

ENHANCING RESILIENCE OF RICE COMMERCIALIZATION IN CAMBODIA

A. Overview

1. The Government of Cambodia (government) is one of the pilot countries participating in the Pilot Program for Climate Resilience (PPCR) - one of three sub-programs of the Strategic Climate Fund (SCF) of the Climate Investment Funds (CIF).¹ The PPCR provides incentives for scaled-up action and transformational change in integrating consideration of climate risks and resilience in national development planning, consistent with poverty reduction and sustainable development goals. The priority sectors for PPCR in Cambodia include water resources, agriculture and infrastructure. In June 2011, the PPCR sub-committee endorsed Cambodia's Strategic Program for Climate Resilience (SPCR) with a funding envelope of up to \$86 million (\$50 million in grants and up to \$36 million in concessional credit). Of this, an allocation of \$10 million (\$5 million loan and \$5 million grant) was endorsed for "Climate Proofing of Agricultural Infrastructure and Business-focused Adaptation" as part of the ADB-funded "Climate Resilient Rice Commercialization Sector Development Program (Rice-SDP)". This document describes in detail the activities aimed at enhancing resilience of the interventions under the Rice-SDP, given Cambodia's vulnerability to potential impacts of climate change. Key Results and Indicators for Success (consistent with PPCR results framework) are presented in Attachment 1.²

2. As presented in the SPCR, the proposed activities contribute to a key output of the investment component II (Enhancing Climate Resilient Agriculture and Food Security) of Cambodia's SPCR. Relevant anticipated outcomes under this component include (i) increased resilience and reduced poverty in the rural, climate-hazard-prone areas, (ii) enhanced protection of coastal areas from storm surge/sea level rise/saltwater intrusion improved resilience of agrobiodiversity, (iii) enhanced and continued water supply during dry season and drought periods, (iv) improved coping mechanisms of small farmers against climate change impacts, (v) enhanced demand-side water efficiency, (vi) improved design, construction/rehabilitation and maintenance of post-harvest facilities to withstand climate risks, (vii) improved institutional structures to respond to climate change, and (viii) new and additional resources for enhancing resilience in agriculture and related infrastructure. Through various activities designed to achieve these outcomes, the capacity for climate-resilient infrastructure by the Ministry of Water Resources and Meteorology (MOWRAM), the Ministry of Land Management, Urban Planning and Construction (MLMUPC) and the Ministry of Agriculture, Forestry and Fisheries (MAFF) - and their provincial equivalents will be enhanced. While data and information on global and regional climate change impacts are improving, it is still challenging to inform the design of engineered structures (primarily irrigation drainage and water management) with precision, especially in Cambodia, where the lack of available climate change impact assessments and data adds to the uncertainty. However, several low risk options and no-regrets resilience measures such as agricultural land-use zoning, irrigation system rehabilitation, land leveling and the more innovative piloting of a weather-indexed insurance scheme may be undertaken.

B. Climate Change Impacts on Rice Production Systems in Cambodia

3. Agriculture and water resources are the most important sectors to the Cambodian economy with 80% of its people relying on agriculture for their livelihood. The National

¹ The other two sub-programs of the Strategic Climate Fund are the Forest Investment Program (FIP) and the Scaling up Renewable Energy Program (SREP) for low income countries.

² More details should be referred to the Design and Monitoring Framework in Appendix 1 of the ADB's Report and Recommendations of the President to the Board of Directors (RRP) presented as Attachment 2 to this document.

Adaptation Program of Action³ determined that these two sectors are highly vulnerable to climate change. Increased rainfall variability impacts surface and ground-water availability including potable water supplies, flood protection and irrigation. Likewise, rural infrastructure - irrigation and water management structures, roads, water supplies and sanitation, suffer from the impacts from floods and cyclones. In the Mekong River and its tributaries, climate induced changes in hydrological flow regimes in seasonality, timing and duration will adversely affect sensitive and economically productive wetland ecosystems such as Tonle Sap, and fisheries productivity, a major source of rural livelihoods in Cambodia.

4. The effects of climate change projected for Cambodia include (i) an increase in ambient temperature consistent with the phenomenon of global warming; (ii) a prolonged hot period of the year with a longer and warmer dry season; and (iii) a later, briefer and more intense wet season, resulting in higher levels of precipitation.⁴ Advances in modeling of the determining factors of vulnerability have been made in recent years enabling projections to be based on a larger body of meteorological data, incorporating a growing understanding of weather patterns and the factors that shape them. At present, these models exist at an international or even global scale. The process of generating locally relevant data from wider scale models (downscaling) helps to generate maps that indicate vulnerability and sensitivity and to make more site-specific projections. The Ministry of Environment (MOE) has initiated a downscaling study with assistance of Bogor Agricultural University in Indonesia, the results from which will be made public in late 2012 or early 2013. Uncertainty over projections is further exacerbated by the fact that the extent of human actions in the future, such as industrial emissions and deforestation cannot be projected with precision and the complexity and hence lack of total understanding of their actual effects on the climate, both in global terms and on the local scale.

5. The average temperature has increased since 1960 by 0.8°C, and with it the frequency of unusually hot days and nights has increased as well. A further 0.3-0.6°C increase is expected by 2025. Alternative estimates put the expected warming at 0.7-2.7°C by the 2060s. Temperature increases will be more severe from December to June.⁵ A sustained increase in temperature is evident from Cambodian data amounting to an average increase of 0.13°C per year.⁶ Projections made using climate models consistently point to a rise in temperature. The rise is expected to accelerate after 2030 and will vary within Cambodia, with more rapid increases expected in lower lying, central areas round the Tonle Sap and its lowland margins, and to the northeast. Based on General Circulation Models and assuming a high emissions scenario, an average increase of 0.036°C per year is projected for the central lowland area and northeast, declining to 0.013°C per year to the hilly areas of the south west (such as the Cardamom mountains).⁷

6. Flooding in Cambodia is a natural occurrence and the agro-ecosystems are adapted to seasonal floods. However, climate change induced extreme events cause damage to

³ The preparation of the National Adaptation Program of Action (NAPA) was supported by a grant from the Global Environment Facility to develop a realistically achievable country-driven programme of action and priority activities addressing the needs of Cambodia for adapting to the adverse effects of climate change. It was issued by the Ministry of Environment and endorsed by the Council of Ministers in 2006.

⁴ Mekong River Commission 2009. Adaptation to climate change in the countries of the Lower Mekong Basin: a regional synthesis Report MRC Technical Paper No. 24.

⁵ Featured Articles: Climate Change: Vulnerability And Adaption In Cambodia. The Fish Site. 30 December 2009 (<http://www.thefishsite.com/articles/805/climate-change-vulnerability-and-adaption-in-cambodia>).

⁶ Ministry of Environment (2010). GHG Inventory and Mitigation Study, draft report prepared for Second National Communication on Climate Change. Ministry of Environment, Phnom Penh.

⁷ Ministry of Environment/UNDP Cambodia (2011). Cambodia Human Development Report: The Future of Rural Livelihoods in the Face of Climate Change. Phnom Penh.

infrastructure, as seen during typhoon Ketzana in October 2009. Devastating floods used to occur about every five years (in 1961, 1966, 1978, 1984, 1991, and 1996). Recently, however, damaging floods have occurred every year since 1999, and the worst hit in 2000; possibly due to the combined impact of climate change and inappropriate land use that degrades the environment. There are two major flood types: (i) flashfloods, resulting from heavy downpour upstream on the Mekong River catchment, which affect provinces along the Mekong and the southeastern areas of the country (e.g. in 2001); and (ii) central area large scale floods, resulting from a combination of runoff from the Mekong River and heavy rains around the Tonle Sap, which affect the provinces around the lake and the southern provinces (e.g. in 1996 and 2000). In the past, annual floods produced more benefits than harm with the associated deposition of nutrients from river sediment. More recently, however, peak flooding has caused extensive damage to the wet season rice crop from extended periods of inundation.

7. Of further significance to rice production are projected changes in the seasons and in the distribution of precipitation during the year. A shift in the onset of the wet season and an increase in the intensity of precipitation are projected. These increase risk related to decisions pertaining to the most opportune time to plant rice, which variety to plant, the risks of flooding and consequent crop losses. Further, the wet season is projected to be briefer and the dry season longer, increasing reliance on stored water and improved efficiency of irrigation infrastructure. More uncertainty exists over the timing of seasons and distribution of precipitation than there is over broad temperature changes. The findings of climate modeling on shifts in the seasons and precipitation patterns are sensitive to assumptions on levels of greenhouse gas emissions. For example, under the high emissions scenario, modeling suggests that wet season rainfall may decrease in the coming years (up to 2025) and then increase towards the end of the current century, while under the low emissions scenario, an increase is expected in the shorter term, with a decrease in the second half of the century.

8. Drought is not adequately monitored in Cambodia but has devastating effects for a country, which relies heavily on agriculture. There are four characteristics of agricultural drought in Cambodia: (i) unpredictable delays in rainfall onset in the early wet season, (ii) erratic variations in wet season rainfall onset, amount, and duration across different local areas, (iii) early ending of rains during the wet season, and (iv) common occurrence of mini-droughts of three weeks or more during the wet season which can damage or destroy rice crops without irrigation.

C. Cambodia's SPCR

9. Cambodia's SPCR themes for intervention include (i) climate risk management; (ii) flood and drought management; (iii) coastal resilience; (iv) disaster risk reduction; (v) ecosystem-based adaptation; (vi) business-focused adaptation; (vii) climate proofing of infrastructure including water supply and sanitation, post-harvest facilities and roads; (viii) capacity strengthening for mainstreaming resilience into development planning; and (ix) stakeholder participation. The SPCR for Cambodia has four investment components which will, through hard investments - such as infrastructure improvement, soft investment components - such as policy support and preparation of guidelines, and through capacity building, scale-up activities that will lead to improved climate change adaptation. The four investment components are: (i) promoting climate resilience of water resources and related infrastructure; (ii) enhancing climate resilient agriculture and food security; (iii) improving climate resilient infrastructure; and (iv) providing co-ordination and support for mainstreaming climate resilience into development planning. The second investment component was endorsed for an allocation of \$18 million for two projects: (i) Promoting Climate Resilient Agriculture Forestry, Water Supply and Coastal Resources in

Koh Kong and Mondulkiri; and (ii) Climate Proofing of Agricultural Infrastructure and Business-focused Adaptation, blended with the Climate Resilient Rice Commercialization Sector Development Program, discussed below.

D. Climate Proofing of Agricultural Infrastructure and Business-focused Adaptation

10. The proposed Climate Proofing of Agricultural Infrastructure and Business-focused Adaptation project, blended with the Climate Resilient Commercialization Sector Development Program (Rice-SDP), is proposed to be financed by Asian Development Fund resources in the amount of \$55 million (\$24 million for the Program and \$31 million for the Project). It comprises a Program component (the Program) and an investment Project (the Project). An amount of \$10 million has been allocated by the Strategic Climate Fund under the PPCR to co-finance the Rice-SDP, \$5 million as a grant⁸ and \$5 million as concessional loan. The Project will also be co-financed by the Trust Fund for the Global Agriculture and Food Security Program (GAFSP)⁹ in the amount of \$14.6 million. The Rice-SDP is due for ADB Board consideration in June 2013.

E. Rice-SDP Impact, Outcome, Outputs and Activities

1. Impact and Outcome

11. Rice-SDP comprises a policy-based loan and a project loan. Its impact is increased net incomes of stakeholders along the rice value chain. The outcome is enhanced production of quality rice in Cambodia while preserving the natural resource base.¹⁰ The details are provided in the Report and Recommendations of the ADB's President to the Board of Directors (RRP) in Attachment 2.

2. Outputs

12. Rice-SDP will address key high priority and strategic measures¹¹ stated in the Rice Policy to improve national food security¹² and expand rice export through (i) removing legal and regulatory constraints inhibiting rice commercialization; (ii) improving productivity of paddy crops and consistency in quality of milled rice; (iii) enhancing rice value chain support services; and (iv) addressing risks of climate change through mitigation and adaptation.¹³ Rice-SDP has six outputs. Output 1 relates to the policy-based loan, whereas outputs 2-6 relate to the Project to capitalize on legal and regulatory reforms proposed under the policy-based loan.

13. Output 1 - A Conducive Legal and Regulatory Environment Established to Facilitate Climate Resilient Rice Commercialization. This output will focus on legal and regulatory reforms that (i) promote local seed production and distribution; (ii) strengthen agricultural land management; (iii) strengthen farmers' organizations and promotes contract farming; (iv) facilitate domestic trading and export of milled rice; and (v) improve access to finance. The reform initiatives are described in detail in the Development Policy Letter (Appendix 3 of the RRP) and the Policy Matrix (Appendix 4 of the RRP).

⁸ \$500,000 of the grant was utilized to finance part of the Rice-SDP's design preparation.

⁹ Established by IBRD as trustee.

¹⁰ The design and monitoring framework is in Appendix 1 of the RRP.

¹¹ Policy measures for promotion of paddy production and rice export are in Annex 2 of the Rice-Policy.

¹² Rice-SDP will improve rice productivity and quality, market access, and enhance resilience of natural resources to climate change. This is in conformity with: ADB. 2009, *Operational Plan for Sustainable Food Security in Asia and the Pacific*. Manila.

¹³ Rice-SDP will add weight to the GMS Southern Economic Corridor initiatives to gain maximum leverage from strengthening of the value chains. It will also enhance impact of investment in transport infrastructure by ADB and development partners, which was amounted to \$15 billion as of June 2012.

14. **Output 2 - Agricultural Land-use Zoning Improved.** This output comprises: (i) establishment of land-use zones;¹⁴ (ii) updating rice ecosystems and soil classification maps for identification of suitable rice growing areas; (iii) incorporating agro-ecosystem analyses into commune land-use planning, and (iv) developing the capacity of Ministry of Agriculture, Forestry and Fisheries (MAFF) and Ministry of Water Resources and Meteorology (MLMUPC) to undertake joint work in relation to agricultural land-use planning. Activities under this output will help identify areas that are more suited to rice production while those that pose a threat to the environment and the high-risk flood prone areas can be preserved to maintain the diversity of the ecosystem. Linked to the zoning initiative, technical procedures will be modified to accommodate guidelines for paddy production to ensure sustainable cultivation practices.

15. **Output 3 - Climate Resilient Rice Value Chain Infrastructure Developed.** This output comprises high priority investments in three major rice-producing provinces - Battambang, Kampong Thom and Prey Veng. The investments include: (i) rehabilitation and climate proofing of irrigation systems; (ii) construction of paddy drying and storage facilities; and (iii) construction of seed cleaning, drying, grading and storage facilities. The investments have been identified and prioritized based on provincial development priorities.¹⁵ Irrigation rehabilitation and climate proofing will help increase productivity and cropping intensities. Establishment of paddy drying and storage facilities will accommodate paddy supplies at peak periods after harvest to ensure better quality for processing and retained added value in Cambodia. Construction of seed cleaning, drying, grading and storage facilities will contribute to increased availability of quality rice seed - an integral component of rice quality improvement and a necessary pre-requisite to supply export markets with rice of consistent quality. To ensure these facilities are maintained and operated on a commercial basis, they will be operated by public private partnerships. These mechanisms are necessitated as the investments are relatively high risk for any individual private firm in Cambodia and the highly commercial nature of the investment renders the government an inappropriate institution to operate these facilities.

16. **Output 4 - Enhanced Rice Value Chain Support Services to Improve Quality of Cambodian Rice.** This output comprises: (i) improving the availability and quality of commercial rice seed; (ii) upgrading technical extension material to guide production in the four main rice crops; (iii) capacity building (technical and financial) of mill managers and operators; and (iv) facilitating access to credit by farmers, traders and millers. Activities under this output will improve the quality of paddy and subsequent milled rice and enhance Cambodia's participation in export markets.

17. **Output 5 - Weather-indexed Crop Insurance Piloted.** This output comprises: (i) undertaking a detailed feasibility study to determine the appropriateness of a weather-indexed crop insurance scheme; (ii) designing the operational parameters, product penetration plan, and institutional arrangements; and (iii) piloting the scheme in selected areas in three project provinces. Activities under this output will reduce the risk associated with paddy production and allow farmers to adopt modern production technologies and therefore extend their longer term planning horizon. Since paddy production for sales will become an increasingly important income component of farming households, it will also stimulate further commercialization.

¹⁴ Participatory approach will be used. Program implementation consultant will provide technical assistance to ensure stakeholders including commune councils, farmers and civil society organizations participate in zoning activities in a systematic manner. Independent entities will be engaged to monitor zoning activities together with other safeguards issues.

¹⁵ The list of pre-screened and eligible subprojects is in Supplementary Document 1.

18. **Output 6 - Efficient Program Management and Implementation.** This output comprises: (i) effective project management; (ii) capacity building of the Program Management Office (PMO) and each National Implementation Office (NIO) and Provincial Implementation Office (PIO); and (iii) coordination between policy development and investment activities. These activities will be supported by consulting services to ensure efficient implementation.

F. Rice-SDP's Relevant Outputs and Activities aimed at Enhancing Resilience to Climate Change

19. **A Conducive legal and regulatory environment established to facilitate rice commercialization and enhance resilience.** The Program loan will be applied in part, to strengthen agricultural land-use management and improve the efficiency of irrigation water utilization and as a consequence enhance resilience to climate change. Specifically, the policy development seeks to (i) strengthen the legal framework for agricultural land management, (ii) promote sustainable land management, and (iii) develop land-use zoning. Achievement of the first item will be confirmed by the issuance of the 'Agricultural Land Policy', and MAFF's submission of the draft Law on the Management and Use of Agricultural Land to the National Assembly. For the second, confirmation will be determined by the government having adopted the National Action Program to Combat Land Degradation, whilst for the third, the measures of success include (i) MAFF will have issued the Framework Providing Procedures for Establishing Agricultural Land-use Zones, (ii) MAFF will have completed agricultural soil classification surveys and commune agro-ecological analyses for identification of agricultural land-use zones in 90 communes, (iii) based on the agricultural soil classification surveys and commune agro-ecological analyses, MAFF will have established agricultural land-use zones in 90 communes, and (iv) MLMUPC will have incorporated agricultural land-use zones (provided by MAFF) into 90 commune land-use plans. The thrust of these policy related issues is directed at improving land utilization for rice production so as to ensure that farming practices do not cause further land degradation whilst maintaining the efficiency of water utilization. These address current land- and water-use practices that are exacerbated by the effects of climate change.

20. **Agricultural Land-use Zoning Improved.** With an appropriate legal and policy environment developed under the Program loan, investment funds will be provided to implement agricultural land-use zoning in selected provinces surrounding the Tonle Sap. Funds have been allocated to allow MAFF and their provincial and district agencies to update the previous agro-ecosystem analyses in some 90 communes to identify cropping suitability on the various types of agricultural land. This process takes into account amongst others, topography, soil suitability, water availability and the threat from flooding. With the anticipated increase in precipitation patterns and the availability of shorter maturation rice varieties, alternative cropping windows can be exploited in order to reduce farmers' risk from climate change. The resultant agro-ecosystem zoning maps will then be incorporated into MLMUPC's commune land-use plans to provide a legal basis for the zoning categorization.

21. On a broader scale, satellite imagery will be used to refine the country's rice eco-systems maps. This will utilize existing data to produce an updated national digital map to identify the various rice growing zones by production system (four are recognized in Cambodia). This involves the integration of existing mapping data, imagery, interpretation and ground-truthing. The updated maps will be amalgamated into a comprehensive Rice Ecosystem Map that will provide reliable information for land-use planning by different levels of government, allowing land productivity and environmental considerations to be readily assessed and evaluated, which in turn will guide decisions that optimize land-use. Specific products will be (i) an updated soils classification map in the main rice producing provinces, (ii) a current Rice

Ecosystem Map detailing seasonal crops spatially over time, (iii) a basis for determining rice production exclusion zones based on potential risk from flood and drought and updating these decisions as climate change continues to take place.

22. **Climate Resilient Rice Value Chain Infrastructure Developed.** Being a sector modality design, this component comprises discrete subproject investments that contribute to Rice-SDP's overall objectives and those outlined in the government's Rice Policy. Eligible subprojects have been screened for potential negative impacts on social and environmental safeguards and are considered to be viable investments.¹⁶ Subproject investments comprise a significant works portion with incremental associated soft initiatives to enhance the impact from the civil works. The main types of investment are irrigation rehabilitation, rice seed production, rice seed processing and storage, and paddy drying and storage, the latter two involving public private partnerships for their operation. The climate resilient aspects come by virtue of (i) the nature of the subproject in the case of irrigation rehabilitation to moderate the impact from drier and longer dry seasons and wetter and shorter wet seasons, (ii) the introduction of paddy drying facilities to enable the early harvesting of paddy to be fully exploited (sometimes necessitating the harvest of wet paddy - 30% moisture content), and (iii) development of approaches to design that take account of climate risks and rigorous construction quality assurance to ensure improved resilience of irrigation infrastructure.

23. The resilience of irrigation infrastructure will be enhanced by improved design approaches, construction supervision and will be complemented by land leveling. Design approaches will incorporate capacity building into the development of design criteria, based on site characteristics and consideration of increased frequency and intensity of precipitation, increased severity and occurrence of flooding events and prolonged periods of drought. Specific engineering measures to take into account include (i) adequate provision for interceptor drains and culverts for cross drainage (where schemes are situated in undulating terrain), (ii) larger spillways to cope with more rapid flows of flood water, (iii) where scope exists, increased emphasis on drainage systems associated with irrigation systems, (iv) design of canal cross sections to substantially exceed full supply level, (v) specification of non-dispersing soils for embankment construction, (vi) inclusion of geo-nets for embankment strengthening where warranted, and (vii) provision of surface protection, such as stone pitching or small concrete flow control details to protect structures from scour as flood waters recede.

24. The associated activities will also address the threat of climate change with initiatives designed to build the capacity of the sector to accommodate such changes. Initiatives include the development of technical extension services to promote good agricultural practices that deal with water management and the application of agricultural chemicals, the demonstration of land leveling estimated on about 100 ha for each subproject to improve water-use efficiency, and support for farmer water user communities (FWUCs) in understanding the need for efficient water utilization through water scheduling and improved maintenance regimes.

25. To render infrastructure more tolerant of climate change, detailed designs will be scrutinized by the relevant technical agencies to incorporate higher design standards to accommodate the impact from climate change. For example, reservoir walls will be designed for a 1:50 year flood compared to the existing design frequency of say a 1:20 year event. These reviews will be ratified by the infrastructure engineer appointed under the Program Implementation Consultants (PICs). Where found to be inadequate, they will be returned to the design engineers for modification.

¹⁶ See Supplementary Document 1 of the RRP.

26. **Enhanced Rice Value Chain Support Services to Improve Quality of Cambodian Rice.** Initiatives under this component include (i) quality rice seed production and distribution, (ii) enhanced technical extension material, (iii) enhanced mill management capacities, and (iv) improved access to finance. Items (i) and (ii) have the greatest relevance in addressing the impact of climate change. Seed quality is the basis for improved productivity within the commercial rice producing sub-sector. The tradition of retaining seed from the previous crop leads to a progressive reduction in potential yields as the genetic content of seed material diminishes. As a risk minimization strategy, farmers use the 'free' seed from their previous season's crop as they do not want to risk losing expensive new seed material in the event of a flood. Whilst Rice-SDP is not developing flood tolerant varieties, it will develop a mechanism to ensure seed quality through a certification system for foundation, certified and commercial seed producers, resulting in a more resilient crop. It will also promote incremental production of foundation seed of preferred market varieties as well as certified seed to be grown on experimental research stations or by commercial seed producers. The subprojects will be the means for multiplying this seed into quality commercial seed based on the certification system introduced. Only with the use of quality seed will the subsector be in a position to maximize productivity in a relatively insecure climate environment.

27. The second area of relevance to address the impact of climate change comes with technical information generation and development of knowledge products, six of which have already been prepared on various aspects of rice production. It is proposed to review these technical bulletins and update their content to improve farmers' ability to respond to climate change. The choice of crops, the varieties grown, water management in paddies, preparation of seed beds and the application of agro-chemicals are areas where technical recommendations will be upgraded to accommodate potential climate change impacts.

28. **Weather-indexed Crop Insurance Scheme Piloted.** As highlighted earlier, the importance of quality seed material for the farmers cannot be overemphasized. Farmers' adoption of high quality seeds is, however, constrained on account of limited affordability (quality seeds are available at premium prices), limited resilience to respond to losses resulting from natural events, and uncertainty of compensation when loss does occur. However, if farmers were assured that seeds lost from floods or other disasters would be replaced, (or at least they would have the resources to purchase quality replacement seed), through establishment and adoption an insurance scheme such as the weather-indexed crop insurance (WICI), then their attitudes towards the use of quality seed is likely to change. While the rationale for the design and pilot testing of WICI is clear, the details including its feasibility for its establishment and operation shall be determined and it will need to be tested in selected areas, before it can become fully operational. Given the limited extent and nature of climate data available from MOWRAM, WICI designers, risk assessors and operators would have to know within a certain degree of certainty the nature and incidence of climate events and their possible impact on crops. It would also be important to determine the most appropriate weather index or indexes that would form the basis for the levels that trigger the release of claims (that will be automatically paid, not claimed as a traditional insurance product). This would require accurate and complete meteorological data sets and appropriate infrastructure that would make such data available and accessible. Development and operation of WICI will need the participation of (i) an insurance company, (ii) an appropriate vehicle to collect premiums - possibly a seed supplier or agricultural inputs supplier with capacity to undertake the required tasks, (iii) a financial institution through which the payments can be made, and (iv) a communications strategy and an entity to facilitate the dispatch of notices to insured farmers. A comprehensive

study is therefore envisaged to provide an appropriate response to all these questions. See section G3 for additional details on WICI.

G. Interventions Proposed for SCF Financing and Their Relevance

1. Irrigation Systems

29. Options for improved climate resilience (i) to build or rehabilitate existing irrigation systems and to design them for projected changes in climate; (ii) to improve the availability and use of stream-flow and other data used in planning and designing irrigation and drainage works; (iii) to carry out land leveling on farmers' paddy fields to improve the efficiency of irrigation water use; (iv) to improve the efficiency of irrigation systems operation; and (v) to adapt irrigated agriculture practices, for example by using more drought or flood tolerant varieties.

30. Considerable investment is currently taking place in the expansion and rehabilitation of irrigation schemes in Cambodia. This includes the rehabilitation of those built around the period of civil strife in the 1970's. Much of the work that took place was emergency reconstruction where long term developmental considerations were afforded relatively low importance because of the need to re-establish critical infrastructure. Little was done during that period to review design guidelines and standards, or to undertake river basin studies to guide planning and design of irrigation infrastructure. Attempts have subsequently been made to develop design guidelines and standards appropriate to Cambodian conditions but none have come into regular use or have been formally adopted, as yet.

31. Further, difficulties arise with quality assurance to ensure that designs and standards are applied during construction. Local engineering capacity to monitor and approve construction work in both the public and private sectors is growing but remains insufficient for the combined needs of water management, transport and building infrastructure. The situation results in a range of defects attributable to both design and construction supervision. Examples include water control structures that are not built to exact levels, inappropriately designed structures such as small bridges and culverts, and use of unsuitable materials for embankments and abutments. The establishment of acceptable engineering standards will have a significant impact in terms of climate resilience and constitute a starting point before further enhancements can usefully be made.

32. In many low-lying areas surrounding Tonle Sap and Mekong River, irrigation systems are established on land only slightly higher than the source of irrigation water that is prone to regular flooding. In these areas, irrigation systems are vulnerable to the effects of prolonged soil inundation, resulting in slumping of canal embankments. There is no scope to drain the system until flood-waters recede. Further from the Tonle Sap where elevations are slightly higher and terrain less flat, provision for drainage can be provided in irrigation systems. Except in severe flood conditions, higher peak flows can result in scouring around water control structures. The risks associated with anticipated climate change are summarized in Table 1.

Table 1: Risks and Adaptation Measures for Irrigation Infrastructure

Effects of Climate Change and Variability	Impacts on Irrigation Infrastructure	Climate Change Adaptation Measures
Higher peak flows in canal systems, from more intense rainfall	Volume of water: Capacities of canals temporarily exceeded	Higher capacities of spillways where there is scope to provide these.

Effects of Climate Change and Variability	Impacts on Irrigation Infrastructure	Climate Change Adaptation Measures
		<p>Larger canal cross-sections.</p> <p>Increased provisions for interceptor drains and wider culverts for cross drainage.</p> <p>Increased provision for system drainage (for subprojects situated in undulating terrain).</p> <p>Improved quality control in design.</p> <p>Improved quality control during construction.</p>
	<p>Velocity of water: Increased risk of collapse of canals (especially earthen canals) and scour around water control structures. Potential dislodging of water control structures</p>	<p>Where economically justifiable, grout or line canals to resist scour.</p> <p>Improve surface protection, with concrete flow control details or stone pitching, at sites liable to scour.</p> <p>Improved quality control in design.</p> <p>Improved quality control during construction.</p>
<p>Prolonged inundation as a result of more frequent flood events</p>	<p>Weakening of canal embankments while soil is saturated, causing slumping</p> <p>Alternate cropping windows need to be considered using short maturation varieties</p>	<p>Where economically justifiable, line or partially line canals to resist lateral pressure from saturated soil.</p> <p>Inclusion of geo-nets for embankment strengthening.</p> <p>Improved quality control in design.</p> <p>Improved quality control during construction.</p> <p>Promote alternative varieties and cropping patterns.</p>
<p>Extended dry seasons</p>	<p>Reservoir capacity is insufficient to maintain supplies to command areas in dry season</p>	<p>Raise reservoir walls and associated intake structures.</p> <p>Introduce basin management approaches necessitating changes to water scheduling for irrigation.</p>

Source: Asian Development Bank.

2. Land Leveling

33. Land leveling is a process redistributing topsoil to create a level surface over each paddy field, ensuring the even distribution of water for rice production. Once leveled, less water is needed to achieve the required levels of inundation for the crop. When a field is not level, farmers introduce water to a level needed for rice in the highest area in the field, resulting in inefficient use of the resource. Leveling is performed by a tractor fitted with a grader blade, guided by a laser. A significant reduction in water requirement can be achieved, reducing the amount of water drawn from reservoirs, which makes water available for longer and assists with

adaptation to longer dry seasons. Under Rice-SDP, each of the subprojects will incorporate demonstrations of up to 100 ha per subproject to demonstrate the impact on yield of land leveling estimated at between 15-20%.

3. Weather-Indexed Crop Insurance Development and Piloting

34. According to the World Risk Report 2012, Cambodia ranks 8th among the global top 15 Countries with Highest Risk to the impacts of climate change. This high level of vulnerability has been highlighted in the SPCR for Cambodia (2011), and may be attributed to the impacts of climate change and variability due to high dependence of the Country's economy on climate-sensitive sectors, and low adaptive capacity. As stated in the SPCR, the country's agricultural production system is dependent on the annual flooding and recession of Tonle Sap and is therefore particularly sensitive to potential changes in local climate and monsoonal deviations. Projections based on an analysis of 14 General Circulation Models suggested that, under the high emissions scenario, the rainy season will start later, wet season rainfall will increase but dry season rainfall will decrease and that extreme weather events will become more frequent. These changes may lead to more intense flood pulses and adversely impact agriculture, infrastructure and floodplain vegetation as well as reduce the fertile land area suitable for agriculture. Combined with the problems of low productivity, Cambodia's predominantly rain-fed farming systems are also highly prone to the effects of seasonal climate variability and, in the long term, impacts of climate change. The poorest farmers will bear the brunt of climate change impacts because they live in the more-vulnerable climate risk-prone areas. The impacts of climate change will amplify food security issues. (SPCR 2011).

35. The rice growing communities already face considerable difficulty from climate variability, with severe flooding and significant droughts occurring with increasing frequency. This will be exacerbated by climate change. Many rice growers, particularly small, single household operations and smaller or medium-sized businesses, are highly vulnerable to the financial consequences of catastrophic flood and drought. Given the vulnerability of Cambodia to the impacts of climate change, in particular, that of the agricultural sector, which is dominated by rice, the WICI Scheme may serve as an appropriate adaptation option for the farmers who are vulnerable to such impacts. Under a WICI scheme, indemnity is based on realizations of a specific weather parameter measured over a pre-specified period of time at a particular weather station. The introduction of WICI on a pilot basis allows both insurers and rice growers to become familiar with crop insurance and identify ways of ensuring that insurance can remain of benefit to farmers as well as commercially viable for insurance companies. It has been reported in various studies that WICI works best where and when other services are in place, such as access to credit, improved seeds and inputs, markets and functioning supply chains, and advisory services. Insurance often cannot add value to a farmer's livelihood unless their income can be enhanced through availability of other services.¹⁷ The combination of a program and project interventions under the Rice-SDP provides an ideal opportunity to design and test the WICI Scheme in Cambodia.

36. As the 2011 study by the World Bank study points out, the underlying index to be a sound proxy for loss has to be based upon an objective measure (for example, rainfall, wind speed, temperature etc.) that exhibits a strong correlation with the variable of interest (in this case, crop yield). Furthermore, the weather variable that can form an index must satisfy the following properties: (i) observable and easily measured; (ii) objective; (iii) transparent;

¹⁷ World Bank. 2011. Weather Index Insurance for Agriculture: Guidance for Development Practitioners. Agriculture and Rural Development Discussion Paper 50.

(iv) independently verifiable; (v) reported in a timely manner; (vi) consistent over time; and (vii) experienced over a wide area. Advantages of weather-indexed insurance as identified in the World Bank study, reiterated in several other studies as well, include (i) reduced risk of adverse selection; (ii) reduced moral hazard; (iii) elimination of field loss assessment; (iv) reduced information requirements and bureaucracy; (v) facilitation of reinsurance; (vi) transparency; and (vii) facilitating access to financial services. The study also lists several challenges, which are more significant in the context of developing countries like Cambodia. These include (i) basis risk; (ii) data availability; (iii) integrity of weather stations; (iv) need for farmer/insurer/regulator capacity building and education; (v) currently limited product options for different weather risks; and (vi) research, local adaptation and scalability.

37. The World Bank study goes on to say that while weather-indexed insurance is rather new to agriculture, it holds significant promise when linked to climate change, given the probability of adverse climate related events and the likely frequency and uncertainty of their occurrence. The concept of a WICI has been tested in a number of Asian countries where it has been successful. It was introduced by Sampo Japan Thailand in 2010 in Thailand in cooperation with The Japan Bank for International Cooperation, with the participation of 1,158 farmers in Khon Kaen Province. Following its initial success, Sampo Japan Thailand expanded the sales area of coverage in an effort to mitigate loss suffered by rice farmers due to drought in 5 provinces in Nakhonratchasima on 17 February 2011 and in other four provinces in Northeast Thailand.¹⁸ The Philippines Crop Insurance Corporation has paid an initial amount of P6.61 million to Southern Luzon farmers who suffered damages from extreme ‘*habagat*’ or southwest monsoon rain and typhoon *Gener* which hit the country in August 2012.¹⁹ India has operated a (subsidized) area yield insurance, National Agricultural Insurance Scheme of India for 20 years. The success of the BASIX–ICICI Lombard product sparked broad interest from other insurers, including the state-owned Agricultural Insurance Company of India to enter this market. *Swiss Re* estimates that more than 539,000 Indian farmers have purchased weather indexed insurance to date. The Indian experience has also given rise to similar pilots and feasibility studies that target individual farmers in many countries around the world, including Thailand, Indonesia, Malawi, Kenya, and Nicaragua.²⁰ Despite these successes, however, there is a need for a comprehensive assessment to determine the appropriateness and applicability of WICI in Cambodia.

38. Development of a WICI scheme will be undertaken under Rice-SDP as a means of reducing the risk associated with rice production. The rationale is that farmers are currently reluctant to commit scarce cash resources to buy quality seed material as they are exposed to the vagaries of weather and regularly lose crops due to extended periods of inundation early in their early post germination period. The development of a crop insurance product will allow farmers to replace seed from flood-affected crops without affecting their cash resource base. This will allow farmers to commit resources to buying improved quality seed on an annual basis rather than relying on retained seed from the previous crop that is currently widely practiced with its direct impact on reducing productivity.

39. Discussions with insurance companies and financing institutions in Cambodia have indicated their willing to establish crop insurance programs, but are reluctant to proceed given

¹⁸ Sampo Japan Insurance (Thailand) Co. Ltd. Sales area expansion of Weather Index Insurance. February 22, 2011 (Thai News Release 22 February 2011).

¹⁹ PCIC Administrator. 18 October 2012. (<http://pcic.gov.ph/index.php/news/headline/coop-farmers-in-laguna-occidental-mindoro-get-habagat-payments/>).

²⁰ World Bank. 2011. Weather Index Insurance for Agriculture: Guidance for Development Practitioners. Agriculture and Rural Development Discussion Paper 50.

the poor state of meteorological data at both national and local levels making the assessment of risk and therefore development of premium structures difficult. There is adequate capability within banks and other financial institutions at provincial level to administer a crop insurance program. Moreover, willingness of the farmers to participate and an enabling policy environment would be necessary prerequisites for its operation. Under the Rice-SDP, all these aspects will be analyzed and assessed and the feasibility WICI determined prior to its testing in selected areas.

40. Several factors contribute to the development of an appropriate WICI. These include availability of historical weather data including precipitation and the intensity of precipitation. Such data is not readily available over a wide geographic area in Cambodia as many of the meteorological stations have ceased collecting routine data because of limited resources and failure to maintain measuring equipment. The WICI feasibility study referred to earlier will include a comprehensive assessment of current state of the automatic weather stations in the subproject areas, prime candidates for pilot testing, and make recommendations to upgrade them to the required standard.

41. In order to develop a WICI scheme, several elements need to be covered in order to establish the risk associated with various weather-related events such as flooding in rural areas. There needs to be an insurance entity to assess the risk associated with different levels and extreme weather events. The insurance company needs to establish premiums needed to cover the risk and to affect reinsurance in the event of payments being triggered in the early years of operation. As farmers are most likely unable to find the cash to pay insurance premiums, a mechanism for incorporating these insurance premiums together with the cost of other input supplies and the logical items most used by farmers are either seed material or fertilizers. On this basis, the insurance product will need to develop a mechanism for adding insurance premiums to the cost of input supplies and will therefore need the cooperation of a number of input suppliers, should this be found to be the most appropriate option. Alternatively, options to establish a Trust Fund to address this constraint regarding payment of premiums by poor and vulnerable farmers will be explored. The third element needed is the financial institution to disburse payments when certain conditions trigger payment (being weather indexed, a defined set of circumstances will trigger payment rather than having farmers claim against a policy). The final entity needed is a communication mechanism whereby weather conditions can be communicated to insurance companies in order to trigger payments. This will most likely involve the services of a communication company operating in rural Cambodia such as Mobitel or similar other entity.

42. The development and implementation of the WICI scheme will be undertaken in two phases. Phase 1 will result in the determination of feasibility for introduction of WICI on a pilot scale in Cambodia, and include an assessment of the requirements for its design, establishment and operation in Phase 2. The feasibility study will entail, among other things, assessment of (i) the current status of weather data and monitoring infrastructure and operational capacity; (ii) the availability and accessibility of sound agronomic data to assess crop vulnerability needed to design an index; (iii) the availability and access to financial data to calculate the level of loss per farmer across the area to be covered by the index; (iv) the status of the local insurance industry and relevant public sector and private sector institutions in terms of structures, capacities, experience; (v) the policy environment that will facilitate adoption of WICI; and (vi) stakeholder consultation to assess their willingness to participate. It would also require identification and selection of potential sites and the crops where WICI would be introduced on a pilot scale. The feasibility study will include a phased implementation plan, identifying various

milestones during the course of implementation that would eventually lead to pilot testing of WICI in selected areas in Cambodia in Phase 2.^{21 22}

43. Phase 2 will comprise design of the WICI scheme, upgrading of the required institutional infrastructure and capacity building, identification and selection of potential sites and the crops where WICI would be introduced on a pilot scale. Based on the feasibility study, Phase 2 may include procurement of materials and equipment, upgrading of automatic weather stations and establishing links to World Meteorological Organization Global Telecommunication System, capacity building, and technical expertise.

44. For undertaking the feasibility study, and the design, establishment and testing of WICI, in case it is determined to be feasible, there will be a need for the services of a team of experts led by a weather-indexed crop insurance design and application expert. Other expertise needed to assist the team leader may include meteorology, hydrology, agronomy, financing, institutional analysis, social development, climate change projections and downscaling, and monitoring and evaluation, among others.

45. An internationally reputed firm, working in association with a national firm, will be selected on a quality-based selection for undertaking the feasibility study, and the design, establishment and testing of WICI, should it be found feasible. The selected firm/s will work directly under the Program Management Office (PMO) under the overall guidance of the PICs. The terms of reference are as follows.²³

Phase 1:

46. **Weather data collection, analysis and monitoring infrastructure and capacity** includes assessment of the current status of weather data and monitoring infrastructure and operational capacity and the reliability and quality of weather data. This will include an assessment of the density, security, and quality of the weather station network, including an assessment of the existence and operational capability of the existing network of automated stations that report daily to a central MET Node and are linked to the World Meteorological Organization/Global Telecommunication System, in case such a link exists. Based on the assessment, recommendation will be made to upgrade the network, if needed, to a standard necessary for operation of WICI.

47. **Assessment of the availability and access to sound agronomic data** to assess the level of crop vulnerability needed to design an index that will truly be representative of loss, specific to crops and in relation to the specific variety being planted. This information, once analyzed, will help determine if the whole crop system is amenable to indexing. Alternate options may also need to be explored.

48. **Assessment of availability and access to financial data** will be needed to calculate the level of loss per farmer across the area (the selected subproject area) to be covered by the index. This will cover (i) input costs are based on input usage and unit cost for those inputs; (ii) credit amount as a factor of input costs plus any additional financing that the farmer required;

²¹ In this context, it may be relevant to refer to the World Bank report, Annex 11: Agriculture Insurance Systems Development in Ukraine, which lists 25 steps to develop a standard product/program (Figure A11.4: Steps to Develop a Standard Product/Program).

²² Further guidance for such an assessment is available in World Bank (2011). Weather Index Insurance for Agriculture: Guidance for Development Practitioners. Agriculture and Rural Development Discussion Paper 50.

²³ Based on guidance provided in the World Bank (2011) publication, referred to above.

and (iii) loss of income based on the lost production and a set value per unit of production. Therefore, data will be required on input costs, costs of labor, interest rates, and so on.

49. **Institutional assessment** of the status of the local insurance industry and relevant public sector and private sector institutions, in terms of structures, capacities, experience to underwrite WICI policies, will be undertaken. This will include assessment of capacity building needs, technical assistance that may be required, and willingness of the relevant institutions in offering such services/products.

50. **Assessment of the current legal and regulatory framework** relevant to crop insurance, including weather index-based scheme, should such a system be in place, will be undertaken. In case such a system does not exist, it will be necessary to make recommendations regarding the establishment of a legal and regulatory framework conducive to WICI. The assessment will clearly identify the prerequisites necessary for pilot testing and the need for strengthening the existing frameworks to facilitate pilot testing in selected areas.

51. **Stakeholder consultation** will be undertaken to assess the willingness or otherwise of key stakeholders among the public or private sector agencies, including farm input providers, NGOs or civil society organizations and the potential farmers' beneficiaries. Since implementation of a WICI product requires coordination of a large number of stakeholders and a larger number of activities to be undertaken, the above assessment will facilitate the identification of key players/institutions that will be most appropriate for its implementation. The assessment will also include an assessment of existing capacities of the delivery channels and identify the deficiencies that should be addressed. Based on this assessment, a determination will be made as to the most appropriate delivery mechanisms and the institutions that will be responsible.

52. **Options for setting up a Trust Fund to operate the WICI.** The feasibility study will consider all possible options for operation of the WICI, which will, among others, include (i) public sector administered with the involvement of other government agencies with details for their internal collaboration, (ii) public private partnership, identifying the partners that would be willing to participate, (iii) completely private sector (insurance entity), either national or international or bilateral collaboration, or (iv) setting up of a \$1.0 million Trust Fund operated under a public-private-partnership (PPP) arrangement and overseen and supervised by a Trust Fund Committee representing the public sector, private sector, and donors. In the context of the Trust Fund, possibilities of co-financing by other development partners would be explored. In such a case, the contributors would become members of the Trust fund Committee.

53. The feasibility study will include an appropriate **Monitoring and Evaluation** system for reporting progress, performance monitoring and evaluation will be designed under the feasibility study, and include internal and external audits and the arrangements for such audits. The evaluation would test the robustness of WICI in Cambodia and the potential for up-scaling within the country.

54. The feasibility study will provide details as to the **Implementation Arrangements** for the two phases of the WICI development and pilot testing, including approaches, procedures and criteria for identification and selection of areas for pilot testing, procurement of materials and equipment, arrangements for upgrading the existing meteorological stations to automatic weather stations or installation of new automatic stations and linked to a central node and to the relevant WMO GTS database. The feasibility study will also include the procedures for capacity building at the central, subproject, and local level for the system to be operational and effective.

55. At the conclusion of Phase 1, the feasibility study will be submitted for consideration by ADB and the government. Approval of the feasibility study will trigger the initiation of Phase 2.

Phase 2:

56. **Development of the WICI Scheme:** After completing the above assessments, the consultant/s will (i) review existing weather records as appropriate for a WICI scheme; (ii) carry out a risk assessment analysis relating the incidence of categories of risk from flooding and drought and the impact these will have on crop production; (iii) develop premiums needed for farmers to receive cover under the WICI scheme; (iv) develop trigger points for the payment of monies under the scheme; (v) based on the risk categories developed, define payout levels for each category of event for which the policy will provide cover; (vi) develop the mechanisms for the payment of insurance premiums via a levy on agricultural input supplies to be collected by input suppliers or other possible options; (vii) develop the mechanism with financial institutions for the disbursement of payments under the insurance policy relating to defined levels of weather events; and (viii) develop the objective measures that will be used to trigger insurance payments under the WICI scheme.

57. **Piloting WICI in Selected Areas:** Subject to a positive outcome of Phase 1 and in accordance with the recommendation of the feasibility study agreed by ADB and government, the selected firm/s will carry out the following in Phase 2 activities (i) undertake identification of target sites for pilot testing in the three participating provinces of Kampong Thom, Battambang and Prey Veng; (ii) initiate upgrading of automatic weather stations as recommended under the feasibility study, including delivery and installation of necessary equipment to record weather events; (iii) identify service providers (insurance companies) who express interest in undertaking the pilot testing in selected areas; (iv) develop and disseminate promotional material explaining the conceptual framework and operation of the WICI scheme in the target areas; (v) undertake capacity building through training and workshops targeted at (a) agricultural extension staff in participating provinces and districts, (b) financial institutions involved in the implementation of the pilot; and (c) participating input suppliers in the operations of the scheme; (vi) establish the Trust Fund, should it be found as an appropriate option, or alternative procedures for administration of WICI including collection of premiums and disbursement of the WICI benefits, to operationalize WICI; (vii) ensure appropriate and adequate supervision of implementation of the WICI pilot; (viii) evaluate the results of the pilot, in line with the monitoring and evaluation plan, including structured series of interviews amongst stakeholders involved in the pilot testing on an annual basis; and (ix) consolidate annual survey results into an overall impact assessment of the scheme and make appropriate recommendations for up-scaling or expansion of the WICI in other areas of the country.

H. Public Private Partnerships and Private Sector Participation²⁴

58. Rice-SDP will promote public private partnerships and private sector participation in five areas, including (i) development and piloting of WICI; (ii) irrigation design and supervision accommodating climate change; (iii) capacity development for rice millers; and (iv) agricultural land leveling; and (v) operating lease of grain drying and storage facilities.

59. It is important to note that Rice-SDP will initially carry out its investment activities in three provinces. However, by 2016 and subject to satisfactory implementation, Rice-SDP will be

²⁴ Referred to in the Cambodia's SPCR as "Business-Focused Adaptation" features.

expanded to about 15 major rice-producing provinces throughout Cambodia. Therefore, PPP and private sector participation in five areas listed below will be replicated nation-wide. As a result, investment leveraged from the private sector will be very significant.

60. Development and Piloting of Weather Indexed Crop Insurance. Development and operation of WICI will require participation of (i) an insurance company, (ii) an appropriate vehicle to collect premiums - possibly a seed supplier or agricultural inputs supplier with capacity to undertake the required tasks, (iii) a financial institution through which the payments can be made, and (iv) a communications strategy and an entity to facilitate the dispatch of notices to insured farmers. While the development and testing under Rice-SDP is subject to the feasibility study, WICI, at the rolling-out stage, will draw attention of business entities along the rice/agricultural value chain due to the fact that WICI has become an attractive niche market for the mainstream (re-)insurance firms and related participants including financial services firms, microfinance institutions, agricultural input suppliers, and marketing agencies. It is expected that about 15 local input suppliers, three local financial institutions, and three local marketing agencies will participate into the pilot tests in three provinces by 2016.

61. Irrigation Design and Supervision to Accommodate Climate Change. The screening of irrigation designs to accommodate higher level risks due to climate change is an initiative that will result in skills development on the job for local private sector engineering firms recruited to undertake the detailed design activities. The design skills of these entities will be sharpened through (i) the Rice-SDP's requirements to incorporate climate resilience in the design of canals and water management structures, and (ii) the review by PICs. While these firms are not allowed to participate in civil works bids for the ones they design, by the time civil works bids are called, the overall local capacity will have been made available to implement irrigation subprojects with enhanced climate resilience and efficiency of water-use in mind. There are currently about 30 local private sector engineering firms of reasonable size and capacity to participate in bids for designs and civil works implementation. The initiatives to get them involved in Rice-SDP will sustainably promote private sector participation in climate resilient designs for and construction implementation of irrigation schemes. It is expected that about five local engineering firms will practice commercial design and construction of irrigation system that incorporated climate resilience option by 2019.

62. Agricultural Land Leveling. The proposed initiatives will provide commercial opportunities for land leveling contractors in each province to tool-up for such activities and will be trained in the commercial planning of these contracting enterprises. Nine private contractors will be selected and trained to offer land leveling services in three participating provinces by 2016. It is expected that an estimated 30 private contractors will offer land leveling services at their own initiatives in three participating provinces by 2019 due to the Rice-SDP dissemination of practices and commercial opportunities.

63. Capacity Development for Rice Millers. Rice-SDP will develop the capacity of rice mill operators to accommodate changing patterns of paddy supply induced by climate change. It is evident that cropping patterns are changing and consequently, the operations of the mills need to change significantly in terms of stock movements, drying and storage facilities. Management training provided by Rice-SDP will improve stock management practices and general mill operations of selected millers. Through the Cambodia Rice Millers Association and expansion of Rice-SDP by 2016, the stock management practices that accommodate supply patterns of paddy induced by climate change will be disseminated to rice mills nation-wide. It is expected that about 10 local firms will participate in providing advisory services to rice millers by 2019.

64. **Operating Lease of Grain Drying and Storage Facilities.** Public private partnership (PPP) arrangements will be used for operation of grain drying and storage facilities, i.e., the government will utilize the loan and grant proceeds from ADB and GAFSP²⁵ for construction of the facilities and lease to private sector entities for operation. The proposed strategy is based on a number of facts - (i) the investment in these facilities for the rice sector is a relatively high risk undertaking for the private sector; (ii) development of the rice sector and the export market is in a premature state; (iii) it is difficult to attract private financing for such an unknown investment in Cambodia; (iv) highly commercial nature of the investment renders the government an inappropriate institution to operate the facility; and (v) facility managers must have flexibility in their operations to continually respond to market signals. At a more mature stage of operation, these facilities will be used for operation of the warehouse receipt financing mechanism, whereby financial institutions can lend based on receipt of the products stored in the warehouse. To this end, Rice-SDP can promote better access of millers, exporter, and farming households to formal finance. More information of how the PPP arrangements work is in the Attachment and the PAM.

I. Proposed Allocation of PPCR Resources

65. Two sources of funds are requested from PPCR, a loan in the amount of \$5 million and a grant in the amount of \$4.5 million.²⁶ The loan will be applied to those items considered to have more commercial application whereas the grant will be used to finance those items where the government would not want to borrow the funds - the more innovative, higher risk activities. The loan will be utilized in part financing the purchase of grain drying equipment in the paddy drying and storage facilities (three units in the three participating provinces). It will also be used to finance the land leveling initiatives within subprojects as a demonstration of improved water-use efficiency. Loan funds will also be applied to the miller development initiative whereby progressive millers will learn the skills of improved mill management under a one-on-one consulting arrangement to be implemented by a qualified private entity.

66. The grant will be applied to a proportion (estimated at 30%) of the consulting services to be recruited to support the government in the implementation of the Program to address climate change (in terms of design and construction supervision). The other item to be financed by the PPCR grant is the development and piloting of the WICI scheme. The feasibility study is estimated to cost about \$350,000 while the testing in the three provinces, including procurement of materials and equipment, and training is estimated to cost a further \$1.65 million.²⁷ The pilot will only proceed if a satisfactory design can be developed.

67. Details of the outputs to which the PPCR resources are applied are presented in Table 3. It is proposed the loan and grant will be administered by ADB under the terms of the agreement between the Strategic Climate Fund and ADB.

²⁵ Grain Drying and Storage Facilities will only be financed by ADB and GAFSP.

²⁶ The total grant is \$5.0, of which \$0.5 million has already been utilized in the preparation of Rice-SDP.

²⁷ In case the Trust Fund option is determined to be appropriate for the operation of WICI, the required \$1.0 million will be taken out of this amount.

Table 3: Climate Resilient Output Cost Estimates (PPCR-financed)

Expenditure	Loan Amount (US\$'000)	Grant Amount (US\$'000)
Rehabilitation of 13 irrigation schemes to enhance climate resilience	3,308.6	0
Detailed design and supervision of 13 subproject construction	0	421.9
Land leveling in the areas of 13 subprojects	1,103.0	
Weather-indexed crop insurance developed and tested in three provinces	0	2,000.0
Miller capacity development in three provinces for climate resilience	588.4	0
Consulting services to incorporate climate resilience	0	2,078.1
Total Cost	5,000.0	4,500.0

Source: Asian Development Bank.

68. Summary of consulting services requirements is in Table 4 and detailed terms of reference for program implementation consulting services are presented in the Program Administration Manual (PAM) in Attachment 3.

Table 4: Summary of Consulting Services Requirements

Consultant Team	Person Months required for Rice-SDP	Person Months financed by SCF / PPCR	Relevance to Climate Resilience
1. International Consultants			
a. Business Development & Commercialization Specialist - TL	32	13	Ensure climate resilience is incorporated into program design
b. Rural Infrastructure Engineer//Hydrologist	18	8	Review technical designs
c. Seed Certification Specialist	9	0	n.a.
d. Extension Specialist	8	0	n.a.
e. Land Use Planning/GIS Specialist	8	0	n.a.
f. MIS/Database Specialist	5	0	n.a.
g. Finance Specialist	5	0	n.a.
h. Gender and Social Specialist	8	3	Ensure that gender issues are incorporated in program activities
i. Environment and Climate Change Specialist	12	4	Ensure that natural resources are not compromised by program interventions and that what are initiated accommodate climate change
j. Procurement Specialist	36	16	Procurement of works and consulting services contracts – ensure documents incorporate

Consultant Team	Person Months required for Rice-SDP	Person Months financed by SCF / PPCR	Relevance to Climate Resilience
			measure for climate resilience
k. PPP Establishment Specialist	12	5	Increase private sector awareness of climate resilience
l. Policy Development Specialist	8	3	Policy elements to incorporate climate resilience
Subtotal International	161	52	
2. National Consultants			
a. Rural Infrastructure Engineer/ Hydrologist, D/TL	55	22	Ensure climate resilience is incorporated into program design
b. Seed Certification Specialist	12	0	n.a.
c. Marketing Specialist	8	0	n.a.
d. Community Mobilization Specialist	15	0	n.a.
e. Land Use Planning / GIS Specialist	42	0	n.a.
f. MIS/Database Specialist	16	0	n.a.
g. Business Advisory Development (Finance) Specialist	15	0	n.a.
h. Gender and Social Specialist	24	10	Ensure that gender issues are incorporated in program activities
i. Environment and Climate Change Specialist	27	11	Ensure that natural resources are not compromised by program interventions and that what are initiated accommodate climate change
j. Resettlement Specialist	18	7	Prepare climate resilient resettlement documents
k. Business Development Specialist (Milling)	63	0	n.a.
l. Procurement Specialist	36	16	Procurement of works and consulting services contracts – ensure documents incorporate measure for climate resilience
m. Implementation Support Specialists	143	59	Assist the provinces implement climate resilience in subprojects
Subtotal National	474	125	
Total Consultant Inputs	635	177	

Source: Asian Development Bank.

J. Implementation Arrangements

69. Details of the implementation arrangements for the Rice-SDP are presented in the Program Administration Manual (PAM) in Attachment 3.

70. The government requested ADB to align its support to the Policy for the Promotion of Paddy Production and Rice Export. Therefore, the preparation and implementation

arrangements of Rice-SDP will be aligned to the policy and regulatory structure stated in the Rice Policy. This will help avoid duplication and minimize implementation complexity. Rice-SDP will utilize the established institutional structure for implementation of the Rice Policy. The Committee for Economic and Financial Policies (CEFP) will assume the role of Rice-SDP's Steering Committee and will be chaired by the Senior Minister of the Ministry of Economy and Finance (MEF). MEF will be the Executing Agency (EA). A Program Management Office (PMO) will be established in MEF to manage both the program and investment activities proposed under Rice-SDP. Three National Implementation Offices (NIOs) will be established in MAFF, MOWRAM, and MLMUPC respectively to carry out national initiatives as well as procurement, resettlement, and coordination of provincial investments.

71. Three PIOs will be established in Battambang, Kampong Thom, and Prey Veng provinces to carry out proposed investment activities. One private insurance company will be selected to design and implement the weather-indexed crop insurance pilot. These arrangements are fully aligned with the government's standard operating procedures.²⁸ Implementation arrangements for the project are described in detail in the PAM. The implementation period is June 2013 to May 2019, and the loan closing date is November 2019. It is proposed that ADB will administer the release of PPCR grant and concessional loan funds for which an administration fee will be charged in accordance with the loan and grant administration agreement between ADB and PPCR.

72. Prescreening of eligible subprojects was undertaken during program design during which time, some 30 subprojects were declared eligible for financing that were confirmed as having minimal social and environmental negative impacts. The implementation arrangements require further analysis of these issues as well as consideration of the anticipated more extreme climate events. In the absence of established procedures for adopting design standards, individual firms, with the cooperation of MOWRAM, will be responsible for preparing detailed designs of irrigation works. These will be reviewed by both MOWRAM and by program implementation consultants to make sure that higher design standards are adopted to mitigate against more extreme climate events. Where standards used are too conservative given the likelihood of climate change, designs will be upgraded in order to allow for such events. This applies to all subprojects that rehabilitate irrigation facilities. Through this process, there will be increased awareness of the issues caused by climate change and capacities will be developed amongst the private sector as well of those of review staff of MOWRAM.

²⁸Ministry of Economy and Finance. May, 2012. *Standard Operating Procedures for Externally Financed Project/Programs in Cambodia*. Phnom Penh including financial and procurement manuals.

**Attachment 1: Key Results and Indicators for Success
(Consistent with PPCR Results Framework)**

Results	Indicators
<p>Increased resilience of households, communities, businesses, sectors and society to climate change and climate variability through investments in irrigation subprojects being rehabilitated and climate proofed.</p>	<p>Numbers of people supported by the PPCR-supported Project to cope with effects of climate change as demonstrated by</p> <ul style="list-style-type: none"> • 50,000 farmers will benefit from climate resilient irrigation structures by 2018 (2012 baseline: 0) • Enhanced gender mainstreaming - 30% unskilled laborers employed in the rehabilitation are women by 2018; 30% of construction sub-committee members are women; 2 farmer water user committees established in each irrigation scheme, with women occupying 30% of the management positions. (2012 baseline: 0) • At least 5 local engineering firms will practice commercial design and construction of irrigation system that incorporated climate resilience options by 2019 (baseline: 0). • 100,000 ha of rice producing areas covered by WICI within the three participating provinces by 2017 (50% of the policy-holders is women, of which 10% is from female headed household) (2012 baseline: 0) • 15 local input suppliers, 3 local financial institutions, and 3 local marketing agencies participating into the pilot tests in three provinces (2012 baseline: 0). • Four seed drying and storage facilities constructed by 2017 with a combined storage capacity of 8,000 tons (30% unskilled laborers and 50% administrative staff are women) • Capacity for drying paddy in target provinces extended by 2,000 tons per day by 2018 • Capacity for paddy storage in target provinces extended by 40,000 tons by 2018
<p>Climate responsive investment approaches implemented through land leveling as adaptation demonstrations being conducted in each irrigation subproject.</p>	<p>Quality of and extent to which climate responsive instruments/ investment models are developed and tested, as reflected by</p> <ul style="list-style-type: none"> • 30% of farmers (disaggregated by sex) have leveled their paddy fields in target provinces by 2018 (2012 baseline: 0) • At least nine private contractors in three project provinces engaged and trained to offer land leveling services by 2016 (2012 baseline: 0).

Results	Indicators
Strengthened climate responsive development planning	<ul style="list-style-type: none"> • Twenty private contractors, including 5 led by female entrepreneurs, replicated offering land leveling services at their own initiatives in three participating provinces by 2018 (2012 baseline: 0). • Strengthened capacity of provincial departments in Project provinces in improving efficiency of irrigation water use through land leveling - baseline: 0% paddy land area leveled, target: 15% paddy land area leveled by 2018. <p>Degree of integration of climate change in national, including sector planning, as reflected by:</p> <ul style="list-style-type: none"> • Strengthened capacity of provincial departments in Project provinces in improving efficiency of irrigation water use through land levelling - baseline: 0% paddy land area leveled, target: 15% paddy land area leveled by 2018. • A joint working group including female representatives established by the government to develop agricultural land-use zoning as a climate adaptation strategy; developed and issued a framework providing procedures for establishing agricultural land-use zones, incorporating measures and targets for involving women in planning and decision making
Strengthened adaptive capacity through mill management training initiatives that integrate climate change concerns.	<p>Extent to which vulnerable households, communities businesses and public sector services use improved PPCR supported tools, instruments, strategies, activities to respond to CV&CC, as reflected by:</p> <ul style="list-style-type: none"> • 30% of rice mills in three project provinces equipped with knowledge to address change in paddy supply patterns induced by climate change by 2018 (2012 baseline: 0). • Post-harvest losses reduced from 15% of crop yield in 2012 to 10% of crop yield by 2017. • Enhanced quality and participation of the private sector in providing advisory services to rice millers to address climate change impacts, as reflected by: 10 local firms participating in providing advisory services to rice millers by 2018 (2012 baseline: 0) Increased leverage factor of PPCR funding, reflected by an estimated \$5 million from private sector mills by 2018 to address change in paddy supply patterns induced by climate change (2012 baseline: 0).

Results	Indicators
Strengthened adaptive capacity through developing and piloting weather-indexed crop insurance scheme.	<p>Quality of and extent to which climate responsive instruments/ investment models are developed and tested, reflected by:</p> <ul style="list-style-type: none"> • 100,000 ha of paddy areas in three Project provinces covered by WICI by 2017 (2012 baseline: 0). • 50% of insured rice farmers (i.e., policy-holders) is women. • Enhanced capacities and participation of the private sector in paddy crop risk mitigation, reflected by: 15 local input suppliers, three local financial institutions, and three local marketing agencies participating in crop insurance services by 2017 (2012 baseline: 0).
Improved institutional framework in place through the adoption of sector development program approach encompassing policy and institutional reform and appropriately coordinated climate resilient investments.	<p>Evidence of strengthened government capacity and coordination mechanisms that demonstrate integration of climate vulnerability in national, including sector planning to mainstream climate resilience, reflected by</p> <ul style="list-style-type: none"> • Three important legal documents (a law, a policy and an action program) will be in place by 2016 to address climate change risks and/or adjusted to incorporate climate change risks, including (i) Law on Management and Use of Agricultural Land (ii) Framework providing procedures for establishing agricultural land-use zones; and (iii) National action program to combat land degradation in Cambodia. • Under the guidance of the Committee for Economic and Financial Policies (CEFP), a cross-sectoral mechanism taking into account of climate variability and climate change will be established by 2016 as part of the review and adjustment of the Policy on the Promotion of Paddy Production and Rice Export.

Source: Asian Development Bank.

Attachment 2: ADB's Report and Recommendation of the President to the Board of Directors

Attachment 3: Program Administration Manual