

Study on services to irrigated agriculture

Territorial diagnosis, typology and assessment of service needs and offers

CAMBODIA

Stung Chinit irrigation scheme

Deliverable L1A

Jean-Marie BRUN

Sophoan MIN

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FINAL VERSION



- Iram Paris (siège social)
49, rue de la Glacière 75013 Paris France
Tél. : 33 (0)1 44 08 67 67 • Fax : 33 (0)1 43 31 66 31
iram@iram-fr.org • www.iram-fr.org

- Iram Montpellier
Parc scientifique Agropolis Bâtiment 3
34980 Montferrier sur Lez France
Tél. : 33 (0)4 99 23 24 67 • Fax : 33 (0)4 99 23 24 68



- ARTE-FACT Development & Agri-Food Consulting Co., Ltd.,
#405B Street 61 BT, Boeng Tompon, Phnom Penh – Cambodge
Tél: +855 (0)12 807 817
jm.brun@artefactdev.com



- BICHE SARL., Bureau d'Ingénieurs Conseils en Hydraulique et Environnement,
9 rue Ahmed Rami 1002 Tunis, Belvédère, Tunisie
Tél: +216 71285946
biche@gnet.tn

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Acronyms

ADB	Asian Development Bank
AFD	<i>Agence Française de Développement</i> / French Agency for Development
ASPIRE	Agriculture Services Programme for Innovation, Resilience and Extension (IFAD project)
ASIrri	
AVSF	<i>Projet d'Appui aux Irrigants et aux Services aux Irrigants</i>
CAVAC	<i>Agronomes et Vétérinaires Sans Frontières</i>
CARDI	Cambodia Agriculture Value Chain Program (AusAID)
CASC	Cambodian Agriculture Research and Development Institute
CC	Conservation Agriculture Service Center
CCA	Commune Councils
CDRI	Climate Change Adaptation
CIRAD	Cambodia Development Resource Institute
COSTEA	Centre International de Recherche Agronomique pour le Développement
CRIC	<i>Comité Scientifique et Technique de l'Eau Agricole</i>
DAE	Chinit Reservoir Irrigation Committee
Dis.	Department of Agricultural Extension
DALRM	District
DAP	Department of Agricultural Land Resources Management
DOANRE	Diammonium Phosphate
DP	District Office of Agriculture, Natural Resources and Environment
DRC	Development Partners
DS	Department of Rice Crops
FBG	Dry Season
FO	Fertilizer Buying Group
FWN	Farmer Organisations
FWUC	Farmer and Water Network
GDA	Farmer Water User Community
HH	General Directorate of Agriculture
IBG	Household
IRAM	Input Buying Group
ISC	<i>Institut de Recherche et d'Application des Méthodes de Développement</i>
ISF	Irrigation Service Center
IWRM	Irrigation Service Fee
MAFF	Integrated Water Resources Management
MEF	Ministry of Agriculture, Forestry and Fisheries
MFI	Ministry of Economy and Finance
MLMUPC	Micro-Finance Institution
MoWRaM	Ministry of Land Management Urban Planning and Construction
MRD	Ministry of Water Resources and Meteorology

NGO	Ministry of Rural Development
NIS	Non-Governmental Organization
NWISP	National Institute of Statistics (of the Ministry of Planning)
O&M	North-West Irrigation Sector Project (ADB/AFD)
PDA(FF)	Operation and Maintenance (of irrigation schemes)
PDoWRaM	Provincial Department of Agriculture (Forestry and Fisheries)
PDRD	Provincial Department of Water Resources and Meteorology
PIMD	Provincial Department of Rural Development
PIP	Participatory Irrigation Management Development
PPP	Public Investment Program
PSG	Public-Private Partnership
RGC	Paddy Selling Group
RiceSDP	Royal Government of Cambodia
SAW	Climate Resilient Rice Commercialization Sector Development Program
SCCRP	Strategy on Agriculture and Water
SCIRIP	Support to the Commercialization of Cambodian Rice Project
SNEC	Stung Chinit Irrigation and Rural Infrastructure Project
SPS	Supreme National Economic Council
SRP	Sanitary and Phyto-Sanitary
ToR	Sustainable Rice Platform
TWGAW	Terms of Reference
WASP	Technical Working Group on Agriculture and Water
WAT4CAM	Water and Agriculture Sector Project (financed by AFD - completed)
WICI	Water resources management & Agro-ecological Transition for Cambodia (financed by AFD – on-going)
WS	Weather Index Crop Insurance
	Wet Season

Units, measures, currencies

ha	hectare
KHR	Cambodian Riel (1 US\$ \approx 4,080 KHR)
km	kilometre
m	metre
US\$	United States Dollar

1. Introduction

The present document is the second deliverable¹ of the Cambodia part of the implementation of the study on “services to irrigated agriculture” commissioned by COSTEA.

1.1. Recall of the study background and objectives

1.1.1. Background on COSTEA

Since June 2013, the French Association for Water, Irrigation and Drainage (AFEID) has been working with the French Development Agency (AFD) and a large set of international partners, within the framework of the Scientific and Technical Committee of Water in Agriculture (*Comité Scientifique et Technique de l'Eau Agricole* – COSTEA), the overall objective of which is to promote the sharing of knowledge and experiences between actors in irrigation in order to support operations and policies in agricultural water.

The specific objectives of COSTEA are as follows:

- Produce conceptual and methodological summaries on the technical, economic, environmental and institutional aspects of agricultural water;
- Support the production of new references on innovations;
- Support actors in developing countries in the development and development of their policies, programs and projects;
- Structure an interdisciplinary and multi-actor network of irrigation partners based on the 3 previous objectives.

COSTEA’s geographic coverage extends to the Mediterranean, West Africa and South East Asia.

1.1.2. COSTEA Study on services to irrigating farmers

COSTEA has commissioned a study on “services to irrigating farmers” which aims at elaborating a global framework for the formulation and the organization of supports for

¹ After the kick-off report for Cambodia (Deliverable I.0A).

irrigating farmers in several contexts of intervention of AFD on irrigation policies in order to maximize their impact. The study is implemented in two countries (Tunisia and Cambodia) by a consortium led by IRAM, associated to ARTE-FACT in Cambodia and BICHE in Tunisia.

The study is implemented on one site only (in each country) and will assess service needs and existing service provision systems in place. The study has two dimensions:

- A methodological dimension: develop methods and tools to assess needs for services in irrigated context, test them and draw lessons.
- An operational dimension: on the selected irrigation scheme, the study is expected to elaborate the vision of an implementable frame for multiple services development to irrigating farmers. [Nota bene: Yet, it is not the responsibility of the study team to operationalize this frame, but it could be carried over by an existing project].

1.2. Main activities carried out in the country since the end of the launching phase of the study

After the launching phase of the study (which had notably produced the launching workshop and launching report, delivered in February/March 2021), the following activities have been implemented (See Table 1 next page).

It has to be underlined that the implementation of the field work has been very significantly delayed and affected by the sanitary situation in Cambodia and the developments of Covid-19 pandemic in the country during the period. From end of February 2021, with increasing community transmission of the disease, authorities have taken lock down measures and restriction on travels and organisation of meetings. Activities had to be suspended for two-three months, then rescheduled but with a need to modify the approach and activities. Notably, the impossibility to organise workshops/meetings had led us to change our plan of starting with a field kick-off meeting. We also had to restrict focus group discussions to 3 or 4 persons maximum, preferably outdoor and with preventive measures strictly applied (distancing, provision of facial masks, sanitizer...).

The first round of field work could finally be organized in June 2021 and was made difficult by a significant outbreak of Covid-19 cases in Kampong Thma that was detected by health services only 2 or 3 days before the start of our field work: this has increased the reluctance of local people to meet with our team, and some villages in the area were banned of this first phase of field work due to significant number of cases detected.

Table 1: Main activities and outcomes, since the delivery of the launching report.

DATES	ACTIVITIES	OUTCOMES
February 2021	Obtain support letters from MAFF and MoWRaM for field surveys	Support letters and/or identification of contact officers at provincial level obtained.
February – March 2021	Preparation of field work	Process for field work developed, guidelines for surveys and focus group discussions prepared, process of field kick off workshop prepared
April 2021	Review additional documentation	
June 2021	Adjust structure of report	Report format adjusted
June 2021	Revise field implementation strategy and preparatory work	Revised plan for field work (adapation to Covid and restriction on meetings)
14-17 June 2021	First field mission	Overview of situation, identification of key problematic, preliminary elements of typology and services assessment
End-June	Review first data collected and integrate in reporting	
End-June	Adjust questionnaires and guidelines for surveys	
July	Phone interviews and data collection for mapping of service providers	Mapping of service providers in the area for input supply, mechanization...
August	On-line detailed interviews with FWN and with ISC	Up-date on the roles and services of FWN and ISC to Stung Chinit FWUC
September	Implementation of field surveys by surveyor / analysis of data collected	More data on farm profiles collected: fine-tune typology profile and assess the farmers service needs, services use and appreciation as well as prioritization and expectations.
Last week of September	Second field mission	Additional information on services. Points of view on different stakeholders and local institutions on key topics and stakes are collected, helping to elaborate a more problematic vision of services for the following steps of the study.
October	Survey data analysis and development of typology	Typology of farmers developed.
October - November	Study report writing.	Draft Report: Territorial diagnosis, typology and assessment of service needs and offers.

In the following weeks, the implementation of surveys was not possible on site. In July, as a first step, phone surveys were done by our surveyor, Mrs Duong Sokkhim, in order to gather figures on the number of input suppliers and mechanization service providers in the different villages and communes of the scheme area, contributing to the mapping of service providers. But more detailed interviews with farmers could not be implemented until mid-September. They were conducted between the 14th and the 22nd of September 2021, with 20 farmers interviewed.

Other phone or on-line interviews were also conducted by the team in August, notably with the ISC and FWN.

Then study team had as second round of field work from 28th to 30th of September. Additional interviews and focus group discussion were undertaken in this period, with District Agriculture office, with District authorities and commune authorities (in Kampong Thma commune), with FWUC staff, with farmers, input suppliers, harvesting service provider and Microfinance Institution (MFI). Phone interview was also made with fertilizer importing company.

In the following week, the study team has worked on the data analysis, typology and writing of the present report.

1.3. Content of the present Territorial and services analysis report

The present report contains:

- A rapid territorial diagnosis and description of Stung Chinit irrigation scheme (section 2);
- A typology of farms and service needs (section 3).
- The mapping and analysis of existing service offer (section 4)
- A preliminary analysis of the adequacy between offer of services and needs (section 5).
- An update of the study time frame and planning of next steps (section 6).

2. Territorial diagnosis and full description of Stung Chinit Irrigation Scheme

Elements presented in this section provide an overview of the geographical context of Stung Chinit area. It is not an exhaustive and detailed analysis but it enhances some key territorial and background elements of the agricultural sector in the studied area that are of importance for the purpose of the study.

2.1. Recall of the methodology used for the territorial diagnosis

The territorial diagnosis is based on a combination of documentation review and interview with key informants or stakeholders (often met not only for the territorial diagnosis but at the same time for analysis and understanding of service provision in the area as well).

Among the interviews or meetings that have mostly contributed to this part, we can mention:

- The first discussion with Santuk District Office of Agriculture, Natural Resources and Environment deputy director (Mr Chan Hok), on 14th of June 2021;
- The elements provided by Stung Chinit FWUC committee (already in the first phase of the study, notably during the kick-off workshop in January 2021 in Phnom Penh, then on site on 14th of June 2021).
- The meeting with the Provincial Department of Agriculture, Forestry and Fisheries (PDAFF) of Kampong Thom Province, on 15th of June 2021.
- The meeting with the Provincial Department of Water Resources and Meteorology of Kampong Thom Province (PDoWRAM), on 15th of June 2021.

Other discussions and inputs have also contributed to depict and understand the local or national context (for instance inputs provided by the Cambodian Rice Federation Secretary General during the kick-off workshop in January) as well as the study team own knowledge of the Cambodian agricultural sector.

A number of documents have been reviewed also to access additional information or statistics, notably:

- PDAFF Kampong Thom, List of rice mill in Kampong Thom Provinces, January 2019. (Khmer version).

- PDAFF Kampong Thom, Provincial Agriculture Strategic Development Plan 2019-2023 Kampong Thom Province, September 2020 (Khmer version).
- Kampong Thom Provincial Administration, Yearly activities report of Kampong Provincial Administration of 2019, February 2020. (Khmer version).
- The NIS's National report on 2019 census results.

2.2. Territorial diagnosis

2.2.1. General presentation of the study area and region

a. Kampong Thom province

Map 1: Localisation of Kampong Thom in Cambodia.



Kampong Thom province is located in central Cambodia, on the East side of Tonle Sap river and lake, and North of Phnom Penh. The province is crossed by the National Road No 6 which connects Phnom Penh to Siem Reap. The population of the province is of 675,400 persons (160,766 households)². Agriculture and primary sector is predominant in the occupation of Kampong Thom people: 2019's Census indicates that the occupation of 73.6% of the provincial population aged 15+ is "Skilled Agricultural, Forestry and Fishing".

Literacy rate of population aged 15+ is of 79.8% in average in Kampong Thom province (relatively lower than the national average (87.7%) and even lower than the national average for rural population (83.8%)³.

Agricultural sector is predominant in the economy of the province, which has very limited industries (garment sector factories are predominantly located in the Southern part of the country) and tourism. More details on the agricultural activities in Kampong Thom province are given in section 2.2.2. next page.

Kampong Thom province counts 8 districts. Stung Chinit scheme is located in Santuk district (Approximately 101,000 inhabitants), over the territory of 3 communes: Kampong Thma,

² Figures from the national Census of 2019, published in 2020.

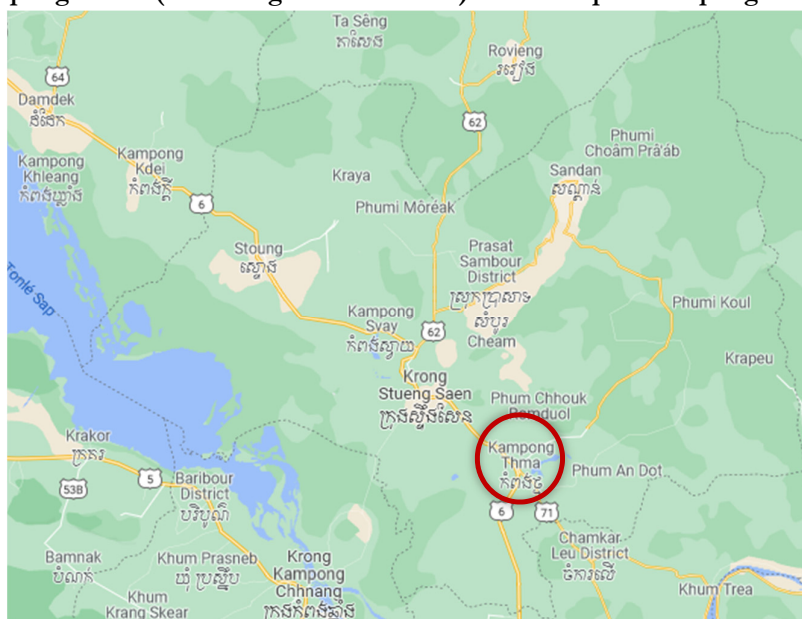
³ Census 2019.

Prasat and Boeng Lvea. The total population of these three communes is about 36,000 people (See Annex 2: Population by commune in Santuk district).

b. Stung Chinit irrigation scheme

Stung Chinit irrigation scheme is located in the Southern part of Kampong Thom province, in the commune of Kampong Thma (+Prasat and Boeng Lvea) as shown on the map below.

Map 2: Kampong Thma (and Stung Chinit scheme) on the map of Kampong Thom province



2.2.2. Agriculture and irrigation in the study region

Agriculture activities are largely predominant in Kampong Thom province. Located mainly in a plain area, rice is a major production of the province, with more than 210,000 ha of wet season rice according to the data provided by PDAFF. Whereas rice is predominant, there has been a very significant development of other crops in the upper lands of the provinces over the past 15 years, notably cassava and perennial plantations of cashew nuts, rubber⁴ and mango, as shown on Table 2 next page.

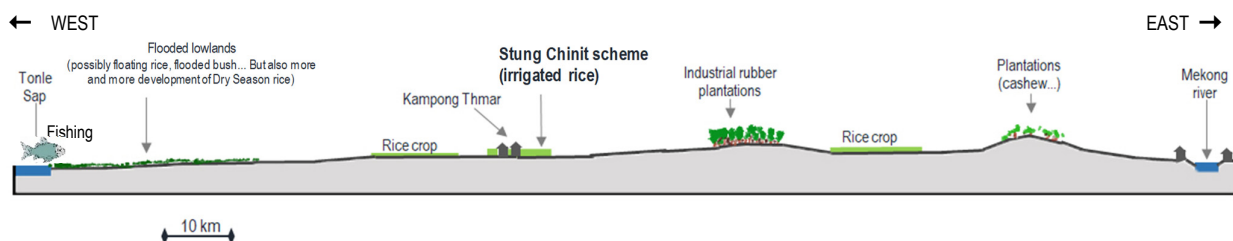
⁴ Rubber in Kampong Thom province being primarily large industrial plantations. In Santuk district, rubber is planted by three companies on a total surface of more than 10,000 ha according to the District Agriculture Officer.

Table 2: Key data on agriculture/crops production for Kampong Thom province:

CROPS	SURFACE
Rice	213,285 ha (average yield of 2.691 t/ha)
Receding rice	68,249 ha, 17.62% of the surface planed (40,000 ha planned).
Cashew nut	78,455 ha
Rubber	61,781 ha (including 8,563 ha of smallholder plantations).
Cassava	51,186 ha
Mango	8,773 ha
Pepper	141 ha
Longan	75 ha

Source: PDAFF Agriculture situation report, January 2021.

The West-East transect representation of the province (below) gives a schematic representation of the agricultural activities in the region. Lowlands on the West side along the Tonle Sap are fishing areas (Tonle Sap fish resources are a major natural resources of the region) or used to be areas where traditional floating rice varieties were grown. But are also increasingly used for dry season / receding rice crops⁵. Irrigated land (such as Stung Chinit) have become intensive rice crop area with 2-3 cycle of rice farming per year (as we will see further). Further to the East, on uplands, large commercial plantations of rubber have been expanded, and medium scale orchards (of cashew notably, but also mango and cassava crops) have developed over the past 10-15 years.

Figure 1: West-East transect representation of the South of Kampong Thom province

Irrigated rice has considerably been developed in Kampong Thom province over the past 15 to 20 years. Stung Chinit was among the first large schemes rehabilitated. It is now considered as part of a broader system which include other schemes fed by the same reservoir on Stung Chinit river, notably Baray scheme located in the South. According to PDoWRaM, two other large systems are located in Kampong Thom province, namely Tang Krasang system and 30 Kanha (Samsep Kanha) system, which covers close to 30,000 ha. Besides there are also 99 medium scale schemes (200 to 5,000 ha) in the province and a number of small scale (below 200 ha) ones.

⁵ It is noted that in these areas (beyond 6 km West of the National road at the level of Kampong Thma) farmers are not owner of the land (no land titles) but they can use it.

More details are provided specifically for Santuk district on agriculture and irrigation in Annex 3: Agriculture, water and irrigation schemes in Santuk district.

The upper lands area in the East of Kampong Thom province (or in neighbouring provinces), which used to be forest or bush area where farmers from Stung Chinit area used to work in dry season (logging...), have progressively been converted to plantations or orchards. Also regulation on logging / preventive measures of deforestation have been consolidated and more strictly implemented (restrictions on the transportation of wood for instance). This evolution has significantly contributed to the development of dry season rice production in Stung Chinit scheme as the alternative logging activity in dry season was no more an income generation opportunity for farmers.

Beyond the local context, at national level, the dynamism of the rice sector (See Box 1 next page) is also a major factor of the evolution of rice production within Stung Chinit irrigation scheme.

BOX 1: BEYOND THE PROVINCIAL BOUNDARIES: THE DYNAMIC EVOLUTION OF CAMBODIAN RICE INDUSTRY

The evolution of the rice sector has to be looked at beyond the local level as main stakeholders (rice millers, exporters...) are deploying their activities over a larger geographical coverage.

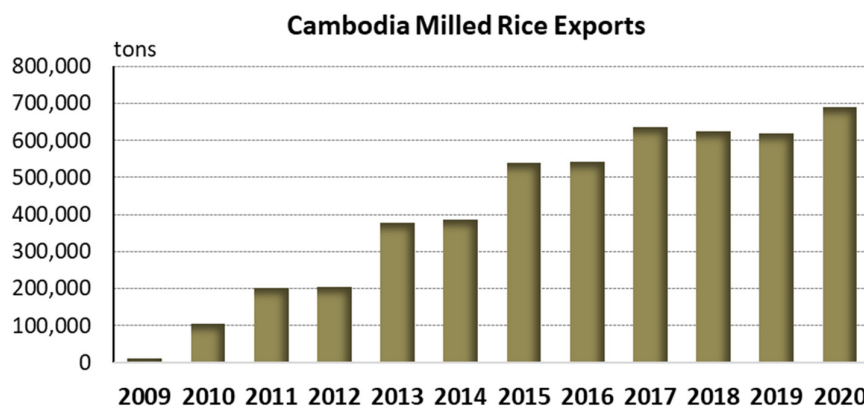
Hence, Cambodian rice sector has gone through very significant developments over the past ten years, which have a considerable impact (together with local investments in irrigation infrastructures) on rice farming throughout the country, and notably in Kampong Thom province.

Overall growth of the Cambodian rice production

After recovering from the 70's and 80's decades, Cambodia paddy production has only reached the required level to balance the domestic market needs in the mid 90's. The production has continued to grow progressively and reach approximately twice the domestic demand nowadays.

Investments in state-of-the-art milling facilities and rice export

But it's only in the last decades that significant investments have been made in large rice mills able to process and export high quality rice. Formal exports of milled rice have increased from only 12,613 tons in 2009 up to 690,829 tons in 2020.



Source: Secretariat of the One Window Service for rice export.

Increased presence of traders exporting paddy to Vietnam

Besides Cambodian established mills, the market is also driven by the demand of the Vietnamese rice mill industry, which buy probably more than half of the surplus of paddy of the country. Hence, even if paddy prices vary depending on international market, there are at least market outlets for Cambodian rice.

Availability of productive short cycle rice varieties and various inputs

Related to the interest of buyers connected to international markets (and also to the development of irrigation, changing the pattern of rice production cycles), new rice varieties have been introduced (some developed in Cambodia, other imported, notably from Vietnam) with a good productivity and – probably even more importantly for enhancing irrigation potential – shorter term and non-photosensitive characteristic, allowing to plan two to three crops per year depending on the conditions of water availability. More diversified offer of inputs came along with that, all together significantly changing the deal in rice production.

2.2.3. Synthesis of main elements of the regional context impacting on the services (needs and offer) to irrigating farmers

We can summarize here the following important background elements that have an influence on the agricultural development of Stung Chinit irrigation scheme area.

- Dynamic rice sector, with both a development of milling capacities in Cambodia, notably for export market, and also a strong and stable demand from traders who are exporting paddy to Vietnam.
- No more accessible forest land or bush for logging activity in dry season in upper lands of the East of Stung Chinit area maintains farmers in the villages in dry season.
- Availability of new varieties of rice: non-photosensitive and short cycle varieties, notably initially imported from Vietnam.
- Pioneer farmers who have started to successfully experience dry season cropping in the scheme.
- Availability of water for irrigation.
- Strong and rapid development of mechanization (service-based) and input supply network, as we will develop in the section 4 of this report).

2.3. Presentation of Stung Chinit irrigation scheme

2.3.1. Overview of the irrigation scheme



▲ *Secondary canal in Stung Chinit scheme (Photo JM Brun, GRET, 2007).*

The scheme consists in one reservoir on the Chinit river (shared with another scheme in the South) a main canal going straight from South to North from the reservoir and 5 secondary canals supply water to a command area of 2,800 ha. The water is delivered is flowing (by gravity) from the reservoir to the main canal then secondary canal, and distributed in tertiary canal to each block by open flume systems. Fields are mainly fed by gravity, except in dry season for some higher plots of land that cannot be irrigated or have to use pumping. Downstream of the blocks, drains are evacuating the surplus of water.

Table 3: Synoptic presentation sheet of Stung Chinit irrigation scheme

Location		Santuk district, Kampong Thom province.
Surface (ha)	Initially developed	Approximately 2,400 ha (rehabilitation since 2002, completed in 2006).
	Currently developed	Approx. 2,800 ha (2,786.87 ha as per the last update database of FWUC, with 9,020 rice field plots registered)
	Currently used within the scheme	Approx. 2,800 ha (100 % of irrigated surfaces are used)
	Used outside of the scheme command area	Another (formal) scheme developed in the South (approx. 5,000 ha), using water from the same reservoir on the Chinit river.
Date	Initial construction	First Built around 1977 during the Khmer Rouge regime
	Rehabilitation(s)	Rehabilitation in 2002-2006 (water availability and use started in 2006-2007) (More recent construction of quaternary canals since 2018-2019).
Number of farmers (users)	Initially	2,828 land owners inside the scheme
	Nowadays	2,850 land owners in the up-dated register of FWUC (2021) – Note that owners and users are not necessarily the same: a number of plots are rented.
	Land tenure statute of farmers	Secured land ownership (« hard » land titles) for a very large majority of surfaces.
	% of women owners	Not available
Water	Source of water used	Reservoir (barrage) on the Chinit river
	Water distribution system (supply down to land plot level)	Primary canal / 5 secondary canals / Tertiary canals supplying water to irrigation blocks. More recent Quaternary canals to distribute water to each plots (for part of the scheme) + drainage canals.
	Water management	Transfer of responsibility for the operation and maintenance to the FWUC from Secondary infrastructures.
	Irrigation service fees	Irrigation Service Fees (now named « contribution ») of 60,000 KHR/ha/year (approx. 15 US\$) regardless of the number of crop cycles. Charged to land owner.
Agriculture	Average size of farms in the command area	Average surface per land owner = 0.98 ha. But this does not necessarily reflect the average size of farms.
	Production systems	Rice crop practically exclusively.
	Cropping intensity	Nowadays two to three cycles of rice crop per year (early wet season / late wet season / dry season).
	Agroecological practices	Nowadays : a conventional intensification of rice crop (« green revolution » model) : mono-cropping of rice, 2 or 3 cycle per year, intensive use of chemical fertilizers and pesticides.
Organisations	Farmer Organisations	Scarce cases of farmers being members of an Agricultural Cooperative (AC) in the area. AC providing support to their members on cash credit, production of paddy seeds, and collaboration with inputs supplier company.
	Water User organisation	Farmer Water User Community established since the rehabilitation of the scheme
On-going or foreseen projects		None identified on-going project covering Stung Chinit scheme area.

2.3.2. History and evolution of Stung Chinit irrigation scheme

a. Construction and rehabilitation

Initially created during the Khmer Rouge regime in the second half of the 70s', the Stung Chinit irrigation scheme has been rehabilitated in the 2000s by the Stung Chinit Irrigation and Rural Infrastructures Project (SCIRIP), under MoWRaM ownership and financed by AFD. Reservoir, primary canal and water gates, secondary canals and tertiary canals were built, as well as drainage canals. The scheme command area was of approximately 2,400 ha at the end of the rehabilitation. But few small extensions have been made in the following years and nowadays, the potentially irrigated area is of approximately 2,800 ha.



Quaternary canals were expected to be made by farmers themselves in each of the irrigated blocks to improve the water distribution to parcels. But it was not done. Only recently, for part of the blocks, quaternary canals have been built by investments made by MoWRaM. According to PDoWRaM, the following quaternary canals were made in the last three years:

- 2018: 20,033 m (17 lines)

- 2019: 17,117 m (24 lines)
- 2020: 48,965 m (56 lines)

b. Evolution of the use of irrigation

At the end of the implementation period of the “Stung Chinit Irrigation and Rural Infrastructure Project”, so after infrastructures were built / rehabilitated and FWUC established, the irrigation was used only for supplementary irrigation of one cycle of wet season rice, and was used for a second cycle of production on less than 10% of the irrigated area. This level of use of the irrigation facilities was clearly below the expected use (and thereof below the foreseen economic benefit) of the investment made. Until 2014, there was nearly no rice cropping in dry season (less than 100 ha). But it has started to increase progressively since then. The FWUC has given the following estimation of surface used in dry season:

Table 4: Evolution of surface used in dry season in Stung Chinit irrigation scheme:

YEAR	2015	2016	2017	2018	2019	2020
Surface used in dry season	317 ha	875 ha	1,230 ha	1,350 ha	1,135 ha	2,360 ha



▲ *Drainage canal in Stung Chinit irrigation scheme (Photo: J.M. Brun, ARTE-FACT, 2021).*

Now, 10 to 15 years after the end of the scheme rehabilitation, practically all the surface inside Stung Chinit irrigation scheme is used for two rice crops a year, and up to three cycles for part

of the scheme. The Annex 6 gives a more detailed chronological description of this evolution from 2007 to 2021, by periods of 2 to 5 years, with key evolutions of farming practices and of the context (including regarding services) that can explain the evolution.

c. The Farmer Water User Community

The Farmer Water Users' Community (FWUC) was initiated in 2003 and formally registered by the Ministry of Water Resources and Meteorology (MoWRaM) in 2006. It counts 2,870 households as members. FWUC plays the major role (together with PDoWRaM, and with some roles of other stakeholders as we will further analyse) regarding the Operation and Maintenance of Stung Chinit Irrigation scheme. More details on the management of O&M services will be provided in this report in section 4.3.1. Water supply and water management.

2.3.3. Focus on key issues for Stung Chinit irrigation scheme

The issues for Cambodian agricultural sector as a whole have evolved dramatically in the last 30 years.

In the early 90's the main objective for the Cambodian agricultural sector was to produce enough paddy to feed its own population⁶, and agriculture was also the main sector for employment and source of income for Cambodian population, predominantly rural.

In the 2010's, the Kingdom has formulated and enhanced its ambition for its rice sector, focusing more and more on export – and as much as possible on export of quality milled rice rather than unprocessed paddy. In parallel, rice production was progressively intensified and modernized, with a very rapid trend toward more mechanization, whereas the share of employment in agriculture was decreasing drastically with dynamic industrial and construction sector providing employment opportunities.

The Stung Chinit irrigation area makes no exception here, and its evolution since the rehabilitation of the scheme is embedded in this context.

For many years after the rehabilitation of Stung Chinit irrigation scheme, an important issue was to encourage farmers to use the opportunity of water availability and to switch from one rice crop per year only to two or three crops annually. It took years for double cropping or triple cropping to take place, but it finally happened in the recent years⁷, and comes with a certain professionalization and intensification of agriculture characterised by a clearer market-orientation of paddy production, introduction of non-photosensitive short-term varieties. Development of input supplies and mechanizations have also strongly contributed to the changes.

⁶ An objective achieved in the middle of the 90's.

⁷ Dry season crop reached about one third of the scheme's surface in 2017, and passed two thirds only in 2020 (See Annex 6).

Paradoxically, whereas more benefit is withdrawn by farmers from the irrigation service, the FWUC faces difficulties to collect the farmers' contributions, despite, until now, the amount of fees (/contribution) has been charged per hectare and per year (not depending on the number of crops made by farmers) and has not been raised (Still 60,000 KHR/ha/year, or approximately 15 US\$)⁸. Hence, the ability of the FWUC to undertake its role and sustain the service is more than ever threatened. This situation is the result of a combination of different factors that will be further analysed in the Section 4 of the report. Now, the viability of the Operation and Maintenance of the irrigation scheme (and hence the service of water supply for rice cropping) is clearly at stake.

Another major issue, with a conventional intensification model of the production, is the sustainability of production methods (degradation of soil fertility⁹) and their environmental impact. For instance, farmers who used to dig ponds to capture fish during the flood period and keep them growing in the pond before to "harvest" them at the end of dry season said that in the area, where they used to capture 600 or 700 kg of fish in one pond, they are getting only 30 to 40 kg of fish nowadays, for the same size of ponds. Likely, the conventional intensification of rice production (and notably the use of insecticide and molluscicides), not only in Stung Chinit but all around the Tonle Sap lake may have a significant impact¹⁰ within the rice production area and also, likely, on the lake's fishery resources (combined also with multiple other factors such as changes in hydraulic regime of the Mekong and Tonle Sap system – due to upstream dams – and possibly overfishing).¹¹

Last, with increasing production costs (trend of increase of prices of agricultural inputs and land rental...), the profitability of rice production depends a lot on one hand on the ability of farmers to maintain or increase paddy yields, and on the other hand on paddy selling prices. For the latter, the connection to international markets (production largely exported) makes farmer's gross incomes quite exposed to price variations.

2.3.4. Rapid comparison with other irrigated schemes

The study has focused only on Stung Chinit scheme and no field work was conducted in other sites. Nevertheless, we can mention the situation of two other irrigation schemes (both in Kampong Thom provinces) with quite different situation regarding the irrigation service

⁸ Historically, the decision to keep a flat level of contribution per hectare and per year was made in order to avoid an additional disincentive for farmers to start double cropping, whereas it was already a challenge to motivate them to use more the irrigation. The evolution of practices has recently (in last July) led the Chinit River Irrigation Committee to envisage to reconsider this principle.

⁹ The decrease of soil fertility has not been scientifically documented in Stung Chinit, but some of the farmers interviewed during the study have noticed a decrease of yield after 2-3 years of intensification (upgrading from one crop to two to three crops per year), and the necessity to apply additional doses of chemical fertilizers just to maintain the same yields.

¹⁰ Not well documented yet.

¹¹ Neang Malyne, Méral Philippe, Services écosystémiques et riziculture autour du lac de Tonle Sap, Cambodge, Cahiers Agricultures, Volume 30, 2021, Novembre 2021.

provision (and its costs for users). These two sites have sometime been referred to by interviewees in Stung Chinit area as comparative examples, in particular in regard of the cost of Irrigation Service Fees charged.

These two very contrasting examples give an idea of the diversity of practices regarding the question of the level of invoicing of the irrigation service. It is useful to keep these cases in mind when we will further discuss the service of irrigation provision, as they are used as references or arguments by some of the stakeholders.

Table 5: Elements of comparison between Stung Chinit and two other schemes of Kampong Thom

SCHEME	STUNG CHINIT	BARAY (KG THOM)	ANG KO
SURFACE	2,800 ha	Approx. 5,000 ha	765 ha
USE	Rice production (2 to 3 cycles).	Rice production (2 cycles).	Rice production (2 cycles).
WATER SUPPLY	Gravity.	Need pumping by farmers.	Need pumping on 595 ha and gravity on 170 ha.
ISF	60,000 KHR/ha/year (change plan in 2021) FWUC go to farmers house to collect the fees.	No ISF collection.	300,000 to 420,000 KHR/ha/season Farmer come to pay at FWUC office.

2.3.5. How key issues are (or not) related to services to agriculture

The key issues rapidly exposed above are related to services to agriculture to a quite large extent. The service of irrigation is actually at stake itself¹² (and largely conditioning the current agricultural model recently developed in Stung Chinit scheme).

The issues of the sustainability and environmental impacts of the technical cropping models are also strongly related to services to agriculture, in particular agriculture extension services and input supplies (both being strongly linked as we will see in the next section).

¹² Until now, the FWUC has done relatively well in supplying the water to users. But maintenance costs are increasing (due to the use of the scheme for two to three crops per year, and with increased mechanization), while the revenues of the FWUC are not increasing (until 2021, same amount of service fee or contribution charged per hectare and per year) and even decreasing due to the erosion of recovery rate of fees payment. We will come back to that in § 4.3.1.

3. Typology of farms and analysis of service needs

3.1. Recall of the methodology used for the typology of farms and needs analysis

Three main steps have been followed to work on the characterization and typology of farms in Stung Chinit scheme, as follows:

3.1.1. Preliminary assessment based on key informants and focus groups

A preliminary assessment and overview was conducted on the basis of interviews with key informants and focus group discussion with groups of farmers¹³. The team notably had discussions with:

- The Head of the District Office of Agriculture.
- The leaders of the Farmer Water Users' Community.
- Group of farmers in Khvaek village, Kampong Thma commune.
- Group of farmers in Boeung Lvea village, Boeung Lvea commune.

Interviews with other key informants such as village representatives of FWUC, input suppliers, service providers have also completed the overview of the situation of farming in the scheme.

We have also obtained from the FWUC the last update of the register of land plots owners, from which we could elaborate statistics on the number of owners per class of surface, or distribution of surfaces per quintile (See § 3.2.). It is noted that the owners are not necessarily the ones farming the land (part of the parcels are rented). But there is no statistical source of data on land users. Irrigation contribution / fees is “invoiced” to land owners who may forward it to users as part of the rent.

3.1.2. Farmer survey

After the first round of field mission, a more comprehensive survey questionnaire was designed and surveys were conducted by Mrs Sokkhim with 20 farmers. The field surveys were conducted in September, before the second field week of the study team. The survey questionnaire was covering quite extensively the topics of farmers' profiles, land owned and

¹³ This was done during the first phase of the field mission in June 2021.

cultivated (inside and outside of Stung Chinit irrigation scheme), rice cropping system and performances, services used and level of satisfaction (in particular for irrigation service), etc. (See questionnaire in Annex 6).

3.1.3. Data processing and analysis

Data from surveys were computed to allow different analysis.

The team has then worked on the data and tried to identify relevant discriminating factors to elaborate the typology (having its mind the focus and purpose of the study on services to irrigated agriculture). The scheme being used nearly exclusively for rice farming, rice cropping practices have been used as the primary factor of differentiation, considering notably the single or multiple cycle of production per year and the surface cultivated.

The typology was hence mainly established on this basis, as we will see in the following pages.

3.2. Main quantitative and qualitative data on farms in the irrigation scheme

Stung Chinit FWUC has data on land owners and surfaces owned but not on the surfaced farmed by farmers or households. According to data on land ownership, approximately 40 % of land owners¹⁴ own less than 0.50 ha as seen in Table 7 next page.

Table 6: Number of land owners per classes of surface owned inside Stung Chinit scheme command area

CLASSES	EFFECTIFS	% OF OWNERS
>10 ha	13	0.46%
> 5 ha	17	0.60%
2 to 5 ha	195	6.84%
1 to 1.99 ha	628	22.04%
0.50 to 0.99 ha	856	30.04%
0.01 to 0.49 ha	1,141	40.04%
	2,850	100.00%

Data on land ownership distribution are presented in another form (by quintile) in the Table 7 next page.

¹⁴ But it has to be underlined that land owners name listed might be members of the same household, with in some cases some land titles being under the name of husband, other of wife.

Table 7: Range of surface owned by land owners inside Stung Chinit scheme, by quintile

NUMBER OF OWNERS	RANGE OF SURFACE (HA)	% OF OWNERS
570	1.26 to 69.56	20%
570	0.78 to 1.26	20%
570	0.49 to 0.78	20%
570	0.30 to 0.49	20%
570	0.01 to 0.30	20%
2,850		100%

As land owners are not always the ones who cultivate, the above table does not represent the distribution of rice farmers by size of farms, but there are no data available on rice farm size (based on cultivated land by farming household).

A number (unknown) of owners are not cultivating their own land, in particular owners who have very small surfaces. Land owners who are not farming at all are not included in the typology.

3.3. Typology of farms in Stung Chinit irrigation scheme

3.3.1. Key factors of farms differentiation

Different criteria can be selected as the main factors of differentiation to establish the typology. For this study and considering its focus on the services to irrigating farmers, we have decided first to segregate in one category farmers who are (still) doing only one crop in wet season, and not growing rice in dry season (even not doing an early wet season + a late wet season rice).

It has to be underlined that we mainly focus here on surfaces cultivated by farmers (which does not necessarily mean rice fields they own, as the practice of land rental is becoming more and more developed, sometime for one season only, or for the full year).

Last, rice is strongly predominant in the farming systems, and other crops are very limited (except for a few farmers who have also some upland crops – cashew, cassava – but in areas very distant from Stung Chinit scheme (10 to 20 km). Livestock production is generally limited to small scale backyard poultry raising. The raising of cattle or buffaloes is rather declining inside Stung Chinit scheme area (due to 1. less grazing land as rice occupies most of the land including in dry season and 2. Abandon of the use of cattle or buffaloes for animal traction, replaced by mechanization).

3.3.2. Synthesis table of main types of farms

The table below present an overview of the types of farmers in our typology.

Table 8: Overview of farms profile in our typology

TYPOLOGY CLASSES	NUMBER OF CROP PER YEAR	SURFACE PER FARMER	ESTIMATED SHARE OF SURFACES*	OTHER COMMENTS
Class 1	1 crop per year only (in wet season), either because they have other priorities, or lack water.	0.2 to 2.0 ha	Maximum 20% of the scheme command area	A few may rent out their land in DS. A significant part of rice is for HH consumption
Class 2	2 or 3 crops per year	Less than 1 ha	Around 50% of the scheme command area	A significant part of rice is for HH consumption
Class 3	2 or 3 crops per year	1 to 4 ha	Around 20% of the scheme command area	
Class 4	2 or 3 crops per year	Above 4 / 5 ha	Probably less than 10% of the scheme command area	Some are tractor owners
Class 5	2 or 3 crops per year	Above 10 ha, mainly rented	Probably less than 10% of the scheme command area	Can be 1 crop if rent in DS only

(DS = Dry season; HH = Household)

* This is only a rough estimation made by experts. There are no statistical data available.

3.3.3. Brief description of each type of farm

We have made a simple typology of farmers in the scheme. The study being focused on the irrigating farmers, and the scheme being used exclusively¹⁵ for rice cropping, the typology is quite largely based on the surface of rice field and on the cropping practices (one wet season crop only or several crops).

To characterize classes, we have used profiles of the twenty farmers which have answered the detailed survey questionnaires (we indicate, in each class, the questionnaires that are classified in the group).

- **Class 1:** Farmers cropping only one cycle in wet season: a number of farmers are still cropping only one cycle of rice in wet season. There are two sub-classes here depending on the reason why they do only one crop:
 - **Class 1-A:** Farmers who are using their rice-fields inside the scheme only in the wet season, mainly because they have other priority activities in dry season (up-land farming such as cassava or cashew production, palm sugar production...). As they do less rice they also have less farming equipment (no pump for instance). In the dry season their rice fields in the scheme are either not used or rented out to other farmers.
 - [Cases: Q5, – Kampong Thmar commune – 0.71 ha in wet season – rent rice field out in dry season and produce palm sugar in dry season]

¹⁵ Apart for very exceptional cases.

- [Cases: Q11, – Boeung Lvea commune – 1 ha used in wet season only – 2 ha upland crops]
- [Cases: Q15, – Prasat commune – 3 ha used in wet season only, 1 owned, 2 rented in]
- [Cases: Q17, – Boeung Lvea commune – 2 ha used in wet season only – 8 ha upland crops]

- **Class 1-B:** Farmers who grow rice only in the wet season because their field is located in the higher part of the scheme's command area and far from canals, so with an insufficient access to water in dry season (notably in Prasat commune). For some of the farmers, the surface concerned by this limitation of access to water can be significant.

- [Cases: Q1, – Prasat commune – 4.2 ha, out of which 2.7 ha inside the scheme – own tractor: sell mechanization service]
- [Cases: Q3, – Prasat commune – 0.30 ha used in wet season only]

It is also noted that, having a limited rice farming activity, Class 1 generally do not borrow money for rice cropping activities, except only for possible delay of payment for purchase of fertilizers. They mainly use their own seeds and grow Cambodian *Phka Rumduol* and *Raing Chey* varieties. They are also people who quite often sell their labour force to others.

- **Class 2:** Farmers cropping 2 or 3 times in the scheme on less than 1 ha. Despite having limited area, rice farming is an important source of income to sustain their livelihood, quite often associated to small livestock production (chicken, cattle...). The area of rice field they own in the scheme has been stable or has decreased in the recent years.
 - [Cases: Q4, – Boeung Lvea commune – 0.35 ha]
 - [Cases: Q2, – Kampong Thma commune – 0.45 ha]
 - [Cases: Q14, – Boeung Lvea commune – 0.50 ha]
 - [Cases: Q10, – Boeung Lvea commune – 0.68 ha]
 - [Cases: Q7, – Boeung Lvea commune – 0.68 ha]
 - [Cases: Q6, – Kampong Thma commune – 0.87 ha]
- **Class 3:** Farmers cropping rice on 1 to 4 ha and at least two times per year. Rice is a major source of income for their household (even if area remains limited). Some of them are renting land in to crop rice on larger areas. They may have complementary incomes from selling labour, small businesses... This category is the one that uses less daily labourers, undertaking most of the non-mechanized cropping tasks on their own.
 - [Cases: Q19, – Kampong Thma commune – 0.20 ha owned only but 2 ha rented in]
 - [Cases: Q12, – Prasat commune – 1.3 ha owned out of which 1 ha inside scheme +2.7 ha rented in,]
 - [Cases: Q20, – Kampong Thma commune – 2 ha owned, out of which 1 ha inside scheme]
 - [Cases: Q8, – Kampong Thma commune – 1.02 ha inside the scheme]
 - [Cases: Q9, – Boeung Lvea commune – 1.5 ha – he also has 1.3 ha of cashew]
- **Class 4:** Larger rice farmers cropping areas of more than 4-5 ha (inside and also possibly outside the scheme) that they own or rent, rather with a trend of increasing their rice fields areas over recent years. They may own their own tractors and can generate additional income from selling mechanisation services. They produce at least two crop per year (at least on part of their land). It is noted also that (based on the limited number of cases surveyed) this group has a bit more in-house labour force available, which contribute to their capacity to extend on larger areas. Yet they are also still hiring labour for part of the tasks of rice crop maintenance (fertilization, treatments).
 - [Cases: Q13, – Prasat commune – 7.8 ha, out of which 4.3 inside the scheme]
 - [Cases: Q18, – Prasat commune – 13 ha inside scheme – own tractor]
 - [Cases: Q16, – Kampong Thma commune – 1 ha inside scheme but 4 ha outside – own tractor]

- **Class 5:** Larger rice farmers cropping on more than 10 ha of land that they mainly rent (not own or only partly own) inside the scheme, either for one or several crop per year. There are no such cases among the 20 farmers surveyed in detail, but the study team has met such large farmers renting in very large areas of land inside the scheme for one or two crop per year. They own their own tractor and are engaged in a very commercial agriculture model. This class would gather only a very small number of farmers (but represents a not so small area of cropped land) and include some farmers living in the area but also some outsiders who often have been among the pioneers of the development of double or triple rice cropping in Stung Chinit scheme. Illustrative cases of “Class 5” are described in the Text Box 2 below.

BOX 2: SOME ILLUSTRATIVE CASES OF FARMERS IN “CLASS 5”

Two farmers met are renting more than 10 ha of rice fields in the scheme:

One in Boeung Lvea commune owns 5 ha himself but is renting 50 ha within the scheme where he mostly cultivates one crop in the wet season (land far from canal and in quite upper zone, so with insufficient access to water to do dry season rice).

Another one in Boeung Lvea commune too, owns only 2.3 ha in the scheme but is renting 13 ha of land in the scheme, in dry season only, to do dry season rice after the owners have done their own wet season crop.

Besides, two outsider farmers are known to have rented relatively large area of land to grow rice: one from Prey Veng province, another residing in Vietnam (“*Kampuchea Krom*”). It seems they were not active anymore this year (likely because of Covid-19 pandemic, in particular for the one living in Vietnam, who was not able to travel). They have been among the pioneers who have developed dry season production in the scheme.

There are also owners of rice fields who are not cultivating them (rent the land out for others to cultivate). But they are not considered here in the typology as they are not really concerned by the services to irrigated agriculture.

3.3.4. Dynamic of evolution between typology classes

Again, there are no statistical sources of information giving a clear and solid assessment of the dynamic of evolution of the respective sizes of the different classes of the typology. Nevertheless, field investigations show that Class 1 is decreasing (as more and more farmers over the last years have switched from one crop per year to 2 or 3 crops).

Besides, it is also very likely that households engaged in larger farming on large surfaces (classes 4 and 5) are also increasing. Economy of scale, possibility to invest in their own mechanization increase the profitability of those models, creating an incentive for further growth. Whereas for smaller scale farms (such as class 2), the option of reducing rice farming and taking up other off-farm opportunities is likely to be more attractive.

In other words, it means that it is very likely that there is a trend toward a progressive reduction of the number of farms, and increase of the average farm's surface combined with more inputs and capital intensive models.

3.4. Analysis of needs/demand for services of irrigating farmers

3.4.1. General needs for services of irrigated farmers in the scheme

As seen above, all farmers within Stung Chinit irrigation scheme are growing practically exclusively rice in the scheme. Hence, even if we can identify differences between farmers in the different categories of the typology, there are still a number of needs for services that are generally common to all farmers. We can list the following:

a. Soil preparation

It is striking to see that practically all farmers¹⁶ are nowadays renting services of tractor owners to plough/harrow their land. Even those who have limited area, and those who still own hand tractors tend to rent such services. Of course only those who own tractors themselves are not renting the service from an external provider.

b. Input supplies

Input supplies (fertilizers, pesticides) are obviously required for all farmers. All farmers interviewed are purchasing and using fertilizers and some pesticides, even those growing rice only one time per year in dry season. For seeds, farmers growing only *Raing Chey* or *Phka Rumduol* are often using their own saved seeds, but still have to renew them periodically.

c. Harvesting and post-harvest

Harvesting and threshing are also services used by all farmers. Even on quite small plot of land, harvesting is nearly never done manually anymore and is mechanized. Hence harvesting and threshing are combined, and straw is now mainly left on the fields.

d. Irrigation

Even in wet season, farmers are expecting to have water supplied for supplementary irrigation, in particular at the early stage of the cropping season.

¹⁶ Except for the few ones who own tractors, obviously.

3.4.2. Specific needs for services depending on the types of farms

There are still some differentiation regarding service needed depending on the farms profiles:

a. Irrigation

Obviously requirements/expectations for irrigation services are much more demanding for farmers implementing two or three cropping cycle, in particular for dry season crop which requires full irrigation. The service here requires sufficient water availability and easy access: it is indeed a factor of differentiation as some farmers are doing one crop only because of the location of their fields in the scheme (Case of category 1-B: on higher lands, far from canals...). Beyond the availability of water, irrigation also requires “soft” services, in particular the planning and coordination among farmers to have compatible cropping calendars.

It is important to underline that, in our survey, water availability has been ranked as the number 1 factor¹⁷ that has allowed to do at least two rice crop per year in the scheme (yet, the history of evolution of the scheme has also shown it is a necessary but not a sufficient factor).

BOX 3: APPRECIATION OF IRRIGATION SERVICE PROVIDED BY FWUC VARIES ACCORDING TO CATEGORIES

Based on the survey made with farmers (and with the limit of this survey, due to limited number of farmers interviewed), it is striking to note that farmers of Classes 1 and 2 have a better appreciation of the irrigation service provided, whereas Classes 3 and 4 are relatively more critic. Whereas it could, at first sight, look paradoxical (as those farmers are the one who benefit more of the irrigation), there is also a certain logic as they are also the categories that are growing more rice in dry season, which is the period in which the service shows some limits with water not always reaching all areas of the scheme or in sufficient quantity. Most of those farmers are reporting the limits of their access to water, either due to the location of their fields and/or because of higher demand and competition between water users.

b. Extension / Technical advices

Whereas all farmers may sometime need technical advices, the need is much higher for farmers growing rice two times or three times per year, in particular in the first years of growing dry season rice as the management of the crop is significantly different from the more traditional wet season rice crop.

¹⁷ Among 14 farmers who are doing more than one crop per year, 11 have ranked water availability as the “number one” factor driving this change.

c. Credit / Financial services

In the detailed survey, a limited number of farmers have reported using credit services from bank or MFI for financing their farming activities: only three cases¹⁸ out of twenty have reported using credit from a bank or MFI (for rice crop). But nearly all the categories of farmers are using embedded credit facilities offered by input suppliers. (Based on the limited number of surveyed farmers: 50% of farmers in Class 1 use embedded credit with fertilizer sales, and more than 90% (13/14) for the other three classes in the typology, i.e. for farmers growing rice more than one time per year).

d. Market / Market linkage

Only very few farmers are growing paddy in Stung Chinit for their household consumption only, hence except for those few, all farmers need a connection to market. After water availability (see above), market demand (or presence of buyers) is seen as the second determining factor that have motivated farmers to start to grow at least two crops per year¹⁹.

e. Advocacy and representation

The need for farmer's representation and advocacy is not expressed (and maybe not identified) as a major need by farmers. Yet it might be interesting to consider it, with in particular two potential issues about which a collective representation could be an asset to address some concerns expressed by farmers:

1. The prices of inputs and selling price of paddy, on which it could be imagined that a collective representation could strengthen farmers' bargaining power.
2. The necessity to ensure that the roles of the different institutional stakeholders in the management of irrigation are ensured according to the institutional arrangement made between FWUC, local authorities and MoWRaM/PDoWRaM.

3.4.3. Synthesis: priority needs for services to irrigated agriculture in Stung Chinit

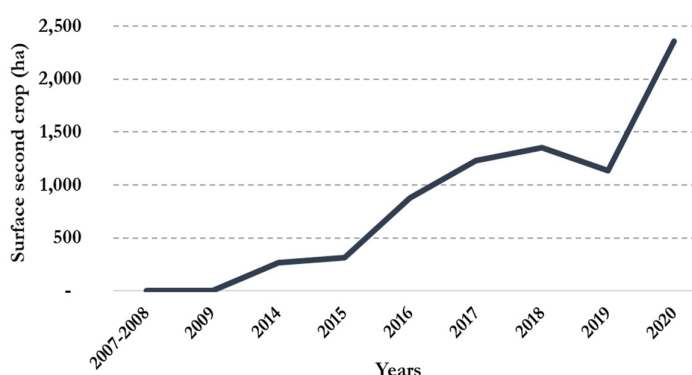
During the surveys, interviewed farmers who are now doing at least two rice crops per year were asked about the determining factors that made them switch to two (or three) crops per year. Practically all of them have ranked irrigation (water availability) as the No 1 factor.

¹⁸ Q7, credit from ACLEDA; Q18, credit from Hathakasekor; Q19, credit from PRASAC.

¹⁹ Among 14 farmers who are doing more than one crop per year, 8 have ranked market availability as the "number 2" factor driving this change (and one farmer ranked it in first place).

Yet, the history of the scheme use reveals that if it is a necessary condition, water availability is probably not a sufficient one. Indeed, water for irrigation is available in Stung Chinit since the end of the rehabilitation of the scheme (around 2006 / 2007). But double rice cropping has started to be widespread in the scheme only in recent years (See Figure 2, opposite):

Figure 2: Evolution of surface with a second rice crop in Stung Chinit scheme over the past 14 years



This means that water availability alone is not enough to trigger the change in farmers' behaviours and strategies regarding double cropping and development of dry season rice. Among the other determining factors (and services), dynamic market demand / market prices and presence of buyers is often ranked second by interviewees. Mechanisation services and availability of suitable inputs are also mentioned as important factors to unlock the potential of production²⁰.

All those are thereof necessary and shall be considered among the priority services.

The Annex 6 provides an attempt of review of the history of the rice cropping practices in Stung Chinit scheme, which shows the progressive development of services (mechanisation, inputs supplies...) in parallel of the changes of practices in the scheme. It also shows how the availability of water alone was not enough to trigger the rice intensification.

The Table 9 next page shows a summarize overview of this evolution.

²⁰ This tend to confirm an hypothesis mentioned in the previous report (kick-off report): "Beyond water availability, services related to value chains, are strong incentives to reach the full potential of irrigation".

Table 9: summary of evolution of practices in the scheme and related services

		BEFORE REHAB.	2007-2008	2009-2014	2015-2018	2019-2021	NEAR FUTURE
Situation	Rice production Features	wet season only (low yields)	Wet season only (low yields)	wet season, some second crop	Start 2 production cycles (3 for few pioneers)	2 to 3 cycles becomes more widespread	Maintain 2 -3 cycles but with risk of failure and higher costs? (Note: Soil fertility starts to decrease)
	Farmers technical knowledge on DS rice	No		Some pioneers bring techniques	Start to copy pioneers	More widespread knowledge of DS rice crop	More widespread knowledge of DS rice crop
Services	Irrigation Water availability	No irrigation service	Water available				Irrigation service at risk (due to issue of fee recovery by FWUC).
	Inputs supplies	Very limited	Very limited	Few distributors	Offer of product increase	Diverse and quality products available	
	Mechanization	No service	Hand tractors	Hand tractors	Hand tractors and start to have tractors	Large availability of tractors and combine harvester	
	Market connection	Local collectors / middlemen			New traders	More connections to market	

3.5. Beyond farmers: Services needed to irrigation management

The service of irrigation water supply and water management in the scheme is mainly the responsibility of the Farmer Water User Community (together with PDoWRaM as detailed below), at least as the entity in direct relation with farmers. But other services are needed and other players engaged to support the FWUC in its role.

For a number of functions and tasks required for the irrigation management, the FWUC may consider internalization or outsourcing. Given its scale and financial capacities, the decision to outsource part of the functions and tasks can be a relevant choice. This is what has been done in the last decade, with a number of functions being externalized and implemented for the FWUC by the Irrigation Service Center²¹, as we will see in details in the next section of the report.

²¹ The Irrigation Service Center (ISC) is a non-profit organisation that has been established in the early 2010's to provide support and capacity building to Farmer Water Users' Communities in Cambodia. It was established as part of the ASIrri project, financed by AFD.

Besides the FWUC does not have all responsibilities alone. Regarding the supply of water and management of irrigation, it shares responsibility with other institutions, in particular the services of PDoWRaM.

3.6. Quid of other services? To supply-chain? To environmental sustainability?

If we look beyond services to irrigating farmers, and to irrigation management, we can identify a number of key services that are essential to maintain (or improve) the conditions for farmers to be able to implement irrigated agriculture.

This notably includes the following:

3.6.1. Services needed by input suppliers

Input suppliers are actually not only supplying inputs but they are also a major source of seasonal / campaign credit to farmers and of technical advises.

They need not only inputs, but also technical guidelines on how to use fertilizers and pesticides, that they will convey down to farmers. They receive these inputs and advices from fertilizers and pesticide import companies.

Besides, because they very frequently provide payment facilities to farmers (payment of inputs at harvest time) input suppliers have very high need for cash flow / working capital. They themselves benefit from short term delay of payment from their suppliers (generally one truck paid at the following delivery, but which gives only the required cash flow for one to two weeks). Hence they need to address higher needs for credit, which can easily reach 50,000 to 100,000 US\$ for large suppliers.

3.6.2. Services needed for mechanized service providers

Providers of mechanization services (tractors and combine harvester) also have needs for credit for their investments, as well as need for mechanical services (even if they can generally do the basic maintenance on their own) and spare part supplies for their equipment.

Companies supplying tractors and harvesters generally provide a one year guarantee and after sale services for repairs.

Some of the equipment suppliers can also provide facilities of payments²². But otherwise, mechanisation service providers may require loans from banks.

3.6.3. Services needed to support downstream value chain actors

The study has not covered the services needed for stakeholders downstream in rice value chain, in particular for rice mill industry.

3.6.4. Services to improve environmental sustainability

Farmers start to see potential impacts of conventional intensification practices on the local environment, and notably on soil fertility and on fisheries (as mentioned above). Yet, there is no significant technical research or advisory implemented to reflect and provide solution on this matter.

There are only a handful of farmers that have tested innovative practices of non-tillage and cover crop rice a few years ago (around 2016-2018). One farmer met has experienced the proposed system²³, growing cover crop after the harvest. He was quite happy with the result, but with the changes of practice of other farmers around (in the same irrigation block) willing to do dry season rice, the irrigation block had to be flooded in dry season and it was not possible for him to continue with the cover crop planting after wet season harvest.

²² For instance, RMA, official importer for John Deere brand, has a leasing license.

²³ Supported by CIRAD, DALRM and the CASC.

4. Mapping and analysis of existing services offer

4.1. Recall of the methodology used for the analysis of services offer

The analysis of existing service offer was conducted through the following steps:

- First screening: during the first part of field mission in June, the study team had:
 - interviews with key informants (such as PDAFF and PDWRaM, head of District Office of Agriculture, Natural Resources and Environment, FWUC committee, FWUC village representatives...)
 - focus group discussions with different farmer groups

This has allowed to get a preliminary overview of services used and service providers in the area.

- In between the two field missions, an inventory of main service providers for
 - soil preparation (tractor owners in the area),
 - harvesting (combine harvester owners),
 - paddy purchase / milling, and
 - input supplies (depots, retailers)

was conducted mainly by phone survey with key informants (village representatives of FWUC, village or commune authorities) to cover the whole area.

- The farmer detailed survey has provided a few more information on the sourcing of services by farmers (more as a confirmation on the services used).
- Last, in order to better understand the service offers and the business models, the study team had interviews with a number of service providers: mechanisation service providers, local input retailers, inputs importers, local financial services (MFI), FWUC, ISC, FWN... This was started during the first mission in June and completed in the second one in September.
- Findings were then analysed and consolidated to produce the following mapping of service providers.

4.2. Mapping of service providers

A large number of services and service providers are available for farmers in Stung Chinit area. The Figure 3 next page provides a summarized overview of services available, some of which have been developed and/or scaled up recently, in the past 5 years. The following pages provide more details on each type of service and service providers.

The main actors for key service provisions are:

- The Farmer Water User Community (FWUC) and the Provincial Department of Water Resources and Meteorology (PDoWRaM) for irrigation service (Operation and Maintenance of the irrigation scheme).
- Private input suppliers for the supply of fertilizer, pesticides, seeds, of course, but also to a large extent for technical advisory to farmers and credit services (embedded with the selling of inputs).
- Machinery owners (generally farmers acting as local service entrepreneurs) for the mechanization services (soil preparation and mechanized harvesting).
- Local collectors or agents are linking farmers to market (i.e. to rice millers or larger traders exporting paddy to Vietnam as detailed in the next pages).

Local public services of agriculture have a limited role in term of support provided directly to farmers, because of the lack of resources available. The District Office of Agriculture, Natural Resources and Environment explains that its main role is the collection of data and production of statistics and report, and to a lesser extent to provide technical advises to farmers in specific circumstances, and also, importantly, to inspect input suppliers.

Banks and MFI are very present in the area, but are not really playing a major role in agricultural campaigns financing.

In the section 4.3. in the following pages, we present with much more details stakeholders and modalities of service delivery for the following services:

- | | | |
|-------------------|---------------------------------|---|
| ● Irrigation, | ● Technical advices, | ● Land rights and land securing, |
| ● Input supplies, | ● Credit and access to finance, | ● Crop insurance and meteorology services |
| ● Workers, | ● Market connection, | |
| ● Mechanisation, | | |

4.3. Analysis of priority services delivery

4.3.1. Water supply and water management

a. Respective roles and responsibilities of FWUC and PDoWRaM for O&M

The irrigation and the maintenance of infrastructures (except primary infrastructure – and theoretically secondary canals as well) is implemented by the Stung Chinit Farmer Water User Community. The Annex 4 describes how the sharing of O&M responsibility was foreseen at the end of SCIRIP project implementation, in 2007.

In term of operations, the PDoWRaM is responsible to ensure water flows from the reservoir to the main canal, whereas FWUC manage the sluice gates from primary to secondary canals. Water is then automatically distributed between the tertiary canals through open flumes. The FWUC has also to make adjustments in the drainage canals, to maintain a level of water not too low so the water is not drained out too rapidly and sufficient water level can be maintained in the fields.

For the maintenance, MoWRaM is in principle responsible of the reservoir, main canal, and secondary canals, but in practice the FWUC is implementing regular maintenance activities on the secondary canals as far as the budget capacities and reactivity of MoWRaM / PDoWRaM do not allow to implement works regularly and rapidly.

BOX 4: KEY FEATURES IN FWUC STRUCTURE AND GOVERNANCE

FWUC organisation chart

The FWUC is managed by a management committee of 4 elected members: President, 1st Vice-President, 2nd Vice-President, and Treasurer.

Besides, the FWUC has 25 village representatives (1 per village) who are responsible for control the services of irrigation and collect services fee from farmers.

Moreover, the FWU employs 4 staffs: 1) Chief of rehabilitation; 2) chief of water management and repartition, 3) accountant and 4) Guard.

Evolution in the mandate duration of elected representatives

From 2006 to 2013: the duration of the mandate of the management committee was 3 years.

Since 2014, the duration of the mandate has changed from 3 to 5 years. A new management committee was elected in 2014, then renewed in 2019.

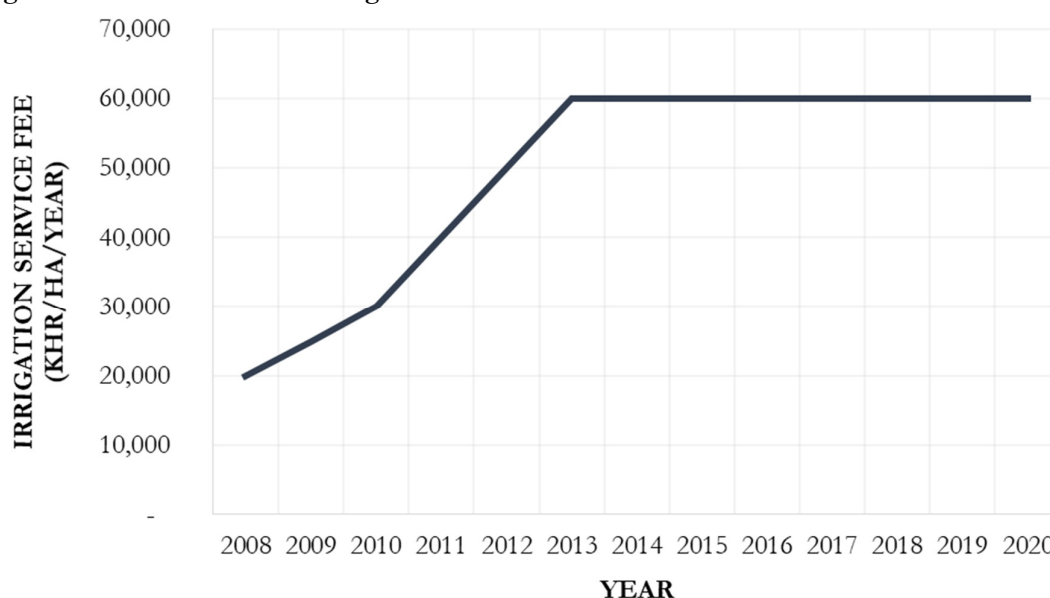
The FWUC used to organise meetings with members at village level two times per year in order to provide information on FWUC management and to present and discuss the water management plan (calendar of opening and closing the water gates of secondary canals). But since 2020, the it has reduced the communication with farmers, notably due to Covid-19

situation, and also in order to reduce its costs, in an effort to adapt to decreasing incomes (see below).

b. FWUC budget and resources

To implement Operation & Maintenance functions, the FWUC is charging an irrigation service fee (or contribution) to each land owners²⁴ in proportion of the surface owned in the scheme. From the beginning of the management of the scheme by the FWUC and until 2020, the fees were charged once per year only. The rate has evolved progressively from 20,000 KHR/ha in the first year (2008) up to 60,000 KHR/ha in 2013. From 2013 to 2020 it has remained stable.

Figure 4: Evolution of annual Irrigation Service Fee from 2008 to 2020



Recently in July 2021, the Stung Chinit Irrigation Local Support Committee (gathering Local Authorities, PDoWRaM and FWUC, see next page) has suggested an evolution in the irrigation service charge and proposed to collect separately the fees for dry season crop and for wet season crop, with an amount of 40,000 KHR/ha/season.

On the basis of a service fee rate at 60,000 KHR/ha/year as applied in the recent years, the FWUC shall in theory have an annual budget of approximately 168 million Riels per year (about 42,000 US\$). In practice the actual budget available is lower as the recovery rate of the fee does not reach 100%. Whereas the FWUC was able to collect 85% to 90% of the amount due in 2013-2015, the recovery rate has progressively declined in the past five or six years. It has dropped to less than 50 % in the recent period²⁵ leading to a crisis in the irrigation

²⁴ In case the owner does not farm the land but rent out, the owner and the user may have an agreement on who shall pay the fee to the FWUC. Yet by default it is charged to the owner.

²⁵ And in addition the fee collection has been affected by the Covid-19 situation in Santuk district: collection process was suspended for several months to avoid risk of disease transmission.

management. The decrease of incomes of the FWUC seems to be due, to a large extent, to the difficulties to enforce the obligation of payment, as technically it is not possible for the FWUC to exclude a particular farmer or owner from the access to water. Hence the enforcement is based on a close partnership with local authorities, which has been less effectively implemented in the recent years.

c. Stung Chinit Irrigation Local Support Committee (or CRIC)

In addition to the internal instance of FWUC governance, a “Stung Chinit Irrigation Support Committee” was established²⁶, gathering together Local Authorities (District governor and head of communes’ councils), PDoWRaM and FWUC. Initially, this committee was expected to have regular meetings, at least twice per year (at the beginning of wet season and at the beginning of the dry season)²⁷ + extraordinary meetings when required. But the CRIC has not been active in the recent years, probably to some extent due to the turnover in local authorities (as well as in PDoWRaM) and the lack of awareness of new district governor and officers about the history of the scheme and these institutional arrangement and responsibilities. Only in July 2021, the committee has been reactivated to address the crisis situation faced by FWUC, due to the erosion of its financial resources and consequently its inability to properly undertake all its responsibilities regarding O&M.

d. Tasks out-sourced by FWUC: the role of the Irrigation Service Center

The size of Stung Chinit irrigation scheme already requires a certain level of professionalization for its management. Yet it is still relatively too small to allow economies of scale and enough financial resources to afford full time professional staff (for instance for accounting and finance, users’ database management, technical maintenance work...).

To address that, a partnership was signed between Stung Chinit FWUC and the Irrigation Service Center²⁸. Since 2012, Stung Chinit FWUC has outsourced a number of tasks to the ISC, as detailed in the text Box 5 next page.

It has to be noted the service price charged by ISC to FWUC (100 US\$ per month, as indicated next page) does not cover the actual cost engaged by ISC to deliver these services. But the ISC considers it is its primary mission to support FWUCs and takes into account the limitations of their budget resources. ISC has been balancing its own budget by selling services to projects or development partners nationwide. ISC utilizes the margins on fees charged to projects or other client to provide balance its internal budget and maintain a capacity to provide quality

²⁶ It was initially and officially established under the name “Chinit Reservoir Irrigation Committee” (or CRIC) by a decision (*Deka* No 61) of Kampong Thom Provincial Governor in 2007 (H.E. Nam Tum).

²⁷ See “Internal rules and regulations of Chinit Reservoir Irrigation Committee CRIC”.

²⁸ The Irrigation Service Center (ISC) is a non-profit organization registered in Cambodia with the Ministry of Interior in 2011. It was created as part of the ASIrr project. It is specialized in matters related to the management of irrigation and provides support to Farmer Water Users’ Communities in Cambodia. It is also occasionally contracted by projects in the irrigation sector.

and affordable services to FWUCs. One shall also note that the Stung Chinit Irrigation Local Support Committee (described above) has never acknowledged and recognize the importance and relevance of the provision of services by ISC to FWUC.

From June 2021, contract between ISC and FWUC Stung Chinit was ended, which creates additional challenge for the FWUC to maintain its capacity to manage properly the system.

BOX 5: ISC SERVICE TO SUPPORT FWUC STUNG CHINIT IN THE RECENT YEARS

Since 2012, the Irrigation Service Center (ISC) has provided service to FWUC Stung Chinit via yearly contract between ISC and FWUC Stung Chinit committee. ISC services have been charged to the FWUC at a concessional price of 1,200 US\$ per year. Below are detail activities and services that ISC has provided to FWUC Stung Chinit committee.

Support to ISF (Irrigation Service Fees) collection:

- Update list of users and plot list – 1 time per year and it take around 2 weeks of 1 person
- Preparing list and summary table of ISC collection plan by each user, village, commune and by collectors.
- Print invoices for all users (each user one invoice – around 3000 copies) – 1 person for a week including task 2 and 3 and deliver these invoices to FWUC chairperson.
- Provide one staff – full time (his salary is 150USD/month) to support field activities of ISC fee collection: 12 months/year

Support to Financial management and reporting:

- Collect document from FWUC, data entry and verification: enter all invoices and support documents of FWUC expends within the month into FWUC accounting system (excel format) and income from ISC collection fee; this task require 2 days of 1 person per month;
- Produce monthly expenditure report with format link to FWUC annual budget line;
- By end of the year, ISC produces annual financial report by consolidating the monthly reports.

Support FWUC in its operational reporting:

- ISC helps to collect weekly minute of FWUC committee meetings to produce summary report of progress FWUC's activity by the end of each month, it takes around 1 day of 1 person per month.
- ISC is preparing the annual report by consolidating data from monthly report.

General support to FWUC:

- ISC provides staff to join monthly meetings between FWUC committee and village representatives;
- It helps to prepare coordination meetings between FWUC committee, local authorities and PDoWRAM;
- It supports the preparation of village meetings as well as the FWUC General Assembly;
- Last, ISC is engaged in facilitation to address conflict (dispute resolution meetings).

4.3.2. Input supplies

A total of 32 locally based depots or retailers selling agricultural inputs have been identified within Stung Chinit scheme area or nearby. All of them are selling at least fertilizers, and most of them fertilizers and pesticides. Some are also selling agricultural equipment and seeds²⁹.

Table 10: Number of local distributors of agricultural inputs in Stung Chinit area (by communes)

COMMUNES	TOTAL	FERTILIZERS	PESTICIDES	MATERIAL	SEEDS
Kampong Thma	11	11	10	5	At least 3
Boeung Lvea	9	9	3	0	
Brasat	8	8	7	2	
Balang (in Baray district)	4	4	2	0	At least 1
TOTAL	32	32	22	7	At least 4

a. Seed supply

Traditionally local rice varieties used are mainly inbred varieties and farmers may save some seeds and renew their seeds only every 2-3 years (in theory, often a bit more in practice).

Purchase of commercial seeds is more frequent for new short cycle and non-photosensitive varieties used in intensified irrigated rice production.

PDAFF has mentioned two seed productions centres in Kampong Thom:

- Balang station (State owned) which produces seeds of varieties obtained by CARDI such as *Phka Rumduol* or *Sen Kraob*.
- The Agricultural Cooperative of Trapeang Russey, which produces fairly good quality of seeds of *Phka Rumduol* variety.

But these varieties are not predominant anymore in Stung Chinit scheme, except in some cases *Phka Rumduol* for the late wet season crop³⁰.

Non-photosensitive, short cycle and highly productive varieties, mostly imported from Vietnam, have largely replaced the Cambodian varieties. Most popular varieties used in Stung Chinit are now identified by farmers as 504 and 5451. Santuk district agriculture officer estimates that these Vietnamese varieties are used for approximately 90% of the rice cropping in the district. In some cases, the seeds are provided by paddy traders, often coming from outside (Prey Veng province or either Vietnam) who are offering to buy the paddy produced at harvest time.

Some of the local input sellers are also selling seeds and they appear to be the main distributors locally, as shown by the farmer survey undertaken as part of this study.

²⁹ We don't have the exact data for seeds, but at least four of them are selling rice seeds too.

³⁰ *Phka Rumduol* is a photosensitive variety and can be grown only in the wet season, with a harvest in November. It is less productive than dry season short cycle varieties used, but its organoleptic quality are higher (fragrant rice).

b. Fertilizers

All of the 32 agricultural inputs retailers identified above are selling fertilizers. This is the most common item they are selling. They generally supply different kind of fertilizers, notably urea and DAP or NPK. Some of them also supply specific fertiliser such a so called “natural fertilizer” from Japan (imported by Bayon Heritage Holding Group).

BOX 6: THE PARTICULAR CASE OF THE “FERTILIZER BUYING GROUP” (FBG)

With some initial support from the AFD funded project “Support to the Commercialization of Cambodian Rice – SCCRP”, some pilot initiatives of setting farmer groups to purchase fertilizers (and hence get lower buying prices) were implemented. One Fertilizer Buying Group was established in Stung Chinit area, with a support to Stung Chinit FWUC to establish and operate it³¹ in 2016 and 2017.

In 2016/2017, the FBG in Stung Chinit has gathered up to 174 members and has purchased and sold more than 27 tons of fertilizer. According to an assessment of the results of this pilot operation, it was estimated that farmers could get the fertilizers at about 5 to 6% lower price than if they were buying through other distribution channels. But the organisational effort required was important and it has been difficult to maintain this activity. Nevertheless, the FWUC is still trying to maintain a bit of collective purchase of fertilizer, but only a very small number of farmers have been using the service in 2020/2021:

In 2020, 30 farmers have purchased through the group a total of 36.7 tons of fertilizers (less farmers, but bigger volumes than before).

In 2021, only few farmers have purchased through the group, for a total of 15.1 tons (hence quite large farms, according to the figure).

The local distributors (depots) are supplied by fertilizer importing companies, which deliver directly to them (for the large depots, at least, whereas smaller retailers may purchase from the larger ones in the district).

The retail distribution of fertilizers requires a large amount of working capital for the local retailers / depots. From the interviews conducted, local fertilizer distributors have to pay their suppliers generally within one or two weeks from delivery³², whereas they most frequently offer an embedded credit to farmers, with the payment of fertilizers made at the following harvest (hence with a cycle of 2 to 3 months) – See also in the section on credit.

³¹ This experience has been documented in a case study as part of the knowledge management from SCCRP project. Case Study #8: Fertilizer Buying Group of Stung Chinit FWUC with Bayon Heritage Holding Group, February 2018.

³² The frequent practice is that the delivery n is paid at the time of the delivery $n+1$, with a pace of rotation of one truck every one to two weeks for large retailers.



▲ *Input sellers' shops in Santuk district (left) and in Kampong Thma (right).*

c. Pesticides

Most of the input suppliers identified (22 out of 32) are also (in addition to fertilizers) selling various kind of pesticides: herbicides, insecticides, molluscicides.

BOX 7: CONTROL ON PESTICIDE AND FERTILIZER QUALITY AND COMPLIANCE

The District Agriculture Office (DOANRE) is implementing some controls at fertilizer and pesticide depots and retailers places to verify the compliance of products and selling points with legal requirements. This notably include:

- Verifying that the seller has followed the mandatory training by MAFF services;
- Checking that the expiration date of the products has not been passed;
- Verifying that all the product instructions for use are translated into Khmer.

In case of non-compliance, the DOANRE cannot take sanctions but only advise and recall the rules. The provincial level only is entitled to take action.

In Santuk district, DOANRE has reported that they regularly monitor 32 selling points, in principle 2 to 4 time per year (in practice a bit less, they said).

In 2020, PD AFF has intervened in one shop (After warning by district level) for a case of pesticides imported from Vietnam without instructions note translated in Khmer.

4.3.3. Workers

Many of the farmers in Stung Chinit are hiring labour / daily workers to undertake some tasks in rice cropping, in particular for the application of fertilizers, herbicides and pesticide. This is the most common purpose for which daily labourers are hired: out of the twenty farmers interviewed, fourteen are occasionally or always hiring labourers for those tasks.



Insecticide treatment applied on rice in June 2021 in Stung Chinit irrigation scheme (Photo: J.M. Brun, ARTE-FACT, 2021) ▲

Daily workers are hired within the area. Labourers are farmers themselves or may be landless people. Whereas farmers have reported that it is not difficult to mobilise labourers in Wet Season (lower need for work, season when most of men are in the area), it is more difficult in dry season (men are either more mobilized on their own rice fields, or may temporarily leave the area in dry season to seek work outside)³³.

4.3.4. Mechanisation

a. Soil preparation

More and more frequently, farmers in Stung Chinit are using tractors for land preparation (most often by service providers, except for those who own a tractor). Only very few farmers are still doing soil preparation with hand-tractors³⁴.

There are 57 tractor owners identified by our own surveys in Stung Chinit scheme area. They are at the same time farmers and small scale entrepreneurs who are selling soil preparation services (ploughing, harrowing, land levelling...).

Most of the tractor owners are providing services in a limited coverage area (their own village and the neighbouring villages).

Ploughing is charged around 120,000 KHR/ha. Soil preparation using rotavator is charged around 250,000 KHR/ha after ploughing or 300,000 KHR/ha if done directly (with no ploughing).

³³ Most of farmers in Class 1 (who are rowing rice only in wet season) said it is not a major difficulty to hire labourers, whereas in other Classes of the typology, a majority of farmers interviewed said it is not easy to find workers, mainly in dry season.

³⁴ All the 20 farmers that answered the detailed survey are doing soil preparation with tractor. Even some who have a hand tractor are also hiring the services of tractor owners.

The soil preparation services are obviously very seasonal inside the scheme (as rice cropping practices are quite synchronized). Hence service providers said they have three peaks of work lasting only two to three weeks: in January, in early April to end of May, and in August.

Even if there can remain some tension for the access on time to mechanization services at the peak period, it is generally considered that there are enough service providers. Tractor owners have mentioned that they can proceed with the ploughing of approximately 5 ha per day, hence with 57 tractors owners in the area, about 285 ha can be covered each day, which means the total surface of the irrigation scheme could theoretically be covered in about 10 days.

b. Harvest

According to statistics produced by the District Agriculture Office in 2020, 100% of rice was harvested by combine harvesters in the whole Santuk district. Indeed, even if the statistics could have missed marginal cases of hand harvesting on very small plots, the mechanization of harvest has progressively become the norm during the past decade. Within Stung Chinit area, there are 26 combine harvesters identified. Because combine harvesters are quite big investments, the owners are trying to use the equipment for as many days as possible, and therefore they are often not providing services only within Stung Chinit scheme command area but sometime quite further away. Reciprocally, farmers in Stung Chinit may hire the services of combine harvester from entrepreneurs located far from Stung Chinit, at the peak of harvest season.

To ease the matching between offer and demand, combine harvester owners often go through the services of local persons acting as agents (called “*méka*”). These agents are the contacts through which farmers can get in touch with combine harvester owners (the agent generally take a commission from the combine harvester owner³⁵). Sometime the same person is also acting as an agent for paddy buyers³⁶. There is an obvious complementarity with the mobilisation of harvesting services, as paddy is bought more and more fresh (wet), directly on the day of harvest.

Here also, it seems that the availability of combine harvesters at harvest time is not an issue. The fact – linked to the irrigation service – that the cropping is quite synchronized at least at irrigation unit (block) level is an asset for this purpose as combine harvester owners can optimize their time too.

³⁵ One agent met has indicated that he was receiving a commission of 10,000 KHR (approximately 2.5 US\$) per hectare harvested. Commissions of up to 20,000 KHR/ha were also mentioned in other cases.

³⁶ See § 4.3.7. Market connection.

4.3.5. Technical advisory / agriculture extension / innovation

a. Public agriculture extension services

Whereas during Stung Chinit irrigation rehabilitation project (2002-2008) there were some experimentations and training implemented with PDAFF services in Stung Chinit irrigation scheme, the public services of agriculture are currently not having any significant activity of agriculture extension on-going in the area. The District Office of Agriculture, Natural Resources and Environment has stated that they have no resources to undertake extension activities, unless when there are projects providing budget to do so. This is currently the case with Rice SDP³⁷ and ASPIRE³⁸ project, but not in Stung Chinit scheme area.

BOX 8: MAIN ROLES OF DOANRE

The vice chief of the District Office of Agriculture, Natural Resources and Environment has described the main roles of his office as follows:

- To collect agriculture data / statistic in the district
- To collect information and data in the events of natural disasters (floods, draught...), in order to assess the damages/impact to agriculture sector, then report to district authorities and to PDAFF.
- Report on a weekly and monthly basis the updated information on agriculture in the district.
- Participate with projects in providing training or extension on agriculture technique to farmers (Rice SDP, ASPIRE, or other small projects...).

In a second discussion in September, DOANRE representative said that they still may be called to provide specific advices to farmers in case of disease or pest attacks, and if they are called upon by farmers or by commune authorities. But this is not frequently the case.

The Provincial Department of Agriculture (PDAFF) also reports that they are providing extension on rice production technique (and post-harvest), and notably extension of resilient agricultural practices that include rice field levelling, use of suitable seed (*Phka Rumduol* for wet season and *Sen Kraob* for dry season³⁹). But PDAFF does not really have resources to implement extension services outside of projects.

³⁷ Rice SDP (Climate Resilient Rice Commercialization Sector Development Program) is a governmental programme financed by the Asian Development Bank, focusing on rice sector.

³⁸ ASPIRE (Agriculture Services Programme for Innovation, Resilience and Extension) is a programme in support of the agriculture sector financed by IFAD.

³⁹ Those are national varieties, bred by CARDI, as all varieties that MAFF is recommending. PDAFF notes that in dry season, most farmers are using Vietnamese varieties and not *Sen Kraob*.

b. Technical advice by input suppliers

A major source of technical advice for farmers are the inputs suppliers/retailers. This was reported by both input suppliers and farmers. Advisory provided are covering:

- Fertilizer use (timing and doses);
- Pesticide/herbicide use (timing of application, in the case – most often recommended by sellers – of systematic application);
- Possibly recommendation on pesticide in case of particular situations (diseases, pest attack...).

Input suppliers are themselves receiving guidance from the importing companies. In some cases, fertilizer importers are also supporting the promotion of their products by demonstration fields and field visits to farmers, often organized in relation with some local distributors.

Advisory services by input suppliers obviously comes with a question of conflict of interest. Input suppliers (both importers and distributors) having an interest in maximizing their sales, it is quite likely that they recommend doses or frequency of application higher than the optimum. In particular, for pesticide treatments, systematic application is generally the recommendation provided by sellers (and followed by farmers) regardless of the actual situation of pest and diseases.

This is not actually balanced by public services recommendations as the resources of public technical services are too limited and depending on projects mainly.

c. Farmer to farmer

Farmer to farmer extension or sharing of knowledge is not formally organised but has to be considered as part of the sources of technical information. In Stung Chinit, it seems that farmer to farmer learning (often just by observation and informal discussion) has contributed to prove the possibility to implement two to three rice crops per year, with in particular some pioneer farmers (often coming from outside⁴⁰ the area and renting land) who had a demonstration effect on the others.

d. Technico-economical advisory (or farm management advisory)

It is noted that the advisory service existing are only providing technical advices, with yields as the only target or indicators⁴¹. There are no support to farmers to look at the sustainability and profitability of their practices.

⁴⁰ Two important innovators or pioneers are often identified by farmers: one originating from Prey Veng province, the other one from Southern Vietnam (Kampuchea Krom).

⁴¹ It shall be underlined that, for MAFF also, yields and production are the main indicators, and not farmers net profits.

4.3.6. Credit / Access to finance

a. Rice cropping campaign credit

Fertilizers are most commonly purchased with an embedded credit provided by the input suppliers. For the 20 farmers surveyed, 16 are buying fertilizer on credit (80%). 50% are also buying the pesticides/herbicide on credit, and only 3 out of 20 said they purchase the seeds on credit too.

For these credit campaign needs, input suppliers are clearly the main providers, and other sources of formal credit (banks or MFI) are practically not used for that purpose.

BOX 9: CREDIT TO FARMERS BY INPUT SUPPLIERS

Input suppliers are very frequently selling inputs (fertilizer in particular) at credit to farmers. An input retailer in Kampong Thma explained that he sells fertilizer at credit to about 90% of his clients. For a bag of fertilizer paid cash at 130,000 KHR/bag, the selling price with embedded credit increases to 137,000 KHR/bag, or +5.4%.

The farmer is reimbursing at harvest time. With short rice cycle production (and the fertilizer being applied at different stage of the crop), this cost of credit is of 2.7% per month if we consider an average duration of two months, or 1.8% per month if we consider up to three-months duration (which is likely to be above the average). This rate is higher than the formal credit offer proposed by MFI, which cannot exceed 1.5% per month.

Another input supplier, located in Taing Krasaing (head of Santuk district), said that there are more and more retailers / distributors of agricultural inputs. Whereas one could think that with more competition, providing credit could be to offer better services and gain client, this supplier said that on the contrary, the more competition there is, the less sellers are willing to grant delay of payments, because with more alternative supply options, the risk of non-reimbursement at harvest time is increasing.

In some cases, the land preparation service providers (tractor owners) may grant a delay of payment to farmers but it is not so frequent. This is limited by their financial capacities and the trust toward their clients.

b. Investment credit

Whereas banks and MFI services are not so widely used for credit campaign, their services are mainly mobilized for longer term investments made by farmers (machinery, etc.). Among the 20 farmers surveyed, only 3 have indicated using banks or MFI services⁴² for their agricultural activities.

⁴² They are using: Bank: ACLEDA; MFI: Hattha Kaksekar, PRASAC.

The study team has interviewed the Director of AMK Branch office in Kampong Thma who has confirmed that there are not many farmers borrowing from MFI for rice cropping activities. The major part of the activities of AMK in Kampong Thma area are group loan (solidarity groups), with a ceiling amount of 3 million Riels per person for the first cycle, then up to 4 million Riels per person, and with an interest rate of 1.5%/month.

For machinery equipment, importers of well-known brands are also offering some credit or leasing schemes. For instance, a combine harvester owner met during the study said that he had to pay 30% of the harvester price up-front, and the remaining 70% have to be reimbursed over a period of 3 years.

4.3.7. Market connection

There are many paddy buyers who have developed a connection with Stung Chinit area (as well as is all the rice production area in Cambodia). These buyers are either rice millers (notably with rice mills established in Prey Veng, Kampong Cham and Kampong Thom provinces) or paddy traders, notably exporting the paddy to Vietnam. They are buying both Cambodian rice varieties (notably fragrant rice varieties) as well as Vietnamese short cycle non-photosensitive varieties. Since the last few years, they mainly buy wet paddy (especially for buyers who are exporting the paddy to Vietnam). Some local buyers still accept dried paddy, but the price is generally less interesting for farmers than selling wet paddy. Also farmers have other incentives to sell wet paddy: 1) it is easier and it saves time (no need to manage the drying on farm and farmers do not always have the space for drying and storage); 2) they often have loans to reimburse (to input suppliers) and need cash rapidly at harvest.

Paddy buyers often have local relays to collect the paddy, who can be either local paddy traders (buying the paddy and reselling it) or local agents (called “*méka*”) making only the connection with the buyers and being paid by the buyer on a commission basis⁴³. The latter has become the more frequent option, in link with the relatively recent development of mechanized harvesting and purchase of wet paddy by buyers instead of dry paddy⁴⁴. Those agents are playing an important role in organizing rice harvesting⁴⁵ and supplying to buyers. 21 “*méka*” are identified in 11 of the 25 villages covered by the irrigation scheme. Some agents work in 3 or 4 villages. In villages with higher production, there can be up to 3 or 4 agents, for instance in Boeung Lvea and Kvaek villages.

Prior to the harvest time, the “*méka*” in the irrigation scheme are communicating with buyers from different sources to get paddy price information. They liaise with buyers offering good

⁴³ The commission is around 10,000 KHR/ton of paddy collected, according to information from interviews and focus group discussions.

⁴⁴ Also, when farmers are selling their paddy to other paddy collectors or traders, they get mostly the same price as farmers selling through the facilitation of “*méka*” but some farmers are reporting that it can be a bit risky as the wet paddy will rapidly lose quality (and hence, value) and also some farmers say that there can be some buyers trying to cheat on weighting scales.

⁴⁵ They are also often the agents connecting farmers with combine harvesters’ owner for the harvest, as seen in § 4.3.4.

prices and accepted by farmers to come to buy paddy in their villages. Buyers need to compete with each other to provide good price and good buying condition, otherwise they are not called by the agents to buy paddy in their area. The agents also have to work closely with combine harvester service providers as well as with farmers to arrange the schedule of harvesting and paddy collection by buyers. Hence, beyond commercial linkage, there is an important logistic dimension in the services performed by the “*méka*”.

This activity is obviously very seasonal: for each cropping cycle (3 times per year maximum) it does not last more than 15 to 25 days.

In the irrigation scheme, even though the buyers are competing with each other to get paddy, the prices are mainly determined based on the buying price offered by main buyers in Vietnam (in particular for non-photosensitive short cycle varieties).

BOX 10: THE PILOT INITIATIVE OF PADDY SELLING GROUP IN STUNG CHINIT SCHEME

It is worth noting that the organization of paddy supplied to buyers by “*méka*” is quite new in the target area. Between 2014 and 2016, as part of the SCCRP project (Support to the Commercialisation of Cambodian Rice Project, funded by AFD), Stung Chinit FWUC has received support to organize “Paddy Selling Groups”, i.e. farmer groups to collectively plan harvesting and sell paddy in group to rice millers. This has worked quite well in the first year, allowing farmers to get a higher price when selling through the group. But then other local traders tend to align the prices (which was still a positive effect for farmers) and integrate the model of liaising with harvesting services and buyers. Also, farmer facilitators who took the lead operational role in the Paddy Selling Group have actually continued to implement these same roles but as “*méka*”.

[Another experience of “Paddy Selling Group” supported by SCCRP project is described in SCCRP Case Study #4: Paddy Selling Group of Baray FWUC, by Hy Thy. <http://sccrp.iram-fr.org/index.php?page=135&folder=10>]

4.3.8. Land rights / land rights securing

Land securing is not really an issue within Stung Chinit irrigation scheme command area. Practically all the land plots within the scheme were demarcated following the systematic land registration procedures during the Stung Chinit Irrigation and Rural Infrastructure Project in the first decade of 2000.

Further land transactions are supposed to be registered with the cadastre (which might not always be done) and are at least acknowledged by local authorities.

Even if more indirect land use has developed (land renting), there are no major issue with the security of land ownership.

4.3.9. Crop insurance, meteorology forecasts

a. Meteorological forecasts

There are no specific / localized meteorological forecast information or alert available for farmers in Stung Chinit area or Santuk district. Only general meteorological information or forecasts are available, and occasionally quite general alert in case of unusual climate events (such as heavy rains, for instance as an attenuated effect of typhoon striking Vietnam) that are broadcasted through traditional media and social media.

b. Crop insurance

At present there is no agricultural / crop insurance service available covering Stung Chinit irrigation scheme area. Yet it is worth noting that there is an ongoing pilot of Weather Index Crop Insurance that is currently deployed in some target communes, including some of the communes of Santuk district. This is described in the text box 11 below.

BOX 11: PILOT OF WEATHER INDEX CROP INSURANCE IN PART OF SANTUK DISTRICT

The Climate Resilient Rice Commercialization Sector Development Program (Rice-SDP), funded by ADB and the Royal Government of Cambodia (RGC), is piloting a “Weather Index Crop Insurance (WICI)” service in the provinces of Battambang, Kampong Thom and Prey Veng. In Kampong Thom, Santuk is one of the target districts of the project. The Rice-SDP has selected 4 communes of Santuk to deploy the pilot: Korkoh (3 villages, 120.5 ha insured, 154 households), Tipo (7 villages, 95.5 ha insured, 161 households), Phnao (3 villages, 12 ha insured, 12 households) and Taing Krasaing (11 villages: no detail data yet). The 3 communes of Stung Chinit irrigation scheme are not yet covered by the service.

The project work with Forte Insurance Company. The insurance is based on the precipitation, measured at meteorology station in the pilot districts.

The insurance cost (premium) charged is of 10 USD/ha/production cycle. At this pilot stage and to promote the insurance, the RC (/Rice SDP) contributes half of the premium (5 USD/ha/production cycle). The insurance company will compensate the insured farmers in case rainfall are below or above certain determined limits, within determined period of time, with compensation that can vary between 5 and 100 USD/ha maximum, depending on the period (2 phases in the production cycle) and on the difference of actual precipitation from reference values. The compensation does not depend on the actual damage on the rice or on the volumes harvested. The project has just started this pilot action within this 2021. The results are not available yet.

It is noted that the ceiling amount of 100 USD/ha is relatively low. It covers probably less than 20 to 30% of the production costs engaged by farmers for one cropping cycle.

4.3.10. Advocacy services

The defence of irrigating farmers' interests is not perceived as a major need by farmers. For the FWUC, in its relation with MoWRAM notably (for instance monitoring and insuring that the public party undertakes its part of O&M responsibility), there can be an interest and a need to be represented by a stronger organisation. This is, to some extent, a role of "Farmer & Water Net" (FWN), a consortium of FWUC providing some services and capacity building to its members, but also being a support of FWUCs in their relation with MoWRaM. Stung Chinit FWUC is a member of FWN (which has its headquarter on the same site, in Kampong Thma).

FWN is also a member of the Cambodian Rice Federation.

5. Preliminary analysis of the adequacy between offer and needs of services (user's satisfaction, perspectives and needs for improvements)

As a summary of the study findings at this stage, the SWOT analysis (Table 11 below) provides a quick overview of the situation on services and underlines some key issues.

Table 11: Overall SWOT analysis of services

STRENGTH	OPPORTUNITIES
<p>IRRIGATION</p> <ul style="list-style-type: none"> • Irrigation water supply is still working relatively well. <p>INPUT SUPPLY and MECHANIZATION</p> <ul style="list-style-type: none"> • Very dynamic private sector investing in the provision of services (mechanization) and input supplies. <p>CREDIT</p> <ul style="list-style-type: none"> • Large offer of credit services: numerous banks and MFI present locally + facilities of payments proposed directly by suppliers. <p>MARKET LINKAGE</p> <ul style="list-style-type: none"> • Solid connection with paddy buyers. 	<p>IRRIGATION</p> <ul style="list-style-type: none"> • The presence of ISC and FWN in Kampong Thom can still be a chance to support the FWUC, as they can offer near-at-hand support services to the FWUC and have strong competences on these matters. <p>OTHER SERVICES</p> <ul style="list-style-type: none"> • Pilots on agricultural crop insurance in neighbouring communes that could be extended to scheme area.
WEAKNESSES	THREATS
<p>IRRIGATION</p> <ul style="list-style-type: none"> • FWUC internal capacities still require to be strengthened (turnover) and/or completed by externalized services for certain functions. • Communication by FWUC with water users has been reduced. <p>TECHNICAL ADVICES / EXTENSION</p> <ul style="list-style-type: none"> • Lack of budgetary and human resources of public services for agricultural extension and technical advices to farmers. • Over-reliance on input suppliers who have vested interest in selling more input than what might be strictly necessary or optimal. <p>CREDIT</p> <ul style="list-style-type: none"> • Costs of financial services (interest rate) still relatively high. <p>MARKET LINKAGE</p> <ul style="list-style-type: none"> • Low capacity of negotiation of producers on prices (failure of "Paddy Selling Groups experience"). 	<p>IRRIGATION SERVICE</p> <ul style="list-style-type: none"> • The economic and social viability of the irrigation service is threatened by decrease of the actual collection of fees and increase of maintenance costs. • Declining support and collaboration of Local Authorities is a threat to the functioning of the FWUC. • End of ISC support to FWUC (without alternative). <p>TECHNICAL ADVICES / INPUTS USE</p> <ul style="list-style-type: none"> • Degradation of soil fertility (not proven based on scientific evidences, but reported by some farmers, linked with double/triple cropping). • Negative externalities on environment and biodiversity (impact on fisheries...) <p>MARKET LINKAGE</p> <ul style="list-style-type: none"> • A certain dependency on Vietnamese market in particular for short cycle non-photosensitive varieties of rice. <p>GENERAL</p> <ul style="list-style-type: none"> • Low diversification of agriculture in the area. Profitability sensitive to evolution of input prices and volatility of market prices for paddy.

The Table 12, page 62, assesses more specifically the different service needs, starting from the ones considered (according to the different surveys and interviews) as higher priorities. From our team analysis, two main points (in red in Table 12), appears as the highest concerns:

The first one concerns the **irrigation service**. The perception by farmers of the water supply service is generally good (with some limits, often underlined by large farmers – notably in classes 3 and 4 of the typology – see section 3) and most of the farmers are also considering that the price charged for the irrigation service is acceptable. But the FWUC is currently facing a crisis (institutional, organisational and financial) which represents a real threat for the sustainability of the irrigation service. Whereas the maintenance costs are significantly increasing due to higher use of the scheme and the increased use of heavy machinery, the FWUC is facing more and more difficulties to collect the contribution from farmers partly due to reduced communication with users – because of the lack of resources and because of Covid-19 – and also to the reduction of local authorities’ engagement aside the FWUC over the past few years. Moreover, the support of ISC is coming to an end because of the lack of financial resources and poor recognition of its importance by FWUC institutional partners. All these elements could jeopardize in a relatively short term the capacity to sustain the irrigation service in Stung Chinit scheme. Whereas it might not yet be perceived by water users, it seems important to acknowledge the difficulties faced and to undertake a comprehensive review and renegotiation of the conditions of irrigation management and necessity of collaboration between all institutions. This has started in July with the reactivation of the “Stung Chinit Irrigation Local Support Committee” and discussion on service fees charged. But the subject probably deserves additional discussions to ensure issues are addressed. This is proposed to be one of the topic of the restitution and consultation workshop in the final step of the study.

The second one relates to the **chemical-intensive cropping methods** used (and hence concerns at the same time input supplies and technical advisory to farmers). Here again, the subject does not (yet) appear as a very hot concern for farmers (except for their complaints on the high price of inputs, in particular fertilizers). But the level of chemical-based intensification starts to come with important threats: a) the sustainability and profitability of rice production could be questioned in the future because of decreasing soil fertility (need to apply more and more fertilizers to obtain the same yields – as reported by farmers, and not surprisingly when moving to a two or three rice crop per year system on the same land – and with prices of inputs being on a growing trend); b) the impact of chemical intensive practices have already started to show negative impact on the environment and natural resources. Locally (within the scheme or in its vicinity), capture and harvest of wild fishes in ponds dug in the scheme or downstream has already severely decreased. At a larger level, the impact of such rice intensification around the Tonle Sap may come with significant negative impacts on the fishery sector on the Lake (also combined with changes in hydraulic regime, as mentioned before in the report). This is not well documented yet. But it could be an important aspect to consider – beyond the scope of this study – as Tonle Sap fishery resources represent a substantial sector and value for the economy of the Kingdom and the livelihood of its people. The technical

intensification model and the services of technical advisory / agricultural extension are proposed to be a second main topic of discussion for the last phase of the study.

Table 12: overview of satisfaction, constraints, risks of services in Stung Chinit

	Priority level (how important the service is for farmers)	Perception by users: Level of satisfaction (or reasons of complains)	Economic model and viability	Other stakes (external) or risks on the service	Difficulties / constraints	Possible improvements
Irrigation	1	Generally good (so far). A bit lower for larger farmers and for owners of parcel in higher land	ALERT Increasing needs for maintenance. Lower level of service fee payment (ISC services charged to FWUC at a lower price than real costs)		Service fee collection. Degradation of the support from Local Authorities. End of ISC support threaten the quality of services.	Re-discuss and re-shape the organisation of the O&M service + Institutional capacity building
Mechanization (soil preparation)	1	Good (some farmers complain a little on price)	OK viable economic model for service providers with the current level of pricing.	Increased mechanization comes with increased damages on irrigation infrastructures	A bit of tension on the availability of service at peak period	
Input supplies	1	Availability, diversity and efficiency of products (near at hand) + embedded credit appreciated Complain on prices of inputs (in particular fertilizer)	Economic viability (market based + sufficient margins)... But a risk link to embedded credit and working capital engaged. One seller mentioned that she reduce the sell on credit.	Environmental impact (on fisheries / human health...)	Guarantee on the quality of fertilizers not always sure	Reinforce technical advices by public services (with budget allocated for that) Quick intervention if pest / disease Buying group
Harvesting services	1	Good level of satisfaction thanks to the increase of availability of CH Some complain of high price	OK viable economic model for service providers with the current level of pricing.		A bit of tension on the availability of service at peak period	
Market	1	Availability of buyers Not always happy with the selling price of paddy Generally good	Collectors financed on their margin, or local "brokers", paid on commission	Depend on Vietnam market for DS varieties.		
Technical advices	2	Farmers quite satisfied Easy to access.	Mainly technical advices provided by inputs suppliers at no extra costs (economic model based on the sale of fertilizers and phyto- sanitary products)	Environmental impact (on fisheries / human health) and sustainability (soil fertility)	Conflict of interest when advice is given by input suppliers Lack of budget resources for public services extension. Advices focused on yield and not on profitability	
Credit	2	Farmers quite satisfied Easy to access.	Actual interest rate applied between 1.8 et 2.7%/month for credit embedded in input sales. Risk of default of reimbursement	What would be the impact in case of economic or natural hazard affecting most of the production in the scheme?		Insurance to cover risk of incapacity to repay in case of major hazard on crops?
Workers	3	Generally available in WS but sometime lack of workers available in DS	Remuneration of work has to align with opportunity cost for the worker	Human health for workers		Drone?? (evoked by some farmers and one input supplier...)
Advocacy	3	Quite unknown by farmers FWUC appreciates FWN support	Difficulty to finance the advocacy role.		Low perception of stakes by farmers	

Color codes :  = Satisfactory  = Quite satisfactory  = Some concerns or risks  = Significant concerns or risks

6. Up-dated study time frame and main risks

6.1. Updated time frame

The completion of the study on services to irrigated agriculture has been severely delayed due to the COVID-19 pandemic context. Note that the delays are similar in Tunisia and in Cambodia and that the two teams are therefore still progressing in parallel.

The updated chronogram is provided in Table 13 next page. It remains uncertain due to the COVID context. Ideally, the workshop for the development of the operational plan could be held in December 2021 or January 2022.

6.2. Possible risks for study implementation

6.2.1. A proposed approach already distorted by circumstances

The Covid-19 pandemic situation has not only induced delays in the implementation of the study activities, but it has also forced us to modify the envisaged plan and workflow. In particular, the field kick-off workshop (described in the Annex 7 of the Study launching report) could not be organised, which has significantly changed the course of the implementation. Even the possibility to implement focus group discussion were constrained, with limited number of participants allowed (+ social distancing and as much as possible outdoor meetings).

These changes (in particular the cancellation of the field kick-off workshop) constitute a very significant distortion to the initial approach considered. The circumstances did not allow us to follow the foreseen methodology and this has an impact on the methodological dimension of the study. Indeed, the purpose and objective were not only about the outcomes for the particular case of Stung Chinit and about the operational plan for improvements of the services, but the study expectations were also about testing an approach and methodology for a more participatory diagnosis and elaboration of solutions for improvements. It has to be acknowledged from now that this methodological dimension of the study has been irretrievably harmed considering that a significant part of the innovative elements in the approach could not be implemented as planned.

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[illegible]

6.2.2. Further anticipated risks or difficulties to mitigate

We can identify the following risks or concerns for the implementation of the next steps of the study:

Table 14: Risks or difficulties for the next steps of the study and mitigation measures

IDENTIFIED RISKS/DIFFICULTIES	MITIGATION MEASURES
The Covid-19 pandemic context makes it difficult to organize the workshop on operational plan for services improvement. It will not allow the physical participation of Iram in the workshop ⁴⁶ . Even if the epidemic situation in Cambodia has officially improved, there are still some risks, possible restrictions to meeting, and reluctance of participants to join large meetings.	The workshop is foreseen to be scheduled in December 2021 or January 2022. Further delay would affect the capacity to finalize the work by March 2022. Iram might participate in some of the sessions by video-call.
The initial technical offer was anticipating that the workshop on operational plan for services improvement would be organised over two full days and a quite broad participation. It is difficult in the context to maintain this plan.	Instead of a two-full-days-workshop, we plan: A full day restitution and discussion of the study main findings. Two half-days-sessions (which will gather different participants) on the two major topics to address: <ul style="list-style-type: none"> • Organisation, management and economic viability of the irrigation O&M service. • Technical advices to farmers and optimization of the use of fertilizers and pesticides. (including not only technical, but also economic considerations).

6.3. Next step: final on-site workshop to set priority and elaboration operational plans

The next and final step of the study will consist in the organisation of the restitution and consultation workshop in Stung Chinit area, with the main stakeholders of the irrigated agriculture there. The purpose will be to present the outcomes of the study and finalize the prioritization of the issues, then organise an open consultation to set the basis of operational action plans for the improvement of services. As indicated in section 5, we foresee two main topics: the review of the institutional, organisational and economic model of the service of irrigation (O&M management), and the discussion on the technical model of production and its impact on environment and natural resources, with a focus on how technical advisory services could help to mitigate the risks. In Annex 7, we present a framing note for the consultation workshop.

⁴⁶ Quarantine measures are still applied at the entrance in Cambodia. It is still a heavy constraint for a short term mission, even if the duration of quarantine is reduced for vaccinated travelers (3 days or 1 week, depending on cases, but still with a risk that it is extended to two weeks or more in case some other passengers on the same flight are tested positive!).

7. ANNEXES

7.1. ANNEX 1: Relevant bibliography

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7.2. ANNEX 2: Population by commune in Santuk district

Table 15: Population by commune in Santuk district

Province/District/ Commune		No. Household	Population			Sex Ratio	Household Size
			Total	Male	Female		
607	Santuk	23,726	101,428	50,031	51,397	97.3	4.3
60701	Boeng Lvea	3,871	16,021	8,202	7,819	104.9	4.1
60702	Chroab	1,097	4,743	2,340	2,403	97.4	4.3
60703	Kampong Thma	2,415	9,854	4,757	5,097	93.3	4.1
60704	Kakaoh	2,624	11,480	5,509	5,971	92.3	4.4
60705	Kraya	4,216	17,484	8,775	8,709	100.8	4.1
60706	Phov	486	2,067	960	1,107	86.7	4.3
60707	Prasat	2,392	10,269	5,045	5,224	96.6	4.3
60708	Tang Krasang	2,785	12,895	6,381	6,514	98.0	4.6
60709	Ti Pou	2,465	10,792	5,301	5,491	96.5	4.4
60710	Tboung Krapeu	1,375	5,823	2,761	3,062	90.2	4.2

Source: National Institute of Statistics, Ministry of Planning, General Population Census of the Kingdom of Cambodia 2019: National report on final census results, October 2020.

7.3. ANNEX 3: Agriculture, water and irrigation schemes in Santuk district

According to district agriculture officer and some other sources:

In Santuk district, there are 10 communes, with a total of 29,100 ha of irrigated land.

Prasat, (part of) Boeurn Lvea and Kompong Thma communes get water from Stung Chinit irrigation scheme, which covers 25 villages and a total surface of approximately 2,787 ha. 2,910 household benefit from this scheme (registered land owners – based on up-dated FWUC database). Farmer plant rice as the main crop in this area. Since 2019, there are commonly 3 cycles of rice production in the scheme: early wet season rice, wet season rice and dry season rice).

In Tboung Krapeu commune, farmers grow two cycles of short term rice varieties using paid irrigation system from private company / entrepreneur.

In Chroap, Kakaoh and Tang Krasang communes, farmers get water from Tang Krasang irrigation scheme, which covers 7,455 ha in total. But farmers are lacking water for their rice fields in some time of the year.

Phnov commune has just started to build the irrigation scheme with the financial support from Rice SDP project. The construction has started in January 2021. The surface of irrigation area is about 508 ha.

In the flooded area nearby Tonle Sap lake, before 2020, farmers used to plant floating rice and receding rice. But from 2020, farmers have kept only receding rice in those area, using the 504 or 5451 rice varieties. Receding rice is grown after the flood, when the water level decrease progressively in the lowlands, from November to February.

The three communes of Kraya, Boeng Lvea and Ti Pou are a bit higher in topography, and there are very few irrigation systems in these 3 communes (approximately 20% of land only). Hence mainly wet season rice only is grown in these areas. Farmers also plant mangoes (Keo Romiet variety) and cashew nuts orchards.

Besides, there are large rubber plantations in Santuk district, in upper land areas, owned by 3 companies (Taing Bean, Barir & Phoeukfar), on a surface of around 10,000 ha.

7.4. ANNEX 4: Tentative sharing of O&M responsibilities as envisaged in 2007

In 2007, the sharing of responsibilities between PDOWRAM, FWUC and Users regarding Operation and Maintenance of Stung Chinit irrigation scheme was tentatively elaborated as follows

Table 16: Tentative distribution of O&M responsibilities as foreseen during SCIRIP project in 2007

	PDOWRAM	FWUC	Users
Operation	<ul style="list-style-type: none"> * Operate the gate from the reservoir to the main canal. * Operate the gate from the reservoir to the Southern area (old Khmer Rouge canal). * Operate other structures on the reservoirs dykes. 	<ul style="list-style-type: none"> * Plan the sharing of water. * Operate the gates of the secondary canals. * Monitor the distribution of water on the tertiary canals and until the inlets of quaternary canals. * Adjust the level in tertiary drains. 	* Build and maintain the quaternary canals
Maintenance	<ul style="list-style-type: none"> * Maintenance of the reservoir * Maintenance of the main canal * Maintenance of the secondary drains. 	<ul style="list-style-type: none"> Maintenance of secondary canals (earth works and structure) Maintenance of tertiary canals (earth works and structures) Maintenance of tertiary drains (earth works and structure) 	

7.5. ANNEX 5: Farmer survey questionnaire

សំណួរសម្រាប់សម្ភាសន៍កសិករ Questionnaires for farmers' interview

Name of Interviewer: **Duong Sokkhim**

ថ្ងៃ ខែ Date...../...../2021

ឈ្មោះកសិករ Name of Interviewee: _____ ភេទ Sex _____ អាយុ Age _____ ទូរសព្ទ Tel: _____

ភូមិ Village _____ ឃុំ Commune _____ អ្នកក្នុងស្រុក Residence: ☐ បាទ Yes / ☐ ទេ No / តាំងពីឆ្នាំ
since when: _____

(បើតិចជាង ១០-១៥ ឆ្នាំ តើមកពីណាដែរ? if less than 10-15 years in the area: coming from where? _____)

ចំនួនមនុស្សនៅក្នុងគ្រួសារ Nb of members in the household: _____ (ស្រី F: _____)

កត្តាផលិតកម្ម PRODUCTION FACTORS

ដី LAND

ដីដែលជាម្ចាស់កម្មសិទ្ធិ Land ownership:

ផ្ទៃដីកសិកម្មដែលជាកម្មសិទ្ធិ Agricultural land surface **owned**:

	បច្ចុប្បន្ន NOW	5 ឆ្នាំមុន years ago	10 ឆ្នាំមុន years ago
ក្នុងប្រព័ន្ធស្រោចស្រព Inside the irrigated area	_____ ហិកតា ha	_____ ហិកតា ha	_____ ហិកតា ha
ក្រៅប្រព័ន្ធស្រោចស្រព Outside irrigated area: ដីស្រែ Rice fields	_____ ហិកតា ha	_____ ហិកតា ha	_____ ហិកតា ha
ដីចំការ/ដំណាំយូអេផ្លែឆ្នាំង Chamkar /plantations	សរុប TOTAL= _____ ha	សរុប TOTAL= _____ ha	សរុប TOTAL= _____ ha
<input type="checkbox"/> កៅស៊ូ Rubber	_____ ហិកតា ha	_____ ហិកតា ha	_____ ហិកតា ha
<input type="checkbox"/> ចន្ទី Cashew	_____ ហិកតា ha	_____ ហិកតា ha	_____ ហិកតា ha
<input type="checkbox"/> ស្វាយ Mango	_____ ហិកតា ha	_____ ហិកតា ha	_____ ហិកតា ha
<input type="checkbox"/> បន្លែ Vegetables	_____ ហិកតា ha	_____ ហិកតា ha	_____ ហិកតា ha
<input type="checkbox"/> ផ្សេងៗ Other _____	_____ ហិកតា ha	_____ ហិកតា ha	_____ ហិកតា ha

ផ្ទៃដីកសិកម្មដែលធ្វើផ្ទាល់ដោយកសិករ Agricultural land surface **used directly by the HH**:

- ក្នុងប្រព័ន្ធស្រោចស្រព Inside the irrigated area =

	បច្ចុប្បន្ន NOW	5 ឆ្នាំមុន years ago	10 ឆ្នាំមុន years ago
ដើមរដូវវស្សា Early wet season	_____ ha	_____ ha	_____ ha
ចុងរដូវវស្សា Late Wet season	_____ ha	_____ ha	_____ ha
រដូវប្រាំង Dry season	_____ ha	_____ ha	_____ ha

- ក្រៅប្រព័ន្ធស្រោចស្រព Outside the irrigated area =

	បច្ចុប្បន្ន NOW	5 ឆ្នាំមុន years ago	10 ឆ្នាំមុន years ago
ស្រូវ Rice	_____ ha	_____ ha	_____ ha
ដំណាំប្រចាំឆ្នាំផ្សេងទៀត (បន្លែ ពោត សណ្តែកដី ដំឡូង ល្ង) Other annual crops (vegetables, corn, peanuts, cassava, sesame...)	_____ ha	_____ ha	_____ ha
ដំណាំយូរអង្វែង (ចន្ទី ឈើហូប ផ្លែ កៅស៊ូ...) Plantations (cashew, fruit trees, rubber...)	_____ ha	_____ ha	_____ ha

សង្ខេប (បច្ចុប្បន្ន: រដូវវស្សាឆ្នាំ ២០២០ និង រដូវប្រាំងឆ្នាំ ២០២១) Summary (Nowadays: Wet Season 2020 and Dry Season 2021)

ដីជួលឲ្យគេធ្វើ Land rented out:

☐ ពេញៗឆ្នាំ full year: _____ ហិកតា ha (ថ្លៃជួល price of renting _____ ៛/ហិកតា KHR/ha)

ឬក៏ or only

☐ ដើមរដូវវស្សា Early wet season: _____ ហិកតា ha (ថ្លៃជួល price of renting _____ ៛/ហិកតា KHR/ha)

☐ ចុងរដូវវស្សា Late Wet season: _____ ហិកតា ha (ថ្លៃជួល price of renting _____ ៛/ហិកតា KHR/ha)

☐ រដូវប្រាំង Dry season: _____ ហិកតា ha (ថ្លៃជួល price of renting _____ ៛/ហិកតា KHR/ha)

ដីជួលពីគេដើម្បីធ្វើ Land rented in:

☐ ពេញៗឆ្នាំ full year: _____ ហិកតា ha (ថ្លៃជួល price of renting _____ ៛/ហិកតា KHR/ha)

ឬក៏ or only

☐ ដើមរដូវវស្សា Early wet season: _____ ហិកតា ha (ថ្លៃជួល price of renting _____ ៛/ហិកតា KHR/ha)

☐ ចុងរដូវវស្សា Late Wet season: _____ ហិកតា ha (ថ្លៃជួល price of renting _____ ៛/ហិកតា KHR/ha)

☐ រដូវប្រាំង Dry season: _____ ហិកតា ha (ថ្លៃជួល price of renting _____ ៛/ហិកតា KHR/ha)

កម្លាំងពលកម្ម LABOUR

ចំនួនមនុស្សក្នុងគ្រួសារដែលចូលរួមធ្វើស្រែ Nb of persons in the HH working on the farm?

☐ ប៉ុន្មាននាក់ចូលរួមធ្វើស្រែរហូត Permanently: _____ នាក់ ☐ ប៉ុន្មាននាក់ចូលរួមជួយបានខ្លះៗ Part time: _____ នាក់

កម្លាំងពលកម្មជួលពីក្រៅ (គិតតែការធ្វើស្រែនៅក្នុងប្រព័ន្ធស្រោចស្រព) Hiring workers (ONLY for rice cropping inside the irrigation scheme)

	រដូវប្រាំង DRY SEASON		រដូវវស្សា WET SEASON	
	ចំនួនថ្ងៃ Nb of days	ថ្លៃជួល/១ថ្ងៃ Price	ចំនួនថ្ងៃ Nb of days	ថ្លៃជួល/១ថ្ងៃ Price
ព្រោះស្រូវ Sowing				
បោចស្មៅ Weeding				
ជួសស្រូវ Adjust rice density				
បាចជី Apply fertilizer				
បាញ់ថ្នាំ Apply pesticide / herbicide/...				
រៀបចំដី (បើសិនជួលកម្លាំងមនុស្សមកធ្វើ) Land preparation (if labour only is rented)				
លើកភ្លើង Bunds				
ផ្សេងៗ Others				
ផ្សេងៗ Others				
ផ្សេងៗ Others				

តើអ្នកជួលកម្លាំងពលកម្ម Do you rent labour force:

☐ ប្រចាំថ្ងៃ on daily basis

☐ ប្រចាំខែ per month?

☐ ជួលតាមប្រភេទការងារ per task

☐ ផ្សេងៗ Other. _____

រដូវកាលត្រូវការកំលាំងពលកម្មពីខាងក្រៅច្រើនបំផុត Period of highest need of external labor force: _____

តើអ្នកនៅតែមានភាពងាយស្រួលក្នុងការស្វែងរកកំលាំងពលកម្មពីខាងក្រៅដែលត្រូវការ? Can you always easily find the labour force you need? ☐ បាទ Yes / ☐ ទេ No

ឬក៏វាមានភាពលំបាកនៅក្នុងពេលវេលាខ្លះ? Or is it difficult during some period of time? _____

តើអ្នកលក់កំលាំងពលកម្មដែរឬទេ? Do you sell your labour force? ☐ បាទ Yes / ☐ ទេ No

សម្រាប់ការងារអ្វី? For which tasks? _____

ទៅឲ្យអ្នកណា? To whom? _____

មួយឆ្នាំធ្វើការបានប្រហែលប៉ុន្មានថ្ងៃដែរ? How many days per year approximatly? _____

បានថ្លៃប៉ុន្មាន? At what price? _____ រ/ថ្ងៃ KHR/ day ឬក៏ or _____ រ/ការងារ KHR/task

គ្រឿងយន្តកសិកម្ម MECHANIZATION (for rice inside irrigation scheme)

តើអ្នកប្រើប្រាស់អ្វីដើម្បីរៀបចំដី (សម្រាប់ដីស្រែក្នុងប្រព័ន្ធស្រោចស្រព)?

What do you use for soil preparation (for rice field inside the scheme)?

		ភ្ជួរ Ploughing	រាស់ Harrowing	លើកភ្លឺ Bunds	ពង្រាបដី Land leveling
គោ/ក្របី Cattle/Bufaloes	<input type="checkbox"/> របស់ខ្លួនឯង owned (ចំនួន Nb:.....) <input type="checkbox"/> ជួលគេ rented	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
គោយន្ត Hand tractors	<input type="checkbox"/> របស់ខ្លួនឯង owned (ចំនួន Nb:.....) <input type="checkbox"/> ជួលគេ rented	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
ត្រាក់ទ័រ Tractor	<input type="checkbox"/> របស់ខ្លួនឯង owned (ចំនួន Nb:.....) <input type="checkbox"/> ជួលគេ rented	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
ឧបករណ៍ពង្រាប ដី (ឡេស័រ) Land leveling equipment (laser)	<input type="checkbox"/> របស់ខ្លួនឯង owned (ចំនួន Nb:.....) <input type="checkbox"/> ជួលគេ rented				<input type="checkbox"/> <input type="checkbox"/>
ធ្វើដោយដៃ Manually				<input type="checkbox"/>	<input type="checkbox"/>

ឧបករណ៍គ្រឿងយន្តតូចៗផ្សេងទៀត Other small mechanical equipments:

- ម៉ាស៊ីនបូមទឹក Motor-Pump (មានប៉ុន្មាន How many: _____ ☐ របស់ខ្លួនឯង owned / ☐ ជួលគេ rented)
- ម៉ាស៊ីនបាញ់ថ្នាំ Sprayer (មានប៉ុន្មាន How many: _____ ☐ របស់ខ្លួនឯង owned / ☐ ជួលគេ rented)
- ម៉ាស៊ីនព្រោះស្រូវ/បាចជី Duster for sowing or fertilizer application (មានប៉ុន្មាន How many: _____ ☐ របស់ខ្លួនឯង owned / ☐ ជួលគេ rented)

ឧបករណ៍ច្រូតកាត់ Harvesting:

- ម៉ាស៊ីនច្រូតកន្ត្រៃ Cutter/harvester (How many: _____ ☐ របស់ខ្លួនឯង owned / ☐ ជួលគេ rented)
- ម៉ាស៊ីនច្រូត Combine-harvester (How many: _____ ☐ របស់ខ្លួនឯង owned / ☐ ជួលគេ rented)
- ម៉ាស៊ីនបោក Thresher (How many: _____ ☐ របស់ខ្លួនឯង owned / ☐ ជួលគេ rented)

ការផ្គត់ផ្គង់ធាតុចូល Inputs Supply:

ឈ្មោះធាតុចូល Name of inputs	ទិញពីអ្នកណា?/ ដេប៉ូ? From whom?/outlet?	ទីតាំងនៅណា? Where?	របៀបបង់លុយ Mode of payment
គ្រាប់ពូជស្រូវ Paddy Seed			<input type="checkbox"/> ដល់ដៃ Cash / <input type="checkbox"/> ជំពាក់ credit
ជី Fertilizer			<input type="checkbox"/> ដល់ដៃ Cash / <input type="checkbox"/> ជំពាក់ credit
ថ្នាំពុល/ថ្នាំស្បៅ Pesticide/herbicide			<input type="checkbox"/> ដល់ដៃ Cash / <input type="checkbox"/> ជំពាក់ credit

ដើមទុន/ឥណទាន CAPITAL / CREDIT

ដើមទុនប្រតិបត្តិការ Working capital

ដើមទុនផលិតកម្មទាំងអស់ជាដើមទុនរបស់កសិករផ្ទាល់? All production costs financed with farmer own capital?

☐ បាទ Yes / ☐ ទេ No

... បើសិនជាទេ តើប្រភពដើមទុនបានមកពីណា if "No": Source of working capital:

ឥណទានស្របច្បាប់ (សាច់ប្រាក់) Formal credit (in cash): ☐ ពីធនាគារ From Bank / ☐ ពីមីក្រូហិរញ្ញវត្ថុ From MFI

ឥណទានក្រៅផ្លូវការ Informal credit (in cash): ☐ ពីអ្នកឲ្យខ្ចីប្រាក់មួយណា? From informal money lenders?

☐ ពីក្រុមគ្រួសារ/ញាតិមិត្ត From family / relatives

- ☐ ឥណទានពីអ្នកទិញស្រូវ (បង់លុយមុន/កសិកម្មតាមកិច្ចសន្យា) Credit from paddy buyer (pre-financing / “contract farming”)

(បើកសិកម្មតាមកិច្ចសន្យា សូមពន្យល់បន្ថែមពីកិច្ចព្រមព្រៀង Explain the agreement in this case:

.....
.....)

- ☐ ឥណទានពីអ្នកផ្គត់ផ្គង់គ្រាប់ពូជ Credit from seed supplier:
- ☐ ឥណទានពីអ្នកលក់ធាតុចូល (ជី/ថ្នាំពុល) Credit from inputs (fertilizer / pesticide) supplier:
- ☐ ឥណទានពីអ្នកផ្តល់សេវាកម្ម (ត្រាក់ទ័រ.....) Credit from service provider (tractors,.....):
- ☐ ផ្សេងៗ Other: _____

ប្រព័ន្ធផលិតកម្ម CROPPING SYSTEM

		ផ្ទៃដី Surface	ទិន្នផល Yield	ផលផលិត បាន Production	ការប្រែប្រួលទិន្នផល(អប្បបរមា និង អតិបរមា) Variation (minimum and maximum yields)	លក់ទៅឲ្យ Destination of rice produced*	ចំណេញសុទ្ធ /១ហិកតា Net profit/ha
ដើមរដូវវស្សា Early wet season	ពូជVar 1:.....						
	ពូជVar 2:.....						
	ពូជVar 3:.....						
ចុងរដូវវស្សា Late Wet season	ពូជVar 1:.....						
	ពូជVar 2:.....						
	ពូជVar 3:.....						
	ពូជVar 4:						
រដូវប្រាំង Dry season	ពូជVar 1:.....						
	ពូជVar 2:.....						
	ពូជVar 3:.....						

* ទុកហូប[HH]=HH consumption / អ្នកប្រមូលទិញក្នុងស្រុក [LT]=Local traders or collectors / ម៉ាស៊ីនកិនស្រូវ ឬ អ្នកនាំចេញនៅកម្ពុជា [M] Large rice millers or exporters in Cambodia / ល្មើចនាំចេញស្រូវនៅវៀតណាម [EXP] Traders exporting paddy to Vietnam / ផ្សេងៗ [O]=Other.

តាំងពីឆ្នាំណាមកដែលអ្នកចាប់ផ្តើមធ្វើស្រែ ២ ដងក្នុងមួយឆ្នាំនៅក្នុងតំបន់ស្រោចស្រព? Since when did they started to do two cycles in the irrigated area? ចាប់ពីឆ្នាំ YEAR: _____.

តាំងពីឆ្នាំណាមកដែលអ្នកចាប់ផ្តើមធ្វើស្រែ ៣ ដងក្នុងមួយឆ្នាំនៅក្នុងតំបន់ស្រោចស្រព? Since when did they started to do three cycles in the irrigated area? ចាប់ពីឆ្នាំ YEAR: _____.

តើអ្វីដែលជាកត្តាជម្រុញឲ្យមានការផ្លាស់ប្តូរនេះ (ពី១ដង ទៅ ២ ដង ឬ ៣ ដង)? (ចាប់ផ្តើមដោយសំណួរដំបូង)

What are the determining factors leading to this change (from 1 cycle to 2 or 3 cycles)? (open question first)

.....

កត្តា Factors	ចំណាត់ថ្នាក់ Ranking
មានទឹកស្រោចស្រព Water availability	
មានសេវាកម្ម (រៀបចំដី) Service availability (land preparation)	
មានសេវាកម្ម (ម៉ាស៊ីនប្រួត) Service availability (combine harvester)	
មានពូជសម្រាប់ធ្វើស្រូវដូរព្រាំង DS seed availability	
មានធាតុចូលកសិកម្ម Inputs availability	
មានសេវាកម្មឥណទាន Credit services (.....)	
មានចំណេះដឹងបច្ចេកទេសធ្វើស្រែ Technical knowledge	
លែងមានប្រភពរកប្រាក់ចំណូលផ្សេងៗក្នុងរដូវប្រាំង End of other alternative activities in Dry Season (.....)	
ទីផ្សារតម្រូវការ (មានអ្នកទិញចាំឈរទិញ) Market demand (presence of buyers)	
តម្លៃទីផ្សារ / អាចលក់ទៅបានប្រាក់ចំណេញ Market prices / profitability	
ផ្សេងទៀត Other 1	
ផ្សេងទៀត Other 2	

កសិកម្មតាមកិច្ចសន្យា Contract farming?

តើអ្នកមានកិច្ចព្រមព្រៀងជាមួយអ្នកទិញជាមុនដែរឬទេ (តាំងពីពេលចាប់ផ្តើមដាំដំណាំ)? Do you have agreement with buyers in advance (from early stage of the crop)? ☐ បាទ Yes / ☐ ទេ No

បើមាន សូមពន្យល់ If yes, explain:

.....

ដំណាំ/ផលិតកម្មផ្សេងទៀត (មិនមែនស្រូវ) ក្នុងប្រព័ន្ធស្រោចស្រព Other crops / productions (non-rice) inside irrigated scheme:

- ☐ បិញ្ចឹមត្រី Fish raising
- ☐ បិញ្ចឹមបង្កង Lobster raising
- ☐ ដាំឪឡឹក Water melon

- ☐ ប្រើប្រាស់ដីស្រែទុកសម្រាប់វាលស្មៅចិញ្ចឹមគោ/ក្របី Use plot as pasture for cattle / buffaloes
- ☐

អង្គការកសិករ FARMER ORGANISATIONS

សហគមន៍ប្រើប្រាស់ទឹក FWUC

តើអ្នកជាសមាជិកសហគមន៍ប្រើប្រាស់ទឹកដែរឬទេ? Are you member of the Stung Chinit FWUC? ☐ បាទ Yes / ☐ ទេ No

តើសហគមន៍បានផ្តល់សេវាកម្មអ្វីខ្លះ? តើសហគមន៍មានតួនាទីអ្វីខ្លះ? What services does it provide / what are FWUC roles?

តើអ្នកបង់ថ្លៃសេវាកម្ម/ប្រាក់បដិភាគដែរឬទេ? Do you pay service fee / contribution? ☐ បាទ Yes / ☐ ទេ No

បើបង់ តើបង់អស់ប៉ុន្មានដើរក្នុង១ឆ្នាំ? If yes: How much per year?.....

តើអ្នកយល់យ៉ាងណាដែរពីថ្លៃសេវាកម្មនេះ? How about the price of services?

បើមិនបង់ តើមកពីមូលហេតុអ្វីដែរ? If no: Why?

តើអ្នកពេញចិត្តនឹងសេវាកម្មស្រោចស្រពដែរឬទេ? (ការបញ្ចូលទឹកទៅក្នុងស្រែ) សូមដាក់ចំណាត់ថ្នាក់ពី១ ១

មិនពេញចិត្ត និង ៥ ពេញចិត្តណាស់។ Are you satisfied with the service of irrigation (irrigation water supply to the parcels) Are you satisfied with the service? Please rank your score: 1 not satisfy and 5 very satisfy.

① ② ③ ④ ⑤

បើមិនសូវពេញចិត្ត តើមកពីបញ្ហាអ្វី? if not fully satisfied, what is the problem?.....

តើមិនសូវពេញចិត្តតែរដូវវស្សា ឬ រដូវប្រាំង ឬ ទាំងពីររដូវ? Is it mainly for wet season, or dry season or both?

☐ រដូវវស្សា wet season ☐ រដូវប្រាំង dry season ☐ ទាំងពីររដូវ both

តើគុណភាព ក៏ដូចជាការពេញចិត្តទៅលើសេវាកម្មស្រោចស្រពរបស់សហគមន៍ប្រើប្រាស់ទឹកស្ទឹងជីនិតមានដំណើរវិវត្តន៍យ៉ាងណាដែររយៈពេល៥ ឆ្នាំចុងក្រោយនេះ? (កាន់តែកែលម្អ/ឬកាន់តែយ៉ាប់ទៅៗ) How the quality / satisfaction of this irrigation service has evolved since 5 years? (improvement / degradation...)

តើសហគមន៍គួរកែប្រែសេវាកម្មរបស់ខ្លួនដូចម្តេចខ្លះដើម្បីឲ្យកាន់តែប្រសើរឡើង? Which improvement could be made on FWUC services?

សហគមន៍កសិកម្ម Agricultural Cooperative

តើមានសហគមន៍កសិកម្មក្នុងតំបន់នេះដែរឬទេ? Is there an Agriculture Cooperative in the area? ☐ បាទ Yes / ☐ ទេ No

បើមាន If yes:

តើឈ្មោះអ្វីដែរ? What is its name?

តើមានតួនាទី និង ផ្តល់សេវាកម្មអ្វីខ្លះ? What are its roles / services it provides?

តើអ្នកជាសមាជិកដែរឬទេ? Are you a member ☐ បាទ Yes / ☐ ទេ No ហេតុអ្វី? Why?.....

ឈ្មោះ និង ទូរសព្ទទំនាក់ទំនងថ្នាក់ដឹកនាំ (Contact of leaders:)

សកម្មភាពក្រៅកសិកម្ម / កសិកម្មក្រៅប្រព័ន្ធស្រោចស្រព OFF-FARM ACTIVITIES / AGRICULTURE OUTSIDE OF IRRIGATED SCHEME

កសិកម្មក្រៅតំបន់ស្រោចស្រព Agriculture outside of irrigated scheme

- ☐ ផលិតកម្មសត្វ Livestock production (☐ គោ Cattle / ☐ ក្របី Buffalos) ចំនួនក្បាល Number of head _____
- ☐ _____

ប៉ាន់ប្រមាណប្រាក់ចំណូលពីកសិកម្មក្រៅតំបន់ស្រោចស្រព Estimated incomes from agriculture outside of irrigated scheme _____

សូមចាត់ចំណាត់ថ្នាក់ប្រាក់ចំណូលពីកសិកម្ម និង សកម្មភាពក្រៅកសិកម្ម (សម្រាប់គ្រប់សមាជិកគ្រួសារទាំងអស់)

Ranking of incomes of agriculture activities and off-farm activities (for all HH members)

សកម្មភាព Activities	ចំណាត់ថ្នាក់ Ranking
ស្រូវក្នុងប្រព័ន្ធស្រោចស្រព Rice inside scheme	
ស្រូវក្រៅប្រព័ន្ធស្រោចស្រព Rice outside scheme	
កសិកម្មផ្សេងទៀតក្រៅប្រព័ន្ធស្រោចស្រព Other agriculture outside scheme	
ចិញ្ចឹមសត្វ Livestock (<input type="checkbox"/> គោCattle <input type="checkbox"/> ក្របីBuffaloes <input type="checkbox"/> ជ្រូកPig <input type="checkbox"/> មាន់Chicken <input type="checkbox"/> ទាDuck <input type="checkbox"/> ត្រីFish <input type="checkbox"/>)	
ជួលដីឱ្យគេ Land rented out	
សេវាកម្ម: (ត្រាក់ទ័រ ម៉ាស៊ីនច្រូត សេវាកម្មជួសជុល សេវាកម្មព្យាបាលសត្វ ...) Services: (Tractor, combine harvester, repairing, animal health services...)	

ក្រៅពីផលិតកម្មកសិកម្ម (តម្បាញ ជាងឈើ ...) Non-agriculture production (handicraft, carpenter...)	
នេសាទត្រី Fishing	
ការប្រមូលផលធនធានធម្មជាតិ (កាប់ឈើ អនុផលព្រៃឈើ ...) Natural resources collection (logging, NTFP...)	
លក់កំលាំងពលកម្ម / ធ្វើការ (ធ្វើការឲ្យកសិករផ្សេងទៀត) Daily labour / worker (on other farms)	
លក់កំលាំងពលកម្ម / ធ្វើការ (ក្នុងការដ្ឋានសំណង់) Daily labour / worker (in construction sector...)	
ធ្វើការបានប្រាក់ខែជាមន្ត្រីរដ្ឋ ឬឯកជន Formal employment.	
ធ្វើអាជីវកម្មខ្លួនឯង (ម៉ាស៊ីនកិនស្រូវ ជំនួញ Business owner rice mill, trading...)	
អាជីវកម្មតូចតាច (លក់/ជួល/ប្រមូល និង លក់) Small business (selling / retail / collect and sell)	

ផែនការអនាគត FUTURE PERSPECTIVES

តើអ្នកអាចស្មានទុកបានទេថាសកម្មភាពកសិកម្មរបស់អ្នកនៅថ្ងៃខាងមុខនឹងទៅយ៉ាងណាដែរ ? How do you foresee the future of your farming activities:

(នៅក្នុងប្រព័ន្ធស្រោចស្រព/ក្រៅប្រព័ន្ធស្រោចស្រព) (inside the irrigation scheme / outside the irrigation scheme)

ការស្នើសុំ/សំណូមពរ PROPOSITION/REQUEST

តើអ្វីដែលជាបញ្ហាប្រឈម/ឧបសគ្គដែលបានជួបប្រទះនៅក្នុងផលិតកម្មកសិកម្មក្នុងតំបន់ស្រោចស្រពបច្ចុប្បន្ន ?

What are the constraints / Obstacles encountered in agriculture production inside the irrigated scheme?

តើសេវាកម្មកសិកម្មអ្វីខ្លះដែលគួរកែលំអរនៅពេលខាងមុខ (សេវាកម្មដែលមានតម្រូវការបំប៉ន) ?

What could be improved for **services in agricultures** (Services required)?

ចប់/End

7.6. ANNEX 6: Evolution of rice cropping in Stung Chinit

Period	2007-2008	2009-2014	2015-2018	2019-2021
Production cycles	<ul style="list-style-type: none"> 1 cycle, Start to do the dry season rice, but no harvest due to destroyed by insect. 	<ul style="list-style-type: none"> 1 production cycles for most of farmers, 2 productions only for around 10 farmers in Kvaek village and outsider farmers from Prey Veng province. 	<ul style="list-style-type: none"> 2 production cycles 3 cycle for few pioneer farmers 	<ul style="list-style-type: none"> 2 to 3 production cycles is becoming more widespread practice.
Surface of dry season rice	<ul style="list-style-type: none"> 5 ha (tentative to do the dry season rice, but not harvested because of damages caused by insects) 	<ul style="list-style-type: none"> 5 ha to 270 ha (increase progressively) 	<ul style="list-style-type: none"> 2015: 317 ha - 2016: 875 ha 2017: 1,230 ha - 2018: 1,350 ha 	<ul style="list-style-type: none"> 2019: 1,135 ha 2020: 2,360 ha
Varieties used	Mainly local rice varieties: <ul style="list-style-type: none"> Local seed Phkar Rumduol 	Early wet season rice: <ul style="list-style-type: none"> Non-photosensitive short term rice (IR 66) Wet season rice: <ul style="list-style-type: none"> Local seed Phkar Rumduol Raing Chey Dry season rice: <ul style="list-style-type: none"> IR 66, Sen Pidoo 2010/2011: arrival of 504 variety 2012: arrival of 5451 variety. 	Early wet season rice: <ul style="list-style-type: none"> 504, 5451 Wet season rice: <ul style="list-style-type: none"> Local seed Phkar Rumduol Raing Chey 504 & 5451 Dry season rice: <ul style="list-style-type: none"> 504 5451 	Early wet season rice: <ul style="list-style-type: none"> 504, 5451 Wet season rice: <ul style="list-style-type: none"> Local seed Phkar Rumduol Raing Chey 504 & 5451 Dry season rice: <ul style="list-style-type: none"> 504 5451
Seed supplied chain	<ul style="list-style-type: none"> IR 66 seed provided by project (GRET & CEDAC) Seed provided by PDAFF 	<ul style="list-style-type: none"> New seed variety imported in the target area by farmers from Prey Veng province (504, 5451) Exchange seed from farmers from Prey Veng province 	<ul style="list-style-type: none"> Exchange seed from the neighbor who still have good quality of paddy during harvesting. Buy seed from inputs supplier in the target area 	<ul style="list-style-type: none"> Exchange seed from the neighbor who still have good quality of paddy during harvesting. Inputs supplier supplied seed to farmers (some time in credit)
Soil preparation	<ul style="list-style-type: none"> Animal traction Hand tractors 	<ul style="list-style-type: none"> Animal traction (very few household) Hand tractors Introduction of tractor + rotavator. 	<ul style="list-style-type: none"> 2015: Hand tractor, tractor. Equipment to adjust rice density (introduced by Ta Hay, Agronomy Engineer from Kampuchea Kraom) 	<ul style="list-style-type: none"> Use of tractors became largely predominant.

Period	2007-2008	2009-2014	2015-2018	2019-2021
Harvesting	Manual harvesting.	Manual harvesting. Start to use combine harvester from outside zones.	– 2016: Existing of 1 combine harvester in Khley village + 3 from Takeo and Prey Veng	– Rapid increase of availability of combine harvesters in the area.
Practice of rice production	– Transplanting	– Transplanting – Introduction of direct sowing by farmers from Prey Veng provinces	– Transplanting decreases – Direct sowing (manual)	– Direct sowing
Technical support / pioneers	– GRET, CEDAC (application of mechanic control to prevent insect, not use pesticide) – PDAPP	– 2009 Farmers from Prey Veng start to rent land from farmer in the target area to do dry season rice: new seed variety, rice field leveling, dam construction, herbicide, pesticide and fertilizer use (application of green evolution) – 2012: farmers in S. Chinit stop renting land to farmers from Prey Veng and start to produce dry season rice by themselves.	– Ta Hay, Agronomy Engineer from Kampuchea Kraom, representative of agriculture inputs supplier of Vietnam Entrepise (An Yang) at Steung Chinit scheme, provides technical support, selling inputs and rent land to demonstrate on rice production techniques. – Arrival of several company selling agriculture inputs in the target area. Staff of company provide also technical support to farmers on rice production technique. They encourage farmers to use inputs from their companies.	– Staff of inputs supplier company + relay by input distributors in the area. – Facebook
Fertilization	Use of chemical fertilizers in limited quantities.	Use of chemical fertilizers in limited quantities.	– 2016: 6 bag/ha (50kg/bag) – 2017: 8 bag/ha (50kg/bag)	– 2019: 8 bag/ha (50kg/bag) – 2020: 10 bag/ha (50kg/bag)
Yield	Dry season rice: – Less than 2 tons/ha	Dry season rice: – 3-4 tons/ha (by farmers from Prey Veng province)	Dry season rice: – 4 tons/ha	Wet season rice: 3 to 4 tons/ha (fertilizer use: 3 bags) Dry season rice: – 4 to 7 tons/ha
Paddy rice market	Local collectors / middlemen	Local collectors / middlemen	– Buyer from Prey Veng province. – Rice miller in the target area	– Buyer from Prey Veng province. – Rice miller from others provinces – Rice miller in the target area

7.7. ANNEX 7: Framing note for the consultation workshop

7.7.1. Evolutions in regard of the ToR and technical offer of the consortium

a. What was mentionned in the ToR

The terms of reference of the study on services to irrigated agriculture suggest the organisation of multi-stakeholder consultation workshops (one in each country of study) with local actors (decision-makers, operators, service providers and researchers) relevant to the subject of irrigated agriculture services. The workshops will allow to share and discuss the findings of the diagnostic, to prioritize the needs for services and services' improvement and to formulate proposals for such improvements.

The ToR also indicate that the formulation of consolidated operational plan for each study sites will be finalized after the workshops.

b. Proposal in the consortium technical offer

In the consortium's methodological offer, IRAM, ARTE-FACT and BICHE have initially proposed a duration of two-days for each on-site workshops, in order to:

- Present the diagnostic reports, discuss the outcome and fine-tune the conclusions;
- Prioritize the needs, identify the trajectories to be favoured, identify the elements favouring these trajectories;
- Identify support measures / activities and formulate operational plans for services to irrigating farmers.

After this workshop, the consultants are expected to finalize the operational plans.

c. What now seems desirable and realistic to organize, given the findings and context

It is still relevant to organise the final consultation workshop on site. Even if formal restrictions for meetings are on the way to be progressively eased in Cambodia, gathering of people still requires to be handled cautiously because of the risk of Covid-19 contamination, and it is therefore reasonable to limit the number of participants.

We are proposing to organise the final field work in two stages:

First a multi-stakeholder debriefing and consultation workshop (one full day), with the main stakeholders, to present and discuss the main findings and start the reflection on the two subjects enhanced as priorities (if they are confirmed).

Then two half-day focus groups, with the relevant stakeholders to discuss each of the two key topics proposed. The participants will therefore not be exactly the same for the different meetings.

This will allow:

- Not to mobilize all the actors for two full days (therefore easier to fit into their agenda);
- To reduce the number of participants in each meeting (preventive measure in relation to COVID-19), the multiplication of meetings (1 workshop + 2 focus groups) nevertheless allowing a sufficiently broad consultation;
- To adapt more easily to the scheduling constraints of the different actors;
- Through focus groups, focus the discussions on what really interests each of the actors and on the points on which they can make effective contributions.

7.7.2. Approach to endorse the diagnosis and to build the operational plan for services improvement

The validation and finalization of the diagnosis, then the formulation of the operational plan, will be carried out in three stages:

- Stage 1: A multi-stakeholder debriefing and consultation workshop (on site);
- Stage 2: Two thematic focus groups (on site) to deepen the analysis and elaborate operational recommendations and plans;
- Step 3: Final drafting of the operational plan by the consortium team.

a. A multi-stakeholder debriefing and consultation workshop (on site)

Workshop's objectives:

The workshop objectives are the following:

- Rapidly present, debate and validate the main elements of the diagnosis: territorial diagnosis, typology, analysis of service needs, offer and offer/needs adequacy. Share and discuss the SWOT analysis.
- Preliminary focus on the two main proposed subjects (if confirmed) and start to identify the broad lines of an operational plan for the development of services to irrigators or a vision for the development of services to irrigating farmers.

Table 17 next page is a preliminary programme of the agenda of the consultation workshop.

Table 17: Tentative agenda of the debriefing and consultation workshop

TIME	ACTIVITIES / CONTENT	SPEAKER
08h15 – 08h30	<i>Participant welcoming and registration</i>	
08h30 – 08h35	Welcoming remarks by the host of the meeting	Mrs Rom Saroeun FWUC Stung Chinit
08h35 – 08h50	Introduction of the workshop: recall / presentation of the study and of the workshop objectives	Study team: Jean-Marie Brun and Min Sophoan
08h50 – 09h00	Importance and interest of the workshop and further plans for Stung Chinit irrigation scheme by MoWRaM representative.	(will be proposed to H.E. Chhea Bunrith)
09h00 – 10h00	<u>Presentation of diagnostic outcomes:</u> Presentation of the territorial analysis, typology, service mapping and identified issues for improvements, sustainability...	Study team: Jean-Marie Brun and Min Sophoan
10h00 – 10h15	<i>Coffee break</i>	
10h15 – 11h45	<u>Discussion of diagnostic outcomes:</u> Discuss on the main problematic points of the assessment and on the priority issues to address for improvement.	
11h45 – 13h15	<i>Lunch break</i>	
13h15 – 14h30	Focus Topic 1: Long term viability of the irrigation management: identified risks and needs to review the modalities of service organisation, stakeholders' roles and responsibility, etc. What is at stake? What are the weak points? Preliminary proposal or ideas to consolidate the service provision (to be further developed in dedicated focus group)	Facilitated by Study team: Jean-Marie Brun and Min Sophoan,
14h30 – 15h45	Focus Topic 2: Technical advisory to farmer and better use of inputs for sustainability and natural resources preservation: - current situation and identified risks and stakes; - perception of farmers; - how to improve cost efficiency of input uses - how to reduce collateral impacts on soils, biodiversity, environment... Preliminary proposal or ideas to optimise input use and move toward more sustainable practices (to be further developed in dedicated focus group)	Facilitated by Study team: Jean-Marie Brun and Min Sophoan
15h45 – 16h00	Summary of outcomes and closing	

Foreseen participants: 15 to 25 persons:

- Representative of national technical authorities (MoWRaM) (1 or 2 persons);
- Representative of local authorities (2 to 3 persons, from district and commune level);
- Representative of Provincial or district public technical institutions (PD AFF, PD oWRaM, DOANRE: 3 persons);
- FWUC representatives (3 to 4 persons);
- Farmer and Water Net (1 person);
- Irrigation Service Center (2 persons)
- AFD (1 person);
- Farmer representatives (1 to 3 farmers, beyond FWUC leaders);
- Private sector representatives (1 to 3 persons, notably from inputs suppliers);

- Study team (2 persons).

Venue: Stung Chinit FWUC office (to be confirmed).

b. Two thematic focus groups to deepen the analysis and elaborate operational recommendations and plans

After the first workshop (maybe around two weeks after the first step to leave the time to take into account the conclusions), two focus group discussion will be organised, one on each of the two priority topics identified (if confirmed by the workshop).

The focus groups will gather participants that are more specifically concerned by the topic.

- First focus group discussion: on the review and consolidation of the institutional, organisational and financial model of irrigation management
- Second focus group discussion: on the technical model of rice production and the possibility to increase its profitability and mitigate its negative impact on environment and natural resources.

Each focus group will rapidly recall the element of diagnostic and fine tune them, then will try to focus on the contributions to build an operation plan of action to address the issues and improve the services (or the sustainability of the services).

Participants: About 10 to 12 persons/focus group.

Table 18: Foreseen topics and participants to the two final focus groups

TOPICS	PARTICIPANTS
Irrigation management	FWUC, ISC, FWN, PDOWRAM, Local authorities
Technical cropping model and technical-economic advisory services	FWUC, PDAFF, DOANRE, Input suppliers, farmers.

Venue: Stung Chinit FWUC office (to be confirmed).

c. Preparation of the operational plan for service improvement

Based on the outcomes of the restitution workshop and focus groups' meeting, the study team will proceed with the writing of the Deliverable L2. Its preliminary content is presented in the Text Box 12 next page:

**BOX 12: PRELIMINARY PROPOSAL OF CONTENT OF OPERATIONAL PLAN FOR SERVICES
IMPROVEMENT (REPORT L2)**

Background: key elements of the diagnosis:

- Element of context (territorial assessment)
- Presentation of the irrigation scheme;
- Presentation of the typology of farms and service needs;
- Presentation and analysis of the current offer of services to irrigators on the perimeter;
- Suitability of requests or needs / offers of services;
- Identification of priority issues to address regarding key services.

Operational schemes for the development of services to irrigators on this site:

- Intervention logic or theory of change proposed (including major elements of vision);
- Technical dimensions: what services? for what changes at farm level? at the level of organizations (PO, IO, WUA)? at the sector level?
- Institutional and organizational dimension: which actors involved? what task sharing? what governance arrangements? what institutional changes are required?
- Economic and financial dimension: what service business models? what subsidy needs?
- What policies / projects / programs needed to support this? Which supporters?
- Possible risks.

