Labor of KHR 42,000 per day, followed by F3: Early- wet- season and F1: Wet-season Non-fragrant. The system with lowest Return to Family Labor was F4: Dry-season Non- fragrant with only KHR 21,200 per day (See Figure 5).

Figure 5: Cash return to family labor (Thousand KHR/Day)



Source: Authors' computation for CRSEO Bulletin

Note: **WS:** Wet Season **DS:** Dry Season **NF:** Non Fragrant **F:** Fragrant **OM:** Own Machine

EWS: Early Wet Season **PF:** Photosensitive Fragrant **RM:** Rent Machine

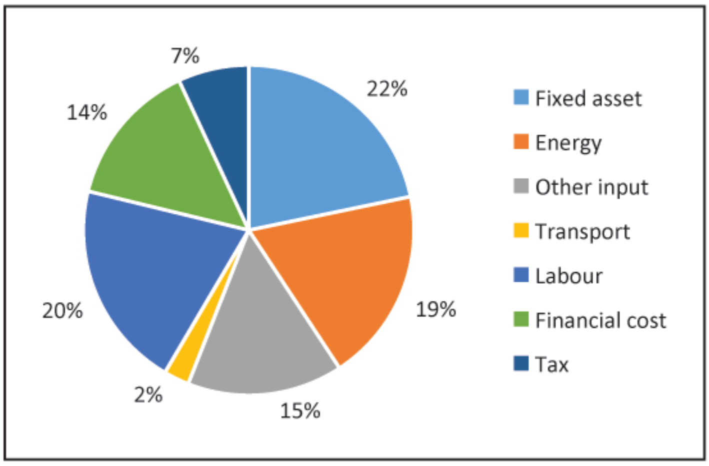
2.2. Miller Performance

2.2.1. Milling Cost

The total milling cost for each milling system and their major cost items per one metric ton of milled rice, excluding cost of paddy purchase, calculated per one ton of milled rice, varied from KHR 185,000 to KHR 370,000, averaging KHR 228,000.

Fixed asset[3], energy[4], and financial costs were the three highest components of milling cost structure for all milling systems. On average, fixed asset cost KHR 89,000 (32.6%), energy cost KHR 51,000 (18.8%), and financial cost KHR 32,000 (11.8%) (See Figure 18). Therefore, policy makers and relevant stakeholders should discuss about the intervention to make improvement in fixed asset cost, energy, and financial costs. We suggest policy options for these issues in Section Recommendation.

Figure 6: Share of milling cost structure (%)

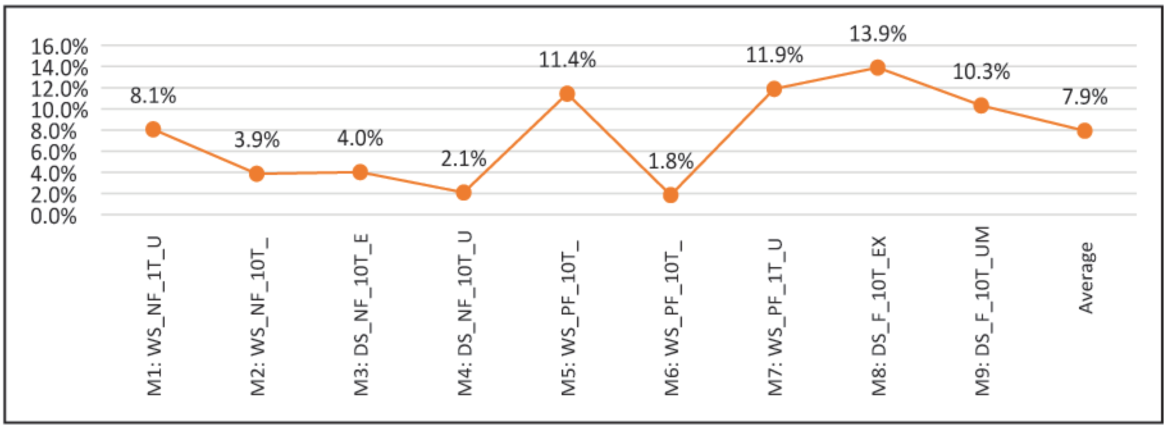


Source: Authors' computation for CRSEO Bulletin

2.2.2. Return to Capital

Figure 7 shows information of return to capital for miller of each cropping system. On average, the return to capital varied from 1.8 % to 13.9%, and the average return to capital was 8.1%.

Figure 7: Return to capital for each milling system (%)



Source: Authors' computation for CRSEO Bulletin

Note: **WS:** Wet Season **DS:** Dry Season **NF:** Non Fragrant **F:** Fragrant **1T:** 1-Ton Mill **UM:** Urban Market
EWS: Early Wet Season **PF:** Photosensitive Fragrant **10T:** 10-Ton Mill **EX:** Export Market

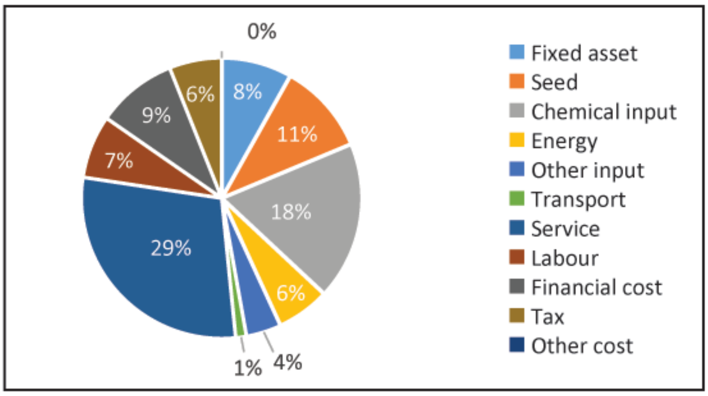
3. Fixed asset refers to depreciation of milling facilities including mill, dryer, sorter, packing line, ware house, milling hangar and loader.
4. Energy include electricity for milling, drying and sorting and diesel for loader.

2.3. Value Chain Performance

2.3.1. Cost Structure

The total cost for each rice-value-chain system and major cost items per ton of milled rice, excluding costs of paddy purchase or milled rice purchase is presented in Figure 8 in terms of proportion. *Service[5], chemical input[6], and seed costs* were the three highest components of all rice-value-chain systems. On average, service cost shared 29%, chemical input cost shared 18%, and seed cost shared 11%, of total cost.

Figure 8: Share of value chain cost structure (%)

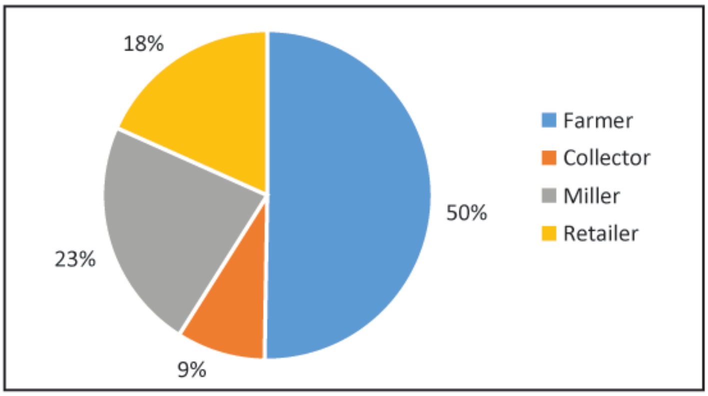


Source: Authors' computation for CRSEO Bulletin

2.3.2 Added Value

The total added value for each rice-value-chain system and added value received by by agent per ton of milled rice is presented in Figure 9 in terms of proportion. Total added value varied from USD 107 to USD 408 per ton of milled rice. On average, total added value per ton of milled rice was USD 266. The average added value, which farmer received, was 50%. Miller came second with 23% share of added value on average. While there have been a lot of debate regarding the added value taken by paddy collector, we found that paddy collector only had 9% share of added value per ton of milled rice.

Figure 9: Share of added value (%)



Source: Authors' computation for CRSEO Bulletin

Figure 10 displays the relative share of each value chain in the total value added generated by the whole set of value chains. The respective weight has been estimated on the basis of data available on production by major systems, domestic consumption, milled rice exports, unrecorded paddyexport being the balance. Wet season rice for domestic market represent 70% of the total value added generated by the 13 systems. Value chains targeting export markets (as paddy or milled rice) generates 22% of the total value added.

Figure 10: Contribution of rice value chains to rice sector value added generation

Source: Authors' computation for CRSEO Bulletin

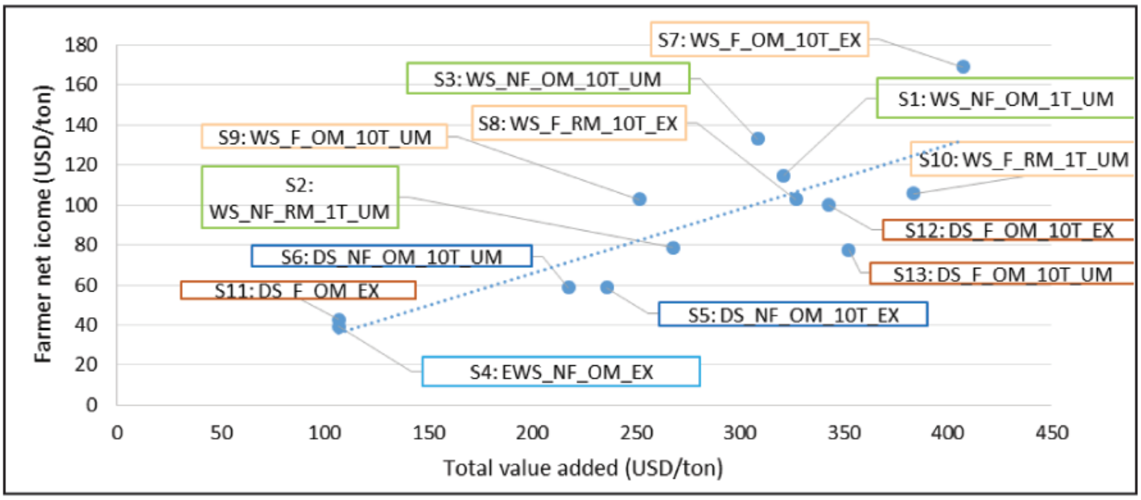
Note: Wet-season Non-fragrant; Wet-season Photosensitive Fragrant; Early-wet-season Non-fragrant; Dry-season Non-fragrant; Dry-season Fragrant

5. Service cost includes farmer's service cost (land preparation, plant management, harvesting, tractor maintenance, pump maintenance, and irrigation), collector's service cost (truck maintenance), and retailer's service cost (telephone subscription and rice delivery). Miller's maintenance of milling facilities was done internally by staffs.

6. Chemical input cost includes fertilizer, pesticide, and herbicide.

Figure 11 illustrates the relationship between the value generated by each ton of rice for each system and corresponding net income per farm. The trend is linear meaning that on average the share of farmer net income is commensurate with the total value generated. This is good for farmers as it suggests that farmers stand the benefit from the higher value added, which can result from higher international prices.

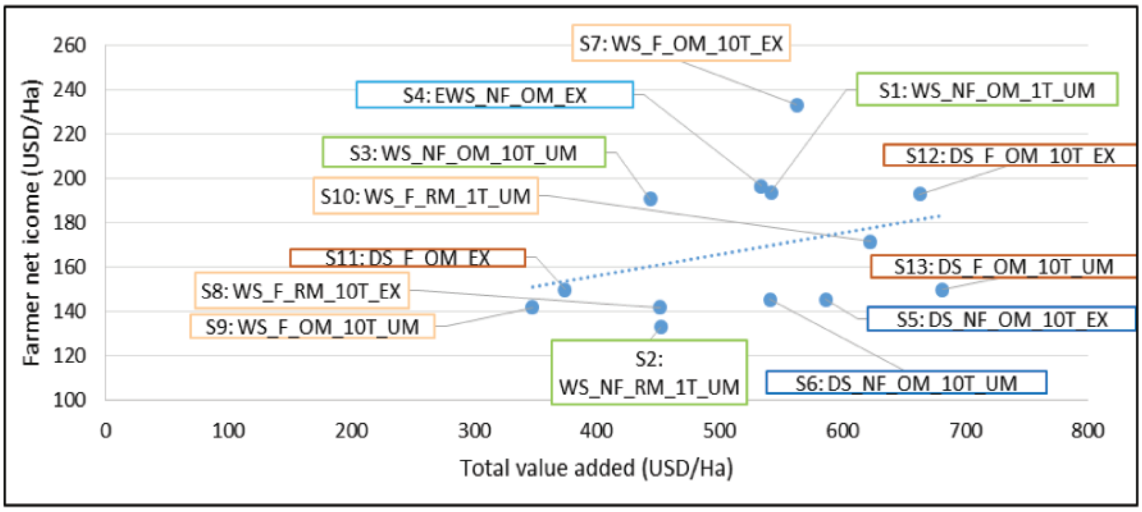
Figure 11: Total VA per ton per systems x net income per farmer per ton of milled rice



Source: Authors' computation for CRSEO Bulletin

Note:	**WS:** Wet Season	**NF:** Non Fragrant	**OM:** Own Machine	**1T:** 1-Ton Mill	**UM:** Urban Market
	DS: Dry Season	**F:** Fragrant	**RM:** Rent Machine	**10T:** 10-Ton Mill	**EX:** Export Market
	EWS: Early Wet Season	**PF:** Photosensitive Fragrant			

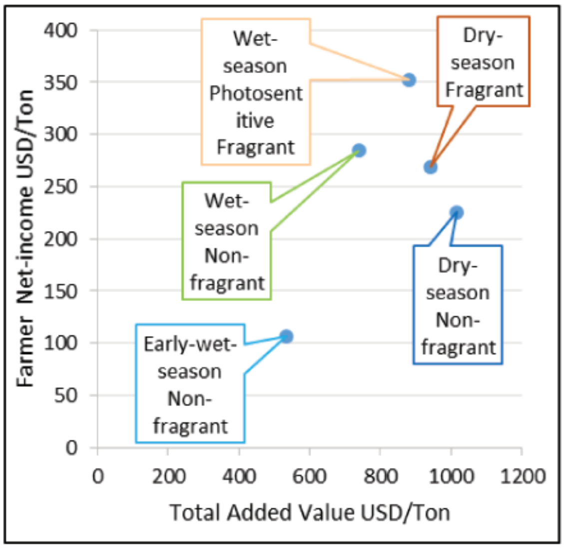
Figure 12 illustrates the relationship between the value generated by each hectare of rice for each system and corresponding net income per farm. In terms of value added and net income per hectare the systems with high yielding improved variety are not necessarily the most remunerative for the farmer while photosensitive varieties (SO1, SO2) are less performed at the system level but generate more net income for the farmer per hectare.



Source: Authors' computation for CRSEO Bulletin

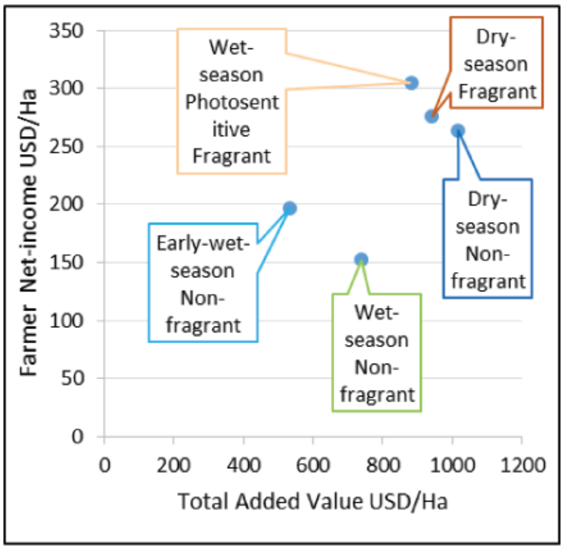
Note:	**WS:** Wet Season	**NF:** Non Fragrant	**OM:** Own Machine	**1T:** 1-Ton Mill	**UM:** Urban Market
	DS: Dry Season	**F:** Fragrant	**RM:** Rent Machine	**10T:** 10-Ton Mill	**EX:** Export Market
	EWS: Early Wet Season	**PF:** Photosensitive Fragrant			

Figure 13: Value added and farmer income generated by type of rice



Source: Authors' computation for CRSEO Bulletin

Figure 14: Total added value generated per ha, and net incomes for farmer per ha for the different types of rice varieties

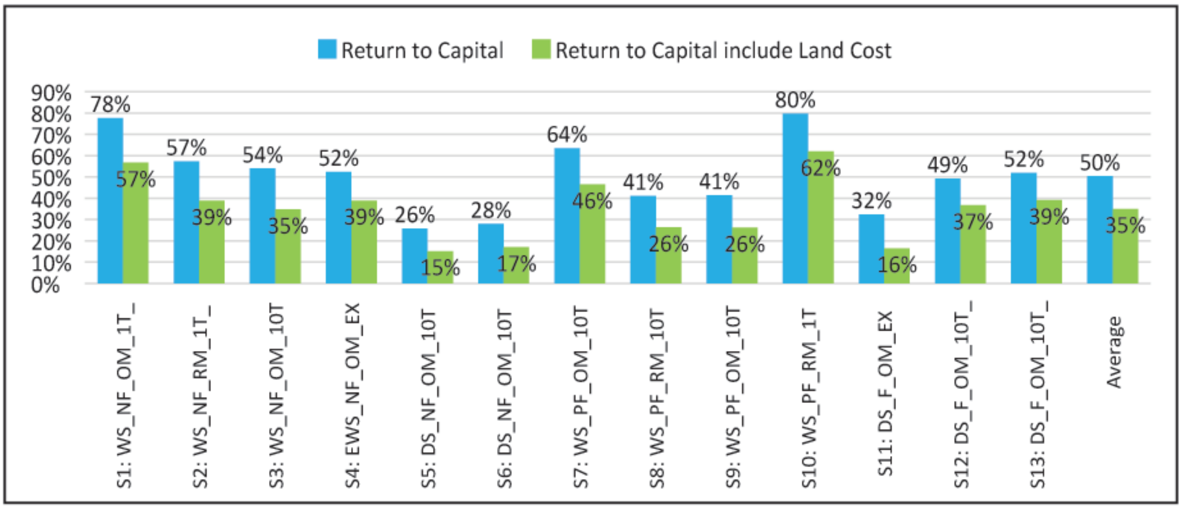


Source: Authors' computation for CRSEO Bulletin

2.3.3 Return to Capital

Figure 15 shows that the return to capital for each rice value chain system varied from 26% to 80% if land cost was excluded. Including the land cost into value chain system would change the return to capital to vary from 15% to 62%.

Figure 15: Return to capital for rice value chain system (%)



Source: Authors' computation for CRSEO Bulletin

Note: **WS:** Wet Season; **NF:** Non Fragrant; **OM:** Own Machine; **1T:** 1-Ton Mill; **UM:** Urban Market
DS: Dry Season; **F:** Fragrant; **RM:** Rent Machine; **10T:** 10-Ton Mill; **EX:** Export Market
EWS: Early Wet Season; **PF:** Photosensitive Fragrant

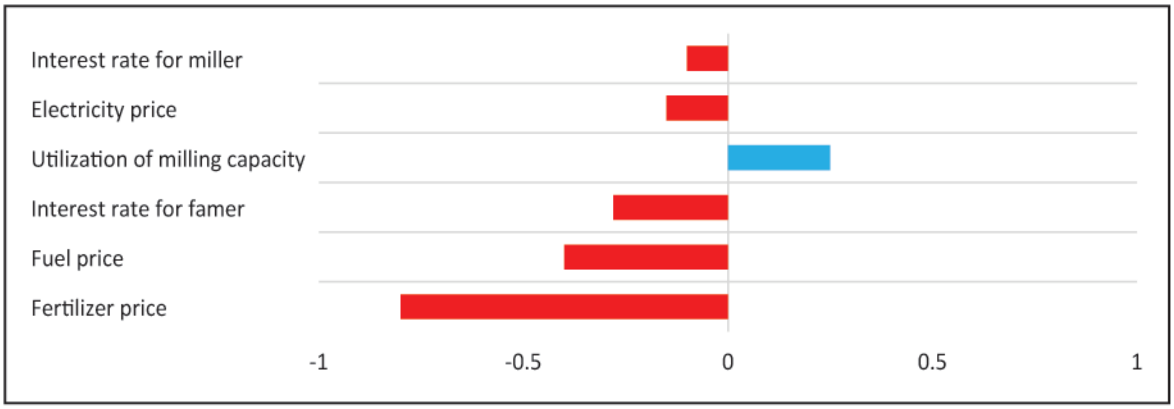
2.4 Impact on Return to Investment based on selected factors:

Figure 16 presents the sensitivity analysis of System 7: Wet-season Photosensitive Fragrant Own machine 10-Ton-Mill Export-market, because this system generated the highest added value.

This analysis indicates that the profitability and competitiveness of the rice sector were most offset by fertilizer price and fuel price, while any increased utilization of milling capacity stands out to benefit the millers remarkably.

Considering the whole value chain, the return to cost was least sensitive to interest rate for millers, compared with the electricity price and interest rate for farmers.

Figure 16: Impact on Return to Investment for System 7: Jasmin rice, Own Machine, 10T Mill Exported



Source: Authors' computation for CRSEO Bulletin

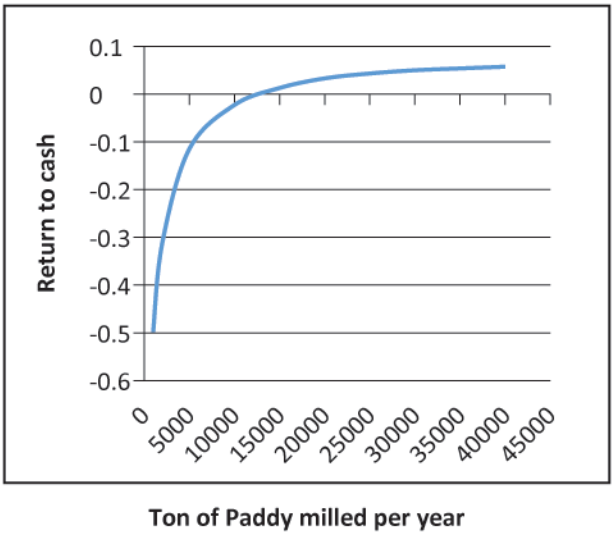
2.5 Milling Profitability

Our analysis found that the 1-ton mill performed better than the 10-ton mill. Although we see small mill performed better than large mill, we did not find any small mill systems, which were able to sell milled rice to export market, while the best-performed systems were both large mill selling to export market.

The sensivity analysis presented in Figures 17 and Figure 18 shows that the profitability of the milling operation is highly sensitive to the utilization of milling capacity. Assuming that a 10T mill is able to process 40,000T of paddy per year, milling operations would not be profitable (Return to capital = 0) if the miller process less that 12,000T of paddy per year.

The sensitivity analysis crossing the combined effect of changes in the level of capacity utilization and interest rate at which millers can access credit shows that the level of capacity utilization is a much heavier constraint than the interest rate (Table 1).

Figure 17: 10-Ton mill return to capital for different level of capacity

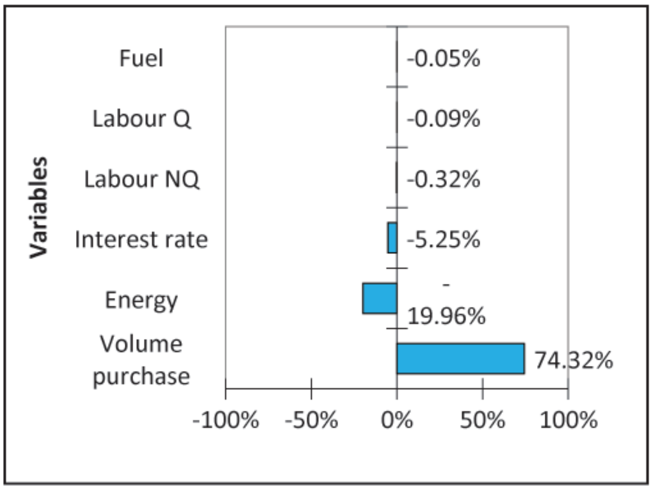


Source: Authors' computation for CRSEO Bulletin

In other words, rather than the interest rate, the major issues remains the level of capacity utilization; a high interest rate (16%) would still be affordable to the millers if it is translated into a higher volume of paddy processed. This assumes that millers have market to profitably sell their product. However, eventually the ability of the mille to find more market outlets, particularly on the export market, remains the major challenge for the viability of their business, as there is a limit to EU markets.

Table 1 shows the level of return achieved by a rice mill exporting wet-season photosensitive fragrant rice for a combination of paddy purchase price and milled rice export price. If all other factors remain unchanged and price wet-season photosensitive fragrant Rice at 688 US$/T, miller with 10MT capacity can afford to pay paddy at 1,300 KHR/Kg (100 KHR increase) and maintain return to cash invested at 3.9%.

Figure 18: Sensitivity of 10Tmill's profitability to various cost parameters.



Contribution

Source: Authors' computation for CRSEO Bulletin

Table 1: Rice milling profitability sensitivity to paddy purchase and milled rice selling price: return to capital invested for System 08: Wet-season Photosensitive Fragrant Rent-machine 10T Export

Paddy purchase price KHR/Kg	Price of milled rice exported USD and KHR/Ton								
	442	492	541	590	639	688	737	787	836
	1 800 000	2 000 000	2 200 000	2 400 000	2 600 000	2 800 000	3 000 000	3 200 000	3 400 000
400	75.4%	93.7%	111.9%	130.2%	148.4%	166.6%	184.8%	202.9%	221.0%
500	49.3%	64.9%	80.5%	96.0%	111.5%	127.1%	142.6%	158.0%	173.5%
600	30.0%	43.6%	57.1%	70.7%	84.2%	97.7%	111.3%	124.8%	138.3%
700	15.1%	27.1%	39.1%	51.2%	63.1%	75.1%	87.1%	99.1%	111.0%
800	3.3%	14.1%	24.9%	35.6%	46.4%	57.2%	67.9%	78.7%	89.4%
900	-6.4%	3.4%	13.2%	23.0%	32.8%	42.5%	52.3%	62.1%	71.8%
1 000	-14.3%	-5.4%	3.6%	12.5%	21.5%	30.4%	39.3%	48.3%	57.2%
1 100	-21.1%	-12.8%	-4.6%	3.7%	11.9%	20.2%	28.4%	36.6%	44.9%
1 200	-26.8%	-19.2%	-11.5%	-3.9%	3.8%	11.4%	19.1%	26.7%	34.3%
1 300	-31.8%	-24.6%	-17.5%	-10.4%	-3.3%	3.9%	11.0%	18.1%	25.2%
1 400	-36.1%	-29.4%	-22.8%	-16.1%	-9.4%	-2.7%	3.9%	10.6%	17.3%
1 500	-39.9%	-33.7%	-27.4%	-21.1%	-14.8%	-8.5%	-2.3%	4.0%	10.3%
1 600	-43.3%	-37.4%	-31.5%	-25.5%	-19.6%	-13.7%	-7.8%	-1.8%	4.1%
1 700	-46.4%	-40.7%	-35.1%	-29.5%	-23.9%	-18.3%	-12.7%	-7.1%	-1.5%
1 800	-49.1%	-43.7%	-38.4%	-33.1%	-27.8%	-22.4%	-17.1%	-11.8%	-6.5%
1 900	-51.5%	-46.5%	-41.4%	-36.3%	-31.2%	-26.2%	-21.1%	-16.0%	-11.0%
2 000	-53.8%	-48.9%	-44.1%	-39.2%	-34.4%	-29.6%	-24.7%	-19.9%	-15.1%

Source: Authors' computation for CRSEO Bulletin

Note: Volume of Paddy Processed: 25,000 T Paddy Price: 1200 KHR/Kg Milled Rice Price: 688 US$/T

Table 2: Rice milling profitability sensitivity to paddy purchase and milled rice selling price: return to cash invested for System 05: Dry-season Non-fragrant Own-machine 10T Export-market

Paddy purchase price KHR/Kg	Price of milled rice exported USD and KHR/Ton							
	300	350	400	450	500	550	600	650
	1 220 400	1 423 800	1 627 200	1 830 600	2 034 000	2 237 400	2 440 800	2 644 200
400	22%	40%	59%	77%	96%	114%	133%	151%
500	4%	20%	36%	52%	68%	84%	100%	116%
600	-9%	5%	19%	33%	47%	61%	75%	89%
700	-19%	-6%	6%	19%	31%	43%	56%	68%
800	-27%	-16%	-4%	7%	18%	29%	40%	51%
900	-33%	-23%	-13%	-3%	7%	17%	27%	38%
1 000	-39%	-30%	-20%	-11%	-2%	8%	17%	26%
1 100	-44%	-35%	-26%	-18%	-9%	-1%	8%	17%
1 200	-48%	-40%	-32%	-24%	-16%	-8%	0%	8%
1 300	-51%	-44%	-36%	-29%	-21%	-14%	-6%	1%
1 400	-54%	-47%	-40%	-33%	-26%	-19%	-12%	-5%
1 500	-57%	-50%	-44%	-37%	-31%	-24%	-17%	-11%
1 600	-59%	-53%	-47%	-41%	-34%	-28%	-22%	-16%
1 700	-61%	-55%	-50%	-44%	-38%	-32%	-26%	-20%

Source: Authors' computation for CRSEO Bulletin

Note: Volume of Paddy Processed: 25,000 T Paddy Price: 800 KHR/Kg Milled Rice Price: 450 US$/T

3. Conclusion and Recommendations

Under the current output and input price condition, while there could be losses incurred by certain actors, on average the thirteen value chains analyzed are profitable and viable for all stakeholders. It is observed that the non-photoperiodic non-fragrant rice value chain, which is mostly for raw paddy export to Vietnam, has a lower profitability than the fragrant rice systems and wet season rice. Farmer received the highest added value among all agents, followed by miller, while retailer and collector came 3rd and 4th in most rice value chain systems.

Our analysis indicate that the well-performance systems were either wet-season or dry-season fragrant variety with farming owning machine. These systems also operated by large mill (10T), which milled fragrant rice for export market. We also observed that the Early-wet-season non- fragrant and dry-season fragrant rice value chain, which mostly exported raw paddy to other countries, had the lowest profitability.

Two rice-value-chain systems with high health and environmental concern were Early-wet-season Non-fragrant and Dry-season non-fragrant, which had very high chemical input cost. Intensive use of chemical inputs (fertilizer, pesticide, and herbicide) could potential affect wellbeing of farmer, consumer, and environment.

On average, the value added was created was $266 out of one ton of milled rice or $444 out of one hectare of riceland. Rice farming, on average, shared approximately 50% of the total value added created in the rice value chains and the analysis shows that the high the value added created, the higher proportion goes to farmers. Of the total value added generated, 23% went to millers, 18% to retailers and 9% to collectors. Yet, while reading these figures, one has to keep in mind that the analysis does not take into account: i) opportunity cost of labor for farmers); ii) opportunity cost of farm land; iii) externalities (such as environmental impact and possible depreciation of soil fertility).

From the policy perspective, it is viable for government to continue to support the rice industry for its high value added generation and especially for farmers. Ensuring a level of milling capacity utilization (above 30% of the total capacity) is a key determinant of the miller profitability and the value chain competitiveness. Energy cost is the second important parameter for ensuring the viability of the modern mill.

- Increasing interventions that bring down the cost of fertilizer and seeds, along with agricultural extension activities to farmers with focus on cost-effective use of chemical inputs.

- Continuing to increase loans to millers, and improving electricity supply and preferably with lower cost.

- The downward trend in international price until June 2017 showed the fierce competition that prevailed on the international market even for fragrant price that is highly valued. With the threat of losing a privileged access to the European market, the need for diversifying export destination is a major challenge and a high priority for the Cambodian rice sector.

Cambodia Rice Sector Economic Observatory

The Cambodia Rice Sector Economic Observatory (CRSEO) is a monitoring mechanism serving as a dashboard for policy makers and stakeholders to analyze the Cambodian rice sector health and competitiveness and to monitor the distribution of added value and socio-economic impacts of the rice sector situation.

CRSEO Bulletin

The outputs of CRSEO are the two bi-annual bulletins, which analyses and report on the distribution of added value in the Cambodian rice sector for Wet Season Rice and Dry Season Rice.

Each bulletin is based on representative budgets for the different groups of stakeholders and for the different sub-value chain and details the cost structure for each of these groups of stakeholders, the distribution of the added value, and key indicators. Sensitivity analysis of key factors on profitability and distribution of added value is also incorporated in each bulletin for policy decision makers to focus on measures with higher impact.

CRSEO Governance

The CRSEO is owned by the Royal Government of Cambodia and is placed under the responsibility of a **Committee**, acting as the ordering institution to a Technical Unit in charge of the implementation of data compilation and analysis.

The Committee composes of representatives of the Supreme National Economic Council (SNEC) as the chairperson, of the Ministry of Agriculture, Forestry and Fisheries (MAFF) and of the Ministry of Commerce (MoC) and of the Cambodian Rice Federation (CRF). All these institutions also facilitate necessary access to data and information and participate in data validation process. After SCCRP project, it is foreseen that the CRSEO will be moved under MAFF.

The Technical Unit, for first stage of implementation, composes of one international consultant from The French International Research Centre for Agricultural Development (CIRAD) and two local consultants from the Centre for Policy Studies (CPS). SNEC's Support to the Commercialization of Cambodian Rice Project (SCCRP), funded by the Agence Française de Développement (AFD), has supported technically and financially the development of this bulletin.