Appendix J Value Chain Analysis

J.1 Overview of Methodology

562. The value chain methodology is a tradition developed from two strains of literature: the business literature on strategy and organization of Porter (Porter 1990) and the literature of global commodity chains promoted by Gereffi (1994; 1999; 1999; 2001; 2002), Gereffi and others (Gereffi and Korzeniewicz 1994; Gereffi, Korzeniewicz et al. 1994; Gereffi, Garcia-Johnson et al. 2001; Gereffi and Kaplinsky 2001; Gereffi, Humphrey et al. 2003) and developed in numerous studies in the late 1990s. The "value chain" is defined by Kapinsky as "the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production, delivery to final consumers, and final disposal after use" (Kaplinsky 1999, pg. 121).

563. Briefly, such analysis focuses on the interaction of actors along each step of the production system (from raw producer to consumer) as well as the linkages within each set of actors (UNCTAD 2000). Such an approach thus considers international trade relations as being part of a series of networks of producers, exporters, importers, and retailers, whereby knowledge and relationships are developed to gain access to markets and suppliers. As UNCTAD notes, such a perspective means that the success of developing countries in value-adding their production lies in the ability of these countries to access these networks (UNCTAD 2000).

564. The role of governance is central to the literature on value chains; that is, who controls the power relationships within the chain. Two types of value chains have been identified in the literature. Producer-driven chains are those in which companies that produce the product control the networks within the chain. As UNCTAD points out, producer-driven chains are most common in capital- and technology-intensive industries where high barriers to entry exist in production (UNCTAD 2000). Buyer-driven chains, by contrast, are controlled by groups that market the product (UNCTAD 2000). In the case of agriculture, there are instance of both types of governance structures, though increased consolidation in the retail sector has led to an increase in the power of retailers in food distribution.

565. UNCTAD remarks that such governance issues are of increasing importance in agriculture, given the greater emphasis on product differentiation, food safety, and product standards required in the competitive market environment (UNCTAD 2000). Such issues place a premium on strong linkages within the value chain between agents within the chain. Two additional elements of the value-chain are also important with respect to agriculture. First, the role of upgrading by upstream actors is an important concept, given that competitiveness is a dynamic, continual process. In the context of value-chain analysis, upgrading takes the form of either developing new, higher-value market niches or by expanding the range of activities employed. For the latter, this could include a manufacturer expanding into distribution or R&D, for instance (UNCTAD 2000). The role of governance structures is important in how such upgrading by suppliers occurs, as is the support of government and other institutions (UNCTAD 2000). The second issue concerns the means by which benefits are distributed within the chain. This refers to the amount of benefit obtained by various actors in the chain as well as ways actors try to improve their position within the chain, through the differentiation of services and roles.

566. Kaplinsky and Morris (2001) observe that in the course of globalization, there has been a perception that the gap in incomes within and between countries has increased. They argue that value chain analysis can help to explain this lacuna, particularly in a dynamic perspective. First, by mapping the range of activities in the chain it provides the capacity to decompose total value chain earnings into the rewards that are achieved by different parties in the chain. Other ways of viewing global distributional patterns provide only partial insights into these phenomena. For example, trade statistics only provide data on aggregate, gross returns rather than on net earnings, and branch-specific analyses (agriculture, industry, services) only capture part of the story. Secondly, a value chain perspective analyses the way in which particular firms, regions and countries are linked to the global economy. This mode of insertion will determine to a large extent the distributional outcomes of global production systems and the capacity which individual producers have to upgrade their operations and thus to launch themselves onto a path of sustainable income growth.

567. A major benefit of value-chain analysis is through the identification of the nature and extent of barriers to entry along the chain. As a result, such an approach is amenable to explain many of the distributional outcomes that occur in the course of globalization as well as the evolution of such relationships over time (Kaplinsky and Morris 2001).

568. Value chain analysis has been applied to the understanding of commodity chains and export strategies in a number of developing countries. Dolan, Humphrey, and Harris-Pascal use this approach to analyze the impact of consolidation and market power in the UK supermarket industry on fresh vegetable suppliers in developing countries (Dolan, Humphrey et al. 1998). The authors note that this commodity chain is a buyer-driven chain, with specifications and standards determined by the supermarkets and enforced upon the suppliers. While this presents opportunities for value-adding by potential exporters who can meet the strict standards of these retailers, numerous challenges exist for suppliers in developing countries. These challenges include producing high-quality produce that is reliably supplied, low cost, ethically produced, and safe, that continually innovates to meet the changing needs of consumers. This has consequently restricted access to these commodities chains. The rewards for such value-adding are significant – the authors note that the price of various types of packaged carrots earn a premium of 7 to 15 times that of ordinary bulk carrots. Yet there is constant pressure among actors in the chain to maintain and upgrade their positions and continually upgrade and innovate to stay ahead of potential competitors. These pressures put exporters in a tenuous position vis-à-vis retailers, who are argued to have greater power and leverage in the chain. As a result, exports and suppliers need to find way to diversify.

569. While the integration of high-value production with retailers in developing countries has positive benefits for developing countries, Dolan, Humphrey, and Harris-Pascal remark that the benefits are mainly concentrated among larger farms and exporters (Dolan, Humphrey et al. 1998). In Kenya, sourcing was once common from smallholders, but has since declined, with less than 20 percent of sourcing by leading exporters coming from smallholders. Reasons given for this decline include problems with credit provision to smallholders, loan defaults, and “side-selling” (selling contracted produce to other buyers) (Dolan, Humphrey et al. 1998, pp. 29-30). Institutional impediments, particularly agronomic practices and post-harvest technologies, are often constraints. Nonetheless, the authors note that there can be an advantage to smallholder suppliers, particularly with respect to the care of production and reduced risks of plant diseases. They also note less supervision of wage labor is required for smallholders. While examples of successful smallholder

sourcing exists, the need for greater control of the supply-chain reduces the reliance on smallholders by retailers.

J.2 Rice Value Chain

J.2.1 Introduction

570. The following section presents an outline of the value chain for rice in Cambodia. It concentrates on the linkages between each of the actors along the value chain, from input supplies for rice production, through to the final milled product and all the associated by-products and value added products derived from rice. While providing a detailed breakdown of the costs, profits and margins along each level of the chain, the analysis identifies the key constraints and linkages at each level of the chain.

571. In general, the marketing chain for rice in Cambodia can be represented in Figure 34. Farmers can either mill their own rice at the local village mill for own consumption (the husk, bran and broken rice being kept by the mill as payment), sold to primary collectors in the local town, or if the farmer has enough surplus paddy they can sell directly to traders or to commercial rice mills. Commercial rice mills in turn can receive paddy from primary collectors, traders, or farmers themselves.

572. Milled rice is then distributed from mills back to collectors and traders and to wholesalers in towns and larger markets. From these wholesalers the rice is distributed to consumers through retailers. Mills are involved directly and indirectly in the export trade, shipping milled rice through transporters to wholesalers in Phnom Penh who then distribute the rice in Phnom Penh and also overseas through Sihanoukville port. Larger mills are fully integrated into this export chain.

573. Cambodia exports the majority of its surplus rice production as paddy to Vietnam and Thailand, by-passing the milling stage. Primary collectors and traders can sell paddy to export traders who act as middlemen guaranteeing payment for the paddy then sold to Vietnamese and Thai traders across the borders.

574. The marketing system for rice and paddy in Cambodia is complex, and discussed in further detail in Section J.2.10.

J.2.2 Rice Production in Cambodia

575. Rice production comprises 84 percent of total cultivated land, and provides 65-75 percent of the population's energy needs. Average growth in rice production has been 5.9 percent for the period 1991-2000, but has been slowing down, with growth from 1996-2000 at 3.1 percent and 2000-2004 at 1.7 percent; see Table 35 and Table 36.

576. Cambodia as only recently moved from rice deficit to surplus; see Table 39 and Figure 24. While the actual volumes of surplus or deficit are under dispute[39], it is generally agreed that Cambodia moved into rice surplus in the 1995-96 cropping year.

577. As Table 36 and Figure 24 show, production of rice has increased around 2.6 percent per year on a long term average basis, while over 2000-2004 production in rice grew only 1.7 percent. Over the same period of time the population is estimated to have

[39] Due to the different post harvest losses, milling recovery and per capita consumption ratios used by different studies.

grown by 1.9 percent per year[40]. Assuming that the amount of rice consumed per capita has not changed, this equates to a 1.9 percent increase in rice requirements. There are potential implications for food security with a 0.2 percent growth in rice production below domestic food requirements[41].

578. The main types of paddy production systems are upland and lowland rainfed rice, deep water floating rice and dry season rice. These can be generally classified as being wet season versus dry season rice; see Table 37. Wet season rice is grown from May to December while dry season rice is grown from December to March; see Figure 23. Dry season rice is usually improved varieties of rice like IR66 and grown for cash income purposes. In contrast, wet season rice is usually traditional varieties cultivated for subsistence and food security purposes. Even though traditional wet season varieties have a lower yield, they fetch a higher price as the quality and taste is better than the dry season improved varieties.

579. Over the period 1992-2004, most of the increase in rice production has come through increases in dry season area production (6.73 percent per year), and yields of wet season rice (4.36 percent per year). The yields of wet season rice increased from 1.2 tonnes per hectare in 1992 to over 1.95 tonnes per hectare in 2003 and thus the increase in yield should be seen in the context of improvements from a very low base. Because access to better wet season variety seeds has been limited, this increase in yield has been due to better access to fertilizer and other inputs (rather than improved varieties of seed).

580. Rice production in Cambodia is mainly conducted under rainfed conditions. Irrigation area for rice was estimated at 473,000 ha in 1997-98 (about 23 percent of total rice area) of which 11 percent is supplemental wet season irrigation, 11 percent is partial dry season irrigation, and about 1 percent is fully irrigated. Double cropping area is also an insignificant quantity, representing about 1 percent of total cultivated area.

581. The total tonnage of wet season rice has increased from 1.87 million tonnes in 1992 to 3.84 million tonnes in 2003, compared with 0.35 million tonnes of dry season rice in 1992 to 0.87 million tonnes in 2003. In 2004 wet season production was 3.13 million tonnes and dry season was 1.038 million tonnes. This indicates that although dry season rice is becoming an important component of rice production in Cambodia (particularly for exports), wet season rice continues to be the mainstay of rice production in Cambodia.

582. Map 1 and Map 2 show the food balance for 2000-2001 and 2001-2002 on a provincial basis (ACI 2002). Of note is the significant provincial variation in food balance, with provinces in the Tonle Sap and Plains regions being in surplus (with the exception of Kandal and Kampong Cham) and provinces in the Coastal and Plateau/Mountainous regions are generally in deficit (ACI 2002). Table 38 and Map 3 to Map 8 show the area of land and production of wet and dry season rice in 2003-2004 while Table 38 shows the same for 2004-2005. With the exception of Takeo, Kandal, Prey Veng and Kampong Cham, very little dry season rice is cultivated in Cambodia; see Map 6 (ACI 2002). Current

[40] Estimates of population growth vary significantly between sources. For example, MOP and NIS MOP and NIS (2004). National Accounts of Cambodia 1994-2003. Phnom Penh, Cambodia, Ministry of Planning and National Institute of Statistics. uses 1.9 percent, MAFF uses 2.2 percent, while ADB ADB (2002). Report on Marketing in the Agricultural Sector of Cambodia. Agriculture Sector Development Program (ADB - TA No. 3695 - CAM). Phnom Penh, Cambodia, Ministry of Agriculture, Forestry and Fisheries, Asian Development Bank. uses 2.5 percent. All that is known is that the 1998 population census reported 11.44 million people.

[41] CIAP notes that slowing productivity gains plus ongoing population growth may see Cambodia slide back into food deficit by the end of 2010 Young, D., R. T. Raab, et al. (2000). "Economic Impact Assessment of the Cambodia-IRRI-Australia Project." Cambodian Journal of Agriculture **3**: 48-52..

levels of yield and cropping intensities in rice production are low compared with similar ecosystems in neighboring countries. In part this is due to mixed seed varieties, poor soil fertility, and low levels of farm inputs such as pesticides, fertilizer and timely water applications (ADB 2002).

J.2.3 Producers
J.2.3.1 Overview

583. The Consultant Team surveyed farmers in four provinces; Kampong Speu, Svay Rieng, Battambang and Kampong Thom. An overview of their production statistics is provided in Table 50 and Table 51. On average, farmers had 4.48 hectares of land, of which 4.11 hectares was devoted to rice production. This is substantially greater than average land holdings for rice producing farmers country-wide and reflects both sampling bias as well as differences across provinces. In Kampong Speu, for example, average rice areas were 1.09 hectares while in Svay Reing they were 8.15 hectares.

584. As shown in Table 51, there are large differences between wet season and dry season production of paddy. Dry season production is carried out over larger areas of land, with higher yields.

585. The following sections detail the characteristics of rice production in Cambodia and specifically for the farmers interviewed by the Consultant Team.

J.2.3.2 Seed Inputs

586. While the varieties of rice grown in Cambodia vary across provinces and seasons, the majority of wet season rice production in Cambodia is based on traditional mixed varieties of seeds and the majority of dry season and early wet season rice production is based on improved varieties of seeds; see Table 37, Figure 23 and Table 40. Overall, improved varieties account for 48 percent of the total planted area across all seasons compared with 52 percent for traditional varieties; see Table 40. This differs across seasons with the majority of wet season rice being traditional varieties (86 percent of planted area and 79 percent of total production) and the majority of dry season rice being improved varieties (97 percent of planted area and 98 percent of total production). The majority of the area under improved variety production consists of IR66 (65 percent of planted area), with smaller areas of devoted to CAR varieties (<1.5 percent of planted area) (Agriculture Quality Improvement Project 2002, pg. 11).

587. The significant increase in early wet season and dry season rice production has been to two main factors. Firstly, access to irrigation has been improved with the introduction of powered pumps, water harvesting and small scale surface irrigation projects. Notably, large-scale irrigation schemes have had little impact on adoption of dry season cropping. Secondly, the promotion of improved varieties of rice, such as IR66, has met with widespread adoption; see Table 41. These are high yielding varieties with quick maturation times, relative disease and pest resistance, and acceptable quality and market price (Young, Raab et al. 2000, pp. 10-11). Importantly, the difficulty in storing IR66 seed from one season to the next has resulted in an expansion of Early Wet Season cropping of IR66 to provide seed inputs for IR66 plantings in the subsequent dry season.

588. While IR66, an IRRI developed variety, is the most prevalent improved variety used by Cambodian farmers, most of the other improved (pure) varieties of seed have been developed by CIAP. Since 1995 CIAP and its successor CARDI have released 12 pure

lines of traditional Cambodian rice under the CAR designation; see Table 42. These varieties are suitable for agroecosystems where farmers grow traditional rice varieties in the wet season. Medium and late duration varieties are generally photoperiod sensitive. While the medium duration varieties flower between mid-October and mid-November, the late duration varieties flower after mid-November; see Table 43. CAR3, CAR6 and CAR12 source populations belonged to the CIAP germplasm collection in Cambodia while the rest were sent to IRRI during the civil war for preservation (Cambodia-IRRI-Australia Project 1997).

589. Despite a relatively late start in seed improvement and purification compared with Viet Nam, the spread of CAR varieties has been swift. By 2000, 11 percent of the total harvested area in 12 provinces was planted to CAR varieties, with Siem Riep, Kampot and Battambang provinces having the highest adoption rates of CAR varieties (ACI 2002).

590. Notwithstanding the swift spread of CAR varieties, the production of certified CAR seeds is limited. In 2000 CARDI produced 5 tonnes of breeder seed, 18.5 tonnes of foundation seed and 9.2 tonnes of certified (graded) seed (ACI 2002). As discussed below, current production rates of the AQIP funded seed companies are around 1400 tonnes of certified seed.

591. Due to the limited capacity of CARDI to produce certified seed for large scale adoption of pure varieties, NGOs and Government companies are involved producing certified seed for sale to farmers. For example, AQIP funded the establishment of 4 seed companies which obtain breeder and foundation seed from CARDI. Through a system of contract growers these seed companies multiply seed to produce enough certified seed for limited sales to farmers.

592. In 2005 the combined AQIP seed companies managed to produce nearly 1400 tonnes of certified seed for sale to farmers, NGOs and government clients. Presently this represents the upper limits of seed production capabilities of the AQIP seed companies due to constraints on the contract farmer side. This amount of seed purportedly can be used for up to 56,000 hectares (transplanting @25kg/ha), down to 28,000 hectares (broadcasting @50kg/ha), however several individual farmers interviewed by the Consultant team have been using AQIP seed at over 100kg/ha with plans to increase seeding rates to 180-200kg/ha

593. The example of the AQIP seed multiplication system shows that although a certified seed industry is still in its infancy, rapid expansion is occurring and more certified seed will become available for farmers in due course. However, there are several constraints to the widespread adoption of certified seed by the majority of farmers. Price is always nominated as a critical factor hampering adoption, but this is not the major constraint.

594. Farmer reasons for the choice of variety (improved versus traditional) appear to be relatively standard. Farmers who choose traditional varieties do so because they are easy to grow, don’t require high levels of inputs and taste better. Farmers who choose improved varieties do so because of the higher yield, shorter duration and are resistant to lodging (Agriculture Quality Improvement Project 2002, pg. 17).

595. AQIP survey results indicate that the existing level of adoption of improved varieties is already very high for dry season and early wet season crops, but that the quality of seed being used is inferior quality. On average farmers only replace their seeds every 4-5 years, resulting in genetically degraded seed with relatively low yield potentials (Agriculture

Quality Improvement Project 2002, pg. 11). As Table 44 shows, farmers still prefer to use their own seed (Farmer Saved Seed – FSS), with 96 percent of seed used in Cambodia being FSS rather than commercially produced Certified Seed (CS)[42]. The source of seed differs between seasons and between varieties. No farmers in the AQIP survey obtained traditional varieties from certified seed sources, despite the emphasis on CAR varieties in the CARDI breeding program; see Table 44. Farmers obtained some seed for their dry season and early wet season production from certified seed sources, but this was only 3-4 percent of total seed used.

596. Table 45 shows that around 7 percent of production is retained as seed, at an average of 272kg per hectare (Agriculture Quality Improvement Project 2002). As broadcasting rates are around 150kg/ha, it is unclear from the AQIP data whether this is all retained for seed use, or whether this includes reserves for animal feed. JICA estimates that around 4-5 percent of paddy is reserved for seed use, and an additional 2 percent is reserved for animal feed (JICA 2001). This corresponds with the 7 percent found by AQIP.

597. As Table 40 shows, yields of improved varieties are only averaging 3.1 tonnes per hectare, which, while being significantly higher than traditional variety yields of 2.2 tonnes per hectare, are substantially below yields in comparable agroecological zones in Viet Nam and Thailand. The low yields are due in part to poor fertilizer application and water management practices as well as inferior quality seed. CIAP noted that germination rates of FSS after 10 months of storage can be as low as 29 percent (CIAP 1999, pg. 169).

598. The relative importance of these factors in affecting yields does not appear to be fully researched. For example, AQIP (Agriculture Quality Improvement Project 2002) notes that low yields are due (in part) to the use of traditional varieties rather than improved varieties, but also notes that the genetic potential of improved seed is low due to the retention of seed over many cropping cycles. AQIP survey results presented in Table 40 and Table 46 indicate that while the yield of improved varieties is 1t/ha greater than that of the traditional varieties, farmers also apply 30 percent more fertilizer to their improved variety crops[43]. Therefore, any argument for the benefits of improved seed over traditional seed is confounded by the higher levels of fertilizer applied to improved variety production systems.

599. As discussed in Section J.2.3.7, for farmers, the cost of seed comprises around 5.24 percent of the total cost of production, including the imputed labor cost; see Table 72. Most farmers use farm saved seed or obtain purified seed from other farmers every few years to generate their seed stocks. Purchases of seed from “official” sources remains low, although increasingly CARDI bred seed is beginning to be disseminated throughout the country.

J.2.3.3 Fertilizer Inputs

600. Between 1979 and 1993 the government was responsible for most of the import and distribution of agrochemicals, in particular, fertilizers and pesticides. Limited amounts

[42] As Table 44 shows, 66 percent of seed if FSS, 12 percent is purchased from other farmers, and 18 percent is from seed exchange with other farmers.

[43] AQIP survey results in Table 46 indicate inorganic fertilizer application rates of between 450-600kg/ha with yields of 2.2-3t/ha. In comparison, application rates in Vietnam are around 400kg/ha with yields of 6-8t/ha. Their results indicate seven different types of fertilizer applied, most with overlapping amounts of NPK concentrations. Most farmers usually apply only 2-3 different types of fertilizer, and it appears that the AQIP results are based on sums of total means rather than conditional means.

were imported and distributed by non-governmental organizations. Fertilizer imports from 1980-1989 during the Vietnamese occupation were of the order of 35-40,000 tonnes per year and from 1991 to 1996 FAO, Japan and ADB made donations of inorganic fertilizer (92,966 tonnes). Between 1993 and 2000 the Ministry of Agriculture, Forestry and Fisheries' Agriculture Inputs Company (AIC) imported and distributed 131,424 tonnes and 89,353 tonnes of various types of fertilizers, respectively.

601. The official imports of fertilizer through Phnom Penh and Sihanoukville ports, which averaged almost 20,000 tonnes per year from 1990-1999. By 1996 the private sector had largely assumed responsibility for fertilizer imports and was seen to be generally quite efficient in terms of amounts, kinds, availability and prices of inorganic fertilizers (Young, Raab et al. 2000, pg. 14).

602. Compared with other countries in Asia, Cambodia has one of the least productive rice growing environments, largely due to the infertile soils. Most soils are acutely deficient in phosphorous and there is widespread nitrogen deficiency (Young, Raab et al. 2000, pg. 13). As a consequence the yield of rice is low and large amounts of fertilizer are needed in order to boost productivity. However, fertilizer inputs are low compared with comparable agroecological zones in Thailand and Vietnam. Fertilizer application rates are around 40kg/ha but AQIP survey results presented in Table 46 indicate that farmers apply 30 percent more fertilizer to their improved variety crops (Agriculture Quality Improvement Project 2002).

603. Part of the low level of fertilizer use is due to the expense of fertilizer. The prices vary between locations, currently ranging from 28-65,000 Riel/50kg sack, and reflect the distance from the Vietnamese border.

604. Most farmers apply available manure in preference to inorganic fertilizer, and only apply inorganic fertilizer when they have sufficient surplus cash to do so. As most of the rice production occurs in the wet season, farmers usually have surplus cash in the beginning of the dry season (after wet season harvest) to afford fertilizer purchases for the dry season crop. However, due to the limited extent of dry season production most farmers do not have surplus cash at the planting of the wet season crop in order to purchase fertilizer for application at this time.

605. AQIP suggested that the reasons for higher fertilizer application rates for improved varieties were (Agriculture Quality Improvement Project 2002, pg. 14):

1. Recognition by farmers of the yield and profit advantages associated with improved varieties.
2. The logistical difficulties of applying fertilizer (especially manure) during the wet season when traditional varieties dominate.
3. The lower risk of crop loss during the dry season (particularly due to flooding) and therefore an increased willingness to invest in inputs such as fertilizer.
4. Farmers growing improved varieties are more likely to be progressive in terms of adopting new methods and are better able to afford a higher level of crop inputs.

606. The main concern about fertilizer raised by farmers and traders is the variability in fertilizer quality and the lack of crop response to fertilizer applications in some instances. The popular belief is that fertilizer contamination, product tampering and substitution and mixing of low quality fertilizer with higher quality fertilizer are the main causes.

607. As discussed in Section J.2.3.7, for farmers, the cost of fertilizer comprises around 18.8 percent of the total cost of production, including the imputed labor cost; see Table 72. Most farmers use limited amounts of fertilizer due to cash constraints. Correspondingly, yields are low.

608. Fertilizer use in the dry season is higher than that of the wet season. In the dry season 31.3 percent of total costs are attributed to the cost of fertilizer while in the wet season it is only 15.2 percent.

J.2.3.4 Pesticide Inputs

609. The sub-decree "Standards and Management of Agricultural Materials" was promulgated in October 1998. However, it is not fully followed and enforced. Pesticides and other agricultural chemicals are available on all markets, and even at communal trading points. The sub-decree requires that whosoever dealing with manufacture, formulation, import, storage, and sales or transactions of agricultural materials in Cambodia (including pesticides, and fertilizers) register the products with the Ministry of Agriculture, Forestry and Fisheries (MAFF). As far as the law is concerned only about six firms have registered. All are international companies from Thailand, Vietnam, Japan, Germany, and Israel.

610. Between 1980 and 1993 official imports of pesticides by the Agricultural Import Company totaled 0.56 million liters and 470 tonnes of pesticides, averaging 40,000 liters and 36 tonnes per year. During 2001 imports of MAFF registered pesticides and herbicides from the 6 registered companies were 63 tonnes and 11,000 liters. However, the volume of pesticides available on markets is far more than this and the Bureau for Agricultural Materials and Standards (BAMS) of MAFF estimates that at least 80 percent of pesticides are smuggled across from Thailand and Viet Nam. Estimates of the amount of pesticides used by farmers is nearly impossible to obtain, given that most of the pesticide imports are unofficial imports through Thailand and Viet Nam.

611. Pesticides are sold under more than one hundred trade names made from 68 common/generic names, mostly consisting of Class IA and IB chemicals[44]. Usually, labels are in Thai, Vietnamese, English, and French, and sometimes German. Hence, most of the farmer users do not know the proper usage and handing of the different types of pesticides.

612. Farmers appear to prefer hazardous pesticides since they deliver immediate effects on pests/insects. There is a lack of understanding about correct application rates and the hazards of mixing chemicals together. Most farmers do not wear protective clothing, and have almost no knowledge of the impacts of the chemicals on their health, consumers, and environment.

613. Use of pesticides is dependent on the growing season. Most farmers do not use much pesticide during the wet season when pest populations are low. However, application rates are higher for the dry season and early wet season when pest populations are at or near the peak of their annual cycle (Agriculture Quality Improvement Project 2002, pg. 15).

[44] A Lutheran World Service survey in 1996 Specht, J. (1996). Pesticides in Cambodia. Phnom Penh, Cambodia, Lutheran World Service. showed that Class IA, and Class IB chemicals had a 70 and 13 percent market share respectively. WHO classifies pesticides in Class-IA (extremely toxic), Class-IB (highly toxic), Class-II (moderately toxic), and Class-III (slightly toxic).

614. As discussed in Section J.2.3.7, for farmers, the cost of pesticides comprises around 2.5 percent of the total cost of production, including the imputed labor cost; see Table 72. Most farmers do not use pesticides on their rice due to cash constraints and because appropriate chemical pesticides are difficult to source in the local market. Pesticide purchased by farmers is usually destined for higher valued crops such as vegetables.

615. As mentioned above, during the dry season pesticide use is higher than in the wet season; comprising 9.8 percent of the total cost of production while there were no observed pesticide usage for wet season crops.

J.2.3.5 Irrigation Inputs

616. The majority of rice production is from rain-fed production systems and in a majority of years, incremental yield due to irrigation is small. The benefits of supplementary irrigation to early wet season or late wet season crops are high in drought years as well as for the production of dry season rice crops or cash crops. Irrigated dry season rice crops usually produce higher yields (1-2 tonnes/ha paddy greater than average wet season rice crop yields) but there is a confounding effect with increased fertilizer use.

617. The use of irrigation is limited due to a widespread disintegration of irrigation infrastructure through years of mismanagement, destruction and neglect. Based on estimates of potential surface irrigation resources, Cambodia is presently only utilizing between 50-60 percent of the potential irrigation resource. As Table 47 shows, if available surface water was fully utilized up to 1.67million hectares could be irrigated. The Mekong would provide 44 percent of this water, while the Tonle Sap tributaries would provide a further 21.5 percent. As Table 47 shows, all but 8.5 percent of the water resources for this would come from the Mekong basin and it uncertain what the implications for downstream users (and countries) would be. Most of the projected water use demand over the next 10 years comes from irrigation users (55 percent), with a further 16 percent coming from increased domestic use.

618. Table 48 shows that in 1996 Cambodia had 946 irrigation systems in place irrigating 256,000 and 143,000 hectares of wet and dry season production respectively. This is only 2.3 percent of the total land area (12.4 percent of wet season and 55.2 percent of dry season cropping area). Of these 946 irrigation schemes, many are not operational or functional. In 1993/94 only 21 percent of the 841 irrigation schemes throughout Cambodia were actually operating (ACI 2002).

619. Of more importance is the potential use of shallow groundwater resources. Table 48 shows that shallow groundwater resources cover 27.6 percent of the total area. Groundwater resources are a potentially important source of irrigation although they have largely been unused for irrigation purposes (most being used for village and family domestic use). Data on the extent of use of groundwater for irrigation is unavailable. The Ministry of Water Resources and Meteorology is responsible for water policy and roughly estimates that 17.6 billion cubic meters of groundwater is available for extraction in Cambodia (ACI 2002). MOWRAM believes that provinces currently using groundwater for irrigation include Prey Veng, Svay Rieng, Takeo and Battambang. The former three use groundwater for rice cultivation, while the latter for fruit tree crops. However, the areas covered are very small. Five districts in Prey Veng, three in Svay Rieng, and two in Takeo are currently using ground water resources (ACI 2002).

620. MOWRAM believes that extensive use of groundwater resources for agricultural irrigation is not feasible due to the low quantity of water, low and variable flow rates, poor recharging capacity, and absence of reliable aquifer (ACI 2002). Table 47 indicates that flow rates vary between 1.5 to 1296m^3 per day, implying that large scale use of groundwater resources is not a feasible option. However, the use of these resources for supplementary irrigation during the early wet season cropping period may be a viable option, due to the limited extent of early wet season production and the economic viability of investment in tubewells for this type of production system.

621. Chea (2002) indicates a significant internal rate of return for tubewell investment in a double cropping system (early wet season and wet season cropping). The data indicate that investment in tubewells for 0.5ha and 1ha plots is certainly economical for farmers, even when different costs of equipment and opportunity costs for labor are taken into consideration. The cost of investment in tubewells has significantly decreased since 1996 when the ADB conducted a pilot project into tubewell irrigation (ADB 1996). In 1996 it cost between US$120-250 to construct a 20-45meter tubewell while in 2000 the cost is US$70-80 (due to the availability of plastic piping in district markets) (Chea 2002). Pump costs have also decreased, from US400-600 to US$150-250 between 1996 and 2000 (Chea 2002).

622. Costs of irrigation are comprised of the cost of hiring pumping equipment, fuel, and labor itself. Out of total costs of production irrigation costs for dry season rice production are around 5.5 percent for pump hire and 18.9 percent for fuel (which is also used for other purposes such as farm machinery operations). During the wet season irrigation use is much lower and mainly for supplementary purposes at the tail end of the wet season to correct for seasonal shortages in rainfall.

J.2.3.6 Labor Inputs

623. Given the dominance of wet season rainfed lowland production, more than 90 percent of the labor usage in rice production is concentrated in the 9 months wet season from May to January (Helmers 1997, pg. 11). As Figure 23 shows, this is compressed into short periods during transplanting and harvest. As with most smallholder farming systems, households frequently experience labor shortages during these period and there is usually a system of hiring or exchanging labor to meet these peak demands. There is some spread in these labor peaks due to the cultivation of different varieties with different cropping schedules ((Helmers 1997, pg. 12).

624. Generally the labor division between men and women are unequal, with men usually tasked with the heavier manual labor of plowing and women undertaking transplanting and general crop husbandry such as weeding. Men are usually involved in task such as applying pesticides and fertilizer, while both men and women are involved in harvesting and post harvest operations.

625. It is a general facet of smallholder farming systems area that farm labor demand is seasonal and opportunities for off-farm work usually exist only during times of peak own-farm demand. In calculating the shadow wage of labor many studies proceed on the basis that the opportunity cost of labor is zero due to the lack of off-farm opportunities. Under this situation it is reasonable to investigate the assumption that the opportunity cost of own household labor is practically zero. Weeding and other maintenance work are usually carried out during slack periods in the household farming cycle, whether this be slack

periods during the day or on a seasonal basis. However, since labor costs (calculated on the basis of a full shadow wage) typically make up 50 percent of the total costs of production, there is a concern that the cost of production will be seriously underestimated if a shadow wage for household labor is not used. The exact wage value used may be subject to debate, but for the purposes of this report the wage rate for hired labor is used as a proxy.

626. As discussed in Section J.2.3.7, for farmers, the cost of labor comprises around 52.9 percent of the total cost of production, including the imputed family labor cost. Most farmers use family labor for agricultural production activities. Weeding (13.9 percent of total costs), harvesting (11.2 percent) and transplanting (11 percent) comprise the bulk of labor costs for rice production.

J.2.3.7 Costs and Margins for Rice

627. Table 52 and Table 53 present information from a survey conduced by ABiC for ACI (2005) on the costs, returns and gross margins for paddy, while Table 54 presents estimates of marketing margins on a regional basis for paddy. From ACI (2005), estimated gross margins for wet and dry season rice are around US$159 and US$194 per hectare, while floating rice is around US$238 per hectare and receding and upland rice are around US$116 and US$109 per hectare respectively. In terms of marketing margins, farmers get around 50 percent of the marketing margin for wet season rice, 71 percent of the margin for dry season rice, and 44 percent of the margin for floating rice.

628. In terms of farm size, Table 57 presents the summary partial budgets for rice production systems while Table 58 to Table 67 present the detailed partial budgets based on ACI (2005) calculations, and include the opportunity cost of household labor. The results are quite different from the ABiC survey, but are presented on a regional basis rather than the national averages calculated in the ABiC survey.

629. For wet season rice in the Tonle Sap, gross margins ranged from US$419 per hectare for small farms down to US$318 for large farms in Battambang. In Pursat, the gross margins ranged from US$331 down to US$143 per hectare for small to large farms respectively.

630. For wet season rice in the Coastal zone, gross margins per hectare in Sihanoukville ranged from US$166 for small farms down to US$77 for medium sized farms, while in Kampot it ranged from US$114 down to US$39 for small down to large sized farms respectively.

631. In the Mekong zone, gross margins for wet season rice in Kampong Cham and Kampong Speu ranged from US$421 for small farms down to negative US$4 for large farms.

632. In the Northeast zone, gross margins for wet season rice in Ratanakiri range from US$71 down to US$2 for medium and small size farms respectively, while in Kratie they are US$181 to US1$78 for the same.

633. For dry season rice, three different partial budgets were calculated; Pursat and Battambang in the Tonle Sap zone, Kratie in the Northeast and Kampong Cham and Kampong Speu in the Mekong. For the Tonle Sap, gross margins per hectare ranged from US$391 for small farms down to $113 for large farms. This compared with US$290 per

hectare for small farms in the Northeast, and US$200 for small farms in the Mekong; which reduced down to negative US$41 for large farms in the Mekong.

634. In all cases, small farms are more profitable than medium or large scale farms, indicating decreasing returns to scale for rice production; see Figure 25.

635. Table 68 to Table 72 illustrates a sample of revenues, costs, gross income, and margins (gross income as a percentage of revenue) for different types of farming systems and commodities assessed by the Consultant's Team during the field work in Kampong Spue, Svay Rieng, Battambang and Kampong Thom. Average gross margins were around $148 per hectare, ranging from a low of $117 in Kampong Thom to a high of $169 in Svay Reing.

636. Gross margins differed significantly between different farmers and between different growing seasons. The gross margin for wet season production across all surveyed households was $150 per hectare while it was $142 per hectare for dry season production.

637. On a percentage of revenue basis margins ranged from 26 percent in Kampong Speu up to 45 percent in Battambang. Gross margin percentages are higher for wet season rice (34 percent) than they are for dry season rice (29 percent).

638. On a cost basis, cash costs represent around 47 percent of total costs while in-kind labor costs represent 53 percent of total costs. It is evident that the contribution of labor to the cost of production cannot be understated. The largest component of total costs is fertilizer purchases (18.8 percent), followed by labor for weeding (13.9 percent), harvesting (11.2 percent), and transplanting (11 percent). Seeds only comprise 5.24 percent of the total cost of production, while fuel comprises 8.7 percent and farm machinery costs are 9.4 percent.

639. The conclusions from analyzing the margins for farmers are the following:

1. Paddy cultivation is generally adding low value.
2. Dryland rainfed agriculture is risky.
3. Margins can be improved by moving to aromatic varieties or intensifying agriculture.
4. Diversification into higher valued crops improves incomes.
5. Contract farming provides higher incomes.

640. These are discussed in detail below.

641. Paddy cultivation is generally adding low value. With average landholding size of around 1 ha, most smallholder farmers (comprising the vast majority of farmers) produce just enough for self-consumption and a slight marketable surplus. In a typical wet season the gross income is about $150/ha. Without much land available and without an additional crop during the dry season, the overall gross margin is low. The land constraint cannot really be removed given the current agrarian structure. Double cropping is either impossible or very risky without access to irrigated water.

642. The dry season paddy cultivation conducted under conditions of rainfed agriculture is very risky, as already mentioned. Moreover, the dry season requires higher material costs (for fertilizers, pesticides, herbicides, and pumping water) than the wet season. As a result, even if some improvements in yield could be obtained through the use of dry season

varieties, the overall outcome in terms of value added can be even lower than during the wet season.

643. Improvement in margins could be obtained by either cultivating aromatic varieties or by intensifying agriculture through the use of irrigation, high yielding varieties, and sound plant nutrient and pest management. The increase in gross income resulting from aromatic varieties is about 20 percent (from $77/ha for CAR4 to $93/ha for Phkar Malis) and for intensified agriculture can be of more than 200 percent (from $77/ha to $249/ha). The increase in margin for aromatic varieties is mainly the outcome of higher prices for the product (Riel 700/kg instead of Riel 500/kg) and the increase in margin for intensified rice is mainly the outcome of increase in yield (5 tonnes/ha instead of 2 tonnes/ha).

644. Diversifying into high value products, such as vegetables, can result in dramatic increases in value. Indications from the field work is that vegetable production can lead to gross income 16 to 30 times higher than in the case of paddy produced during the wet season. Shifting to vegetables and other higher value products is of course partly an issue of technology and partly an issue of market access. The total size of the vegetable market in Cambodia is much smaller than the size of the rice market. However, one should not forget that there is still a large demand for vegetables that is currently met by imports from Viet Nam (estimated at 80 percent of total demand).

645. A well organized contract farming system enables farmers to access credit, inputs, technical advice and marketing information directly from processors or market intermediaries thereby reducing risk and increasing profits. The disadvantages of contract farming are important – including loss of bargaining power, potential reductions in margins, and increased emphasis on improving quality (and associated penalties for non-compliance) – however, the choice to enter into or leave a contract arrangement is there for the farmer to make.

646. There are limited examples of contract farming in Cambodia, despite the potential for dramatic increases in farmer incomes and productivity; see McNaughton et al (2003) for a survey of agribusiness models in Cambodia. An examples examined by the consultant team is the case of organic rice farmers linking with the Angkor Kasekam Roongroeung rice mill. Table 55 and Table 56 present a financial analysis of contract farming activities versus non-contract farming of rice.

647. Under normal conditions, contract farming of rice returns a gross margin of around US$478 per hectare, compared with US$229 for non-contract rice. This is attributed to higher yields (3 t/ha versus 2.5 t/ha) as well as a higher farm gate price. Under drought conditions gross margins for contract rice are US$318 versus US$39, again due to better management conditions providing higher yields. In the case of Angkor Kasekam Roongroeung (AKR), farm gate prices are much higher than normal market prices due to AKR's strategy of restricting competition by ensuring there are no leakages of their Neang Malis seed into the general market. There is no incentive for farmers to sell the seed into the normal market since AK offers R830/kg whereas the market offers R575/kg. AKR has market linkages with buyers in Hong Kong and the EU, and leverages their niche market status to ensure there are no competitors setting up in the domestic milling sector. The AKR case is a good example of how restricting competition (and the continuing threat of new entrants) results in higher returns being paid to farmers to ensure their loyalty to the value chain.

648. The results of the analysis into contract farming indicate that farmers involved in contract farming are able to capture higher returns than those without contracts. Higher returns are achievable due to higher productivity from better management (assisted by targeted extension and the provision of credit and inputs), as well as higher prices from producing a crop to the required specifications of the processor.

J.2.3.8 Constraints

649. The Consultant Team identified several major constraints to increasing efficiency of producers. These are in addition to the constraints identified by JICA (2001) and ACI (2002); see Table 120 and Table 121.

650. Through individual and group interviews, farmers have indicated the following constraints:

1. Production Constraints
    e. Irrigation and water use efficiency
    f. Access and quality of inputs (seeds, breeds, fertilizers, pesticides)
    g. Plant nutrients and protection management
    h. Animal nutrition and disease

2. Marketing Constraints
    i. Access to markets
    j. Market opportunities information

3. Postharvest Technology Constraints
    k. Threshing, drying and storage
    l. Primary processing

4. Capacity Constraints
    m. Business Planning
    n. Establishing linkages among themselves and with the market

5. System-wide Constraints
    o. Credit
    p. Infrastructure (rural roads, electrification)
    q. Deforestation
    r. Land titles

651. These are discussed in more detail in Section J.2.12

J.2.3.9 Service Providers' Constraints

652. Service providers interviewed by the Consultant Team mainly involved those agencies working with farmers and farmer groups. Through individual interviews with public and private/NGO, service providers have indicated the following constraints:

1. Public service providers
    a. Budgetary constraints
    b. Capacity of staff (technical, management, planning, monitoring)
    c. Multiple objectives and limited instruments
    d. Technology dissemination

e. Lack of Irrigation for farmers
f. Coordination among agencies and programs
g. Marketing by farmers

2. NGO service providers
    1. Weak communication and coordination with public agencies
    2. Multiple objectives and limited instruments
    3. Sustainability of activities
    4. Lack of Irrigation for farmers
    5. Technology know how by farmers
    6. Market linkages of farmers

653. These are discussed in more detail in Section J.2.12

J.2.4 Collectors and Paddy Traders

654. Although Cambodia produces surplus paddy, not every farmer produces paddy for commercial sale; see Table 45. Farmers tend to sell surplus paddy immediately at harvest in order to repay debts, the store the rest until they need more money (JICA 2001). The farmers surveyed by the Consultant Team indicated that around 56 percent produced wet season rice for only own consumption, while no farmers produced dry season rice for only own consumption purposes; see Table 51.

655. Depending on the location of farmers to mills, and the amount of rice they have for sale, farmers will sell to either collectors or mills. As Table 49 shows, only around 40 percent of farmers actually sell paddy, and most of this is sold to collectors rather than directly to mills (67 percent versus 20 percent respectively). These percentages differ significantly between provinces, but there is a broad correspondence between sales of paddy and the food balance situation in each province. Farmers in Battambang and Kampong Chhnang sell more of their paddy directly to mills than in other provinces. While in Battambang this is a function of more paddy being offered for sale (a larger quantity offered for sale makes it profitable for farmers and millers to shorten the marketing chain), the quantities offered for sale in Kampong Chhnang are only 1t/ha on average. Average sales per farmer are between 1.6 to 1.7 tonnes per year and this also varies between provinces; see Table 49.

656. The sale of paddy to collectors and paddy traders hampers the ability of mills to separate different varieties of paddy and sell pure variety rice at a higher market price. Much of the wet season rice sold commercially is classified as “Mixed Variety”, and relatively smaller quantities of pure varieties can be found in the marketplaces. Unless all the farmers in a collection area grow the same variety of paddy, or collectors can be convinced that it is profitable to keep separate the different varieties of paddy, sales to collectors and paddy traders will result in mixing. As noted above, there are sales of pure variety wet season rice in marketplaces so there are cases when mixing of varieties does not occur. When millers receive a large or urgent order for a specific variety they contract collectors to purchase this paddy. JICA notes that in this situation the scale of orders is between 20-300 tonnes and millers give collectors 30-70 percent advance payment (JICA 2001).

657. As far as ACI (2002) could ascertain, there are no sales of paddy at the markets in provincial towns. It appears that most paddy is milled in the province of origin (or in a neighboring province). This corresponds with the JICA study, which also noted that regular

inter-provincial paddy trade is observed only at Neak Loeung, Prey Veng Province where a large trader collects mixed variety paddy from Siem Reap, Battambang, Pursat, Kampong Thom, Kampong Cham, Prey Veng and Kandal to supply rice mills in Prey Veaeng and Kampong Cham and Vietnamese traders (JICA 2001).

658. Paddy traders are significantly larger than paddy collectors and generally use collectors to aggregate individual farm lots together. Paddy traders are typically involved in the inter-provincial and cross border trade and have their own trucks. Paddy traders are also involved in the trade of other commodities, such as soybean, mungbean, seasame, cashewnut, and fertilizer. These are carried out on a season basis although some specialization does occur – for example, soybean traders are usually also mungbean traders but potentially do not get involved in the paddy or rice trade.

659. The Consultant Team interviewed several traders in each of the surveyed provinces (Kampong Speu, Svay Rieng, Battambang and Kampong Thom). Table 81 shows the flow of intra- and inter-provincial sales by traders. By far the majority of paddy is sold into Vietnam as well as into the local provincial markets. Figure 29, Figure 30 and Figure 31 show the flows diagrammatically. As far as was able to be ascertained by the team, the direction and destination of the flows have not dramatically changed since the ACI (2002) report although the volumes of the flows have increased in line with increases in farm productivity.

J.2.4.1 Costs and Margins

660. Due to the nature of the job, collectors are very mobile. ACI (2002) only managed to meet with one collector, who arrived at a medium size mill in Takeo while the Team was interviewing the miller. The partial budget for this collector is shown in Table 73. The data indicate that the collector only made $56 for the 6 months to August. The majority of her margin, R15-20/kg or 3.5 percent of the ex-mill price, is taken up by the cost of transportation (R15/kg) and collection of dry season IR66 is only a breakeven activity. Table 73 shows that the gross margin per tonne is only R1500, which equates to a profit margin of 0.35 percent. Table 117 shows that the percentage of the marketing margin accruing to collectors is around 2.6 percent.

661. Partial budgets for traders were calculated by the Consultant team and presented in Table 74 to Table 80. As Table 80 shows, gross margins for traders average 3.1 percent. However, while these margins may appear small, the absolute value of the gross margin is quite large; averaging $10,000 per year.

662. Naturally, the biggest expense of the trader is the purchase of the raw commodity itself, 98.4 percent of total costs. Trading costs such as truck hire/depreciation is around 0.8 percent of total costs, while labor fees are 0.3 percent. Unofficial and official fees are a relatively minor component of the total cost of trading, while “Other Costs” (which includes items such as sacks and bags etc.), is around 0.5 percent of the total cost.

663. The conclusions from analyzing the margins for paddy traders are:

1. Low margins but high income due to volumes
2. Considerable differences amongst traders
3. Most traders are self financing

664. These are discussed in detail below.

665. Gross income from trading activities is much larger than in the case of production activities by farmers, due to volumes of trade. However, Margins are relatively low, suggesting that contrary to commonly held belief there are not monopolies. Traders themselves often complain about too much competition. A study conducted in Battambang by AFD (pers. comm.) has supposedly indicated local monopolies in which farmers become captives of traders. This situation however might be the outcome of interlocking products and credit markets: the trader provides credit to farmers in need and by doing so exercises influence on the price of the product. In most cases observed by the Team there is no credit involved in selling of paddy from farmers to traders and markets appear rather competitive.

666. There are considerable differences among the performance of difference traders. Comparing just two traders of similar size (see the first budgets in both Table 74 and Table 75) the difference in gross income is striking. The main difference seems to be related to storage decisions by different traders. In the case of the first trader in Table 74, she decided to store paddy and was penalized by a sudden drop of prices when she finally put the produce on the market. In the case of the second trader (first budget in Table 75), he was quite skillful in exploiting high price hikes during the postproduction period. There were no noticeable differences in varieties of paddy sold by the two traders. This suggests that trading is a highly risky and specialized occupation. Good knowledge of seasonal prices and the capacity of taking quick decisions in response to market conditions are the key to success.

667. Almost all of the traders self-finance their investment both for working capital requirements and investment capital. The reason is obvious. Given the high cost of capital and the relatively low margins in paddy trade, there is hardly any chance of making a profit in trading after paying the interest on borrowed capital.

668. If, however, lower interest rates were available, it is not clear how trading in paddy could increase substantially at this stage of development in Cambodia and policy environment in the neighboring countries. The reason is that most of the paddy traders either market for the domestic market (which is small and stagnant) or sell to Viet Nam and Thailand. Trade in paddy with either Viet Nam or Thailand seems also to have reached its peak; see Section J.2.10. Unless major policy decisions are made in Viet Nam or Thailand to reduce the cultivated area of paddy, the imports of paddy from Cambodia will continue to be only marginal for those neighboring countries. If, moreover, those countries make policy changes and allow less protected imports of rice, then there could be considerably scope for the growth of the milling industry in Cambodia as well as external trade of rice and domestic trade of paddy, which would then require larger amounts of credit than what self-finance currently allows.

J.2.4.2 Unofficial Fees and Charges

669. Given the interest in the level of fees and charges (both unofficial and official), it is of interest to put these into perspective. To do so, we need to calculate the relative cost of the non-commodity purchased items; i.e. the cost of each item relative to the total trading costs. From Table 80, Truck charges comprise 47 percent of the total trading cost of the surveyed enterprises. This is followed by “Other Costs” which comprise 32 percent, labor costs which are 19 percent, official fees which are 2 percent, and unofficial fees which are 0.04 percent.

670. Official fees are usually parking fees for trucks along the side of the road, as well as income taxes and business license fees. Apart from the parking fees which are accrued according to the volume of trade, the income taxes and business license fees are somewhat negotiable and not all traders pay these fees or even pay according to their value of sales.

671. Unofficial fees for traders have received the greatest attention from Donors as a possible policy area for reform. The issue of unofficial fees has been covered in detail in ACI (2002) and JICA (2001) and it is not the intention of this report to cover these details again. In ACI (2002) it was found that unofficial fees and charges are the equivalent of a 1 percent export tariff and that in the transportation area the fees comprised 50 percent of the total transportation cost.

672. The Consultant Team devoted a significant amount of time to interviewing value chain stakeholders about unofficial fees and charges in the provinces of Kampong Speu, Svay Rieng, Battambang, Kampong Thom, Kampong Cham, Prey Veng, and Banteay Meanchey. In all cases, traders indicated that the practice of paying unofficial fees for intra- and inter provincial transport had all but ceased. While there were still some cases where small bribes of 2-3,000 riel had to be paid to police for minor traffic infringements the large-scale organized levy of charges had ceased.

673. To take the place of the unofficial charges for transportation, several other income generating mechanisms have been introduced such as:

1. Provincial governments had introduced truck weighing stations which charged an “official” amount for what had been previously an “unofficial” charge.
2. Parking fees for loading and unloading trucks along the roadside have been introduced

674. As a typical example, the cost of transportation from Kampong Cham to the Thai border has the following fees and charges for a 20 tonne truck:

1. Truck Weighing Fees – 300,000 riel
2. Ferry Charge – 150,000 riel
3. Parking Fee in Kampong Cham – 15,000 riel
4. Parking Fee in Battambang – 30,000 riel
5. Traffic Infringement Bribes (speeding etc., 2-3000 riel per time), 10-20,000 riel
6. Total Fees – 510,000 riel ($127.50)
7. Transportation Cost (fuel, truck depreciation, etc.) – $172.50
8. Total Transportation Cost - $300

675. As can be seen, the total fees and charges comprise 42.5 percent of the total transportation cost. This is slightly less than the unofficial costs outlined in ACI (2002) but the point is that the unofficial costs have now been transferred into official costs.

676. While the above description relates to the imposition of fees and charges for intra- and inter-provincial trade, the issue of cross-border trade still remains one where the imposition of unofficial costs is carried out.

677. The Consultant Team looked at the unofficial costs being imposed on the Vietnamese and Thai cross-border trade and found that these still remain high.

678. For the cross-border trade with Thailand, Box 22 presents the details of an interview with a chili trader. The fees to cross the border are around $7.50 per tonne while the fees and charges on the Thai side of the border are extremely high depending on the crop and its relative value. For the cross-border trade with Vietnam Box 23 presents the details of an interview with a paddy trader. The unofficial fees just to cross the border are around US$1,000 per 120 tonne boat, or $8.30 per tonne.

Box 22 Unofficial Fees and Charges in the Cross-Border Trade with Thailand

Meeting with a Trader in dried chili - Poipet Town, Battambang

In the year 2000 he moved into trading in dried chili, away from soybean. The tax on soybean is very high at the checkpoint (O. Somag ?? Checkpoint).

He exports dried chili to Thailand. He collects the dried chilli from many traders and middlemen and stores at his warehouse before exporting. Chili is collected from Kampong Cham, Kandal and Battambang. The cost of transportation is 1 Baht per kg from Battambang to the border - on a 7-8tonne truck this is 7-8,000 baht per truck. There are no fees to pay along the road, only parking fees which are 60-70 baht per truck. For the last 3 years there have been no fees.

The ex-warehouse price is 35-39 baht/kg selling into Thailand. There is a 1-2 baht/kg difference between the buying and selling price.

Sales are 80 tonnes per month during the harvesting period (3 months from November - January). Sourced from Battambang. For Kampong Cham and Kandal it is also 80 tonnes per month for the period June-July. For the other months of the year it is around 40tonnes per month.

Selling into Thailand is difficult because of the export Tax. Thai Customs charges 9 baht/kg export tax, while the Thai military checkpoints just back from the border crossing charge 200-300 baht per 3 tonnes (unofficial). On the Cambodian side a 4-5 tonne truck is charged 1500 baht in total fees - not sure of the breakdown of the fees into official and unofficial.

Source: Consultant Team Interviews, 23 February 2006

Box 23 Unofficial Fees and Charges in the Cross-Border Trade with Vietnam

Meeting with cross border trader in paddy around 60km from the Vietnamese border in Peam Ro District.

Started 20 years ago as a small trader and now has built up to be one of the bigger traders. Last year on average she sold 10-11,000 tonnes, averaging 30 tonnes per day. Today she will ship 70 tonnes. There are presently 3 x 15 tonne trucks unloading and 2 x80 tonne boats and 3 x 120 tonne boats waiting to be loaded. It takes around 2 days to load a 120 tonne boat. The paddy is shipped to VN, where just across the border there are rice mills who mill the paddy into brown rice.

Unloading paddy from trucks and loading onto the boats costs 3500-4000 riels per tonne.

Costs for business:

Unofficial costs: Uncertain about what goes to whom, as it is the responsibilty of the collector and the vietnamese traders, not her.

From the field to the collection point there is no fees - but the collector is responsible for any fees.
At the collection point there is parking fees for the trucks and mooring fees for the boats. These are official fees paid to the provincial office.

Parking Fee:
1000 riel for <5 tonne truck
2000 riel for 5-10t truck
3000 riel for >10 tonne truck

Costs for cross-border -
15 tonne truck is 50,000 riel

Larger truck is 70,000 riel
120 tonne boat is $1000

Payment for cross border is made by the Vietnamese trader, so she is not sure of what is paid to whom. As far as she knows, the payment is paid to Border Police and then this is then distributed amongst all the organizations involved:
Military Police, Police, Tax Office, Customs, Cam Control, Economic Policy, Border Authority, Border Police Border Soldiers, Plus others.

Sometimes when the boat crosses the border there is a border soldier allocated to ride with the boat while it is in Cambodia.

Buying prices: currently IR @ 530r/kg and Mixed @ 540r/kg. Margin is around 5-10r/kg of which around 5r/kg is profit.

In the district there are around 20 traders who trade paddy with VN. Half of them are large traders who do 100-200 tonnes per day and the other half are smaller ones doing 50-100tonnes per day. Before this time the traders were not like this. However, so many VN traders are coming to buy the paddy that the number of Cambodian traders has now increased.

Costs: Levies paid to the tax department R1.3 million per year, business licence R50,000 per year, Provincial department of Commerce, R20,000 per year, Department of Environment, R50,000 per year.

Source: Consultant Team Interviews, 16 February 2006

J.2.4.3 Constraints

679. Collectors are small private enterprises operating on small margins. There are definite economies of scale in collecting activities as well as significant imperfectly competitive market constraints due to spatial effects. This is despite large numbers of people involved in the trade. Each collector might have their own particular collection region and there is scope for asymmetric information effects. Constraints for collectors comprise credit and capital constraints as well as price and information constraints; see Table 120. Collectors find it difficult to make enough money to upgrade transportation means in order to increase capacity.

680. Through individual interviews, traders have indicated the following constraints:

1. Transportation Cost
   a. Poor infrastructure
   b. Illegal Fees

2. Capital
   a. High interest rates for working capital

3. Postharvest technologies
   a. Storage, Drying, Packaging, Handling

4. Quality
   a. Low quality of marketed products

5. Lack of organized channels
   a. Market places
   b. Collection and Distribution centers, Packhouses
   c. Contracts

681. These are discussed in more detail in Section J.2.12

J.2.5 Millers

682. Two types of milling operations are involved in the production of rice in Cambodia; custom (or village) mills and commercial mills; see Table 87 to Table 91. Custom mills are small operations that mill primarily for farmers' own consumption and market small or no quantities of rice for the domestic market. In some cases, village mills augment the operator's own livestock production by providing a source of animal feed, in the form of bran, to the miller. Typically, the custom miller will mill the farmer's paddy free of charge in exchange for the bran. When the farmer requests the return of the bran from the miller, the farmer is generally assessed a milling fee of about 500 Riel per 15 kg of milled rice. Other by-products, such as the husk, are sold locally to households, wine/alcohol makers, and brick manufacturers at a price of about 200 Riel per 25 kg of husks; see Table 92.
Custom mills have a capacity of less than 500 kg per hour, with most mills operating for only a few hours per day. JICA (2001) reports that the average capacity for a small mill is 300 kg per hour; see Table 93. The capitalization of custom mills is small, with the machinery, equipment, and facility valued at between US$500-US$3,000. The equipment used is often second-hand and obtained through household savings and borrowed money from relatives (see Table 94) (EDC 2001; JICA 2001; Vuthy 2001).

683. The combination of low levels of operating technology and mixed varieties of paddy milled result in high levels of broken rice, ranging from 35 percent to 45 percent. ACI (2002) found that recovery rates for custom mills were about 60 percent milled rice for each 100 kg of paddy. This figure is lower than that found by JICA, which reports extraction rates of 62.57 percent for dry season rice and 63.61 percent for wet season rice (see Table 84, Table 85, Table 86, and Table 95) (CIAP 1999; EDC 2001; JICA 2001). The Consultant Team interviews with millers did not find substantial differences with the indications of the milling recovery rates as found by ACI (2002) and JICA (2001) and again views the JICA survey as being more accurate than the limited number of field interviews carried out by the team.

684. A CIAP survey of 20 mills in 1999 showed that the quality of milled rice was low and highly variable (see Table 95) (CIAP 1999). CIAP noted that potential yields of rice, bran and husk is 70, 10 and 20 percent respectively and that the average rice yields in the mills they visited were less than 60 percent, indicating that 16 percent of the white rice was being lost in the bran[45].

685. Working capital is generally limited to update and expand the custom mill operation (see Table 94). Custom mills do not generally use credit for their milling operations, though one interviewed miller reported that she sometimes sold rice on credit to farmers in periods of deficit (ACI 2002). Custom mills are generally household operations that rarely hire outside labor. A survey by EDC of millers in four Southern provinces found only 1 custom mill (of 47) employing hired labor (EDC 2001).

686. Commercial mills are rice mills that produce rice primarily for domestic and export markets. Some commercial mills also mill rice for farmer consumption at similar terms as custom mills (i.e., in terms of the milling fee for bran), but farmers often prefer to use

[45] "*These results suggest that the rollers need replacing on a more regular basis. Millers appear to be holding the rice in the polisher longer than normally required to whiten up and polish the brown rice. If the rollers were replaced and/or set correctly, a better quality brown rice would result and this would then require less time in the polisher*." CIAP (1999). Annual Research Report. Phnom Penh, Cambodia, Cambodia-IRRI-Australia Project**:** 177+xxix..

custom mills for own consumption purposes since they can bring small quantities of rice at a time to the custom mill for immediate consumption needs (World Bank study team interview, 14 July 2002). Commercial mills in Cambodia purchase paddy either directly from farmers or from paddy collectors; JICA reports that mills obtain about one-half of their paddy from farmers and one-half from collectors (JICA 2001). Most purchases of paddy are made on a cash basis, although a few mills procure paddy on credit. At harvest time, there is often too much paddy for millers to absorb in terms of their available capital requirements to purchase the paddy. When working capital is limited to purchase paddy, millers will idle their plants.

687. The larger commercial mills often work directly with farmers to obtain paddy for their operations. Such arrangements involve the provision of seed and inputs where appropriate. For example, Angkor Kasekam Roongroeung is a mill in Kampong Speu that produces high quality fragrant rice for export markets and contracts directly with farm associations to obtain pure, high-quality paddy; see Box 25.

688. Commercial mills sell their products to wholesalers and traders, who then distribute milled rice to other wholesalers, retailers, and end-users; see Table 96. Most milled rice is consumed locally within the province it is produced, with medium and larger mills selling rice to traders with distribution networks outside the province, in Phnom Penh, and abroad. Interviews with integrated millers involved in export suggest that these mills will contract or use their own transport to deliver rice to the port at Sihanoukville. Field interviews by both the Consultant Team and ACI (2002) suggest that the majority of sales are made on credit, which contributes to the shortage of working capital of mills, as most purchases of paddy are made on a cash basis.

689. Most commercial rice millers provide credit to rice traders who obtain rice from their mills and sell to wholesale shops on 10-15 days interest free consignment terms. With the lack of legally enforceable contracts, traders and millers usually form close relationships over long periods of time. Traders pay for the previous shipment when they come to collect the next shipment of rice from the millers.

690. In some cases, but not many, millers also provide small amounts of interest-free credit to farmers for purchases of farming inputs. These loans are invariably to farmers whom the miller has a close relationship over a long period of time. Farmers are required to sell their paddy to the miller at below market prices.

691. Most millers pay cash for paddy, at the market spot rate. There are very few instances where farmers are paid via promissory notes or installments. One survey in 2001 of 67 commercial millers in Kandal and Phnom Penh province indicated that only 4 millers offered delayed payment terms for their paddy purchases (Vuthy 2001, pg. 8).

692. Recovery rates for milled rice are generally higher for commercial mills. JICA reports extraction rates of 63.85 percent for dry season rice and 66.94 percent for wet season rice (JICA 2001). Field interviews by ACI (2002) and the consultant team revealed lower extraction rates (64-65 percent), though these were not based on analytical tests.

693. Commercial mills can be differentiated into small, medium, and large mills on the basis of their milling capacity. Small mills have a capacity of 500-700 kg per hour. Medium-sized mills have a capacity 700 kg-1.2 tonnes per hour, while large mills have a capacity of over 1.2 tonnes per hour (ACI 2002). Anecdotal evidence and limited statistics suggest that most commercial mills are small mills. In Battambang, of the 376 commercial mills

licensed in 2001, nearly one-half (184) were classified as small, with 105 medium-sized and 79 large mills in the province (ACI 2002). In Takeo, there were 19 commercial mills in the province in 2001, most of which are medium and large mills, although maximum capacity in that province is small, at 1.5 tonnes per hour (ACI 2002).

694. Table 93 shows the estimated milling capacity of mills in provinces surveyed by JICA (2001). On the basis of available paddy, there was a shortfall in capacity of approximately 849,800 tonnes in the 1998-99 crop year. Thus the capacity of existing mills only served 61 percent of the milling needs in 1998-99. More concerning is the rate of actual utilization. Table 97 shows that custom mills only worked at 9 percent of capacity while commercial mills only worked at 61 percent of capacity. In the case of commercial mills the major constraint to full-time operation is the lack of working capital to purchase paddy. This is exacerbated by the need to pay for paddy in cash while selling to traders on a consignment basis.

695. The Consultant Team found the situation in 2006 almost unchanged. Substantial numbers of mills were no longer milling rice, instead preferring to trade in paddy themselves. The lack of working capital and higher prices for paddy made milling an unprofitable activity. Of the larger commercial mills in Cambodia (e.g. Angkor Kasekam Roongroueng in Kandal and Poi Pou in Battmabang), milling volumes are well down on previous years and Poi Pou is currently operating at only 10 percent capacity utilization.

696. The number of custom and commercial mills in operation is hard to identify, because a lot of mills, particularly the smaller commercial mills and custom mills, are not registered with the Ministry of Industry. JICA (2001) found almost 96 percent of surveyed mills were custom mills; see Table 98. Prey Veng and Kampong Cham have the largest number of mills, with well over 2,000, while the province of Battambang has a majority of its mills being commercial mills. As Table 98 shows, the JICA study identified 518 registered commercial mills and 12,198 custom mills in 2000 (JICA 2001). The numbers of mills varies between provinces, with the number of commercial mills not appearing to have a significant relationship with the amount of paddy produced, or the food balance within each province. In contrast, ACI (2002) found that while there is a large variation, there appears to be a significant, positive relationship between the numbers of custom mills and the amount of paddy available and food balance within each province.

697. On an historical basis the number of registered commercial and custom mills is difficult to obtain. JICA managed to obtain historical data on four provinces (Takeo, Kampong Speu, Prey Veng and Seam Reap) from the Ministry of Industry (JICA 2001). As Figure 27 shows, the number of registered commercial mills in operation increased at a steady rate until 1997-1998 when there was a jump in the number of commercial mills. In contrast, the number of custom mills was relatively constant in Prey Veng and Seam Reap provinces but there was an increase in the number of custom mills in Kampong Speu from 1998 and a decrease in the number of custom mills in Takeo, from a peak in 1996; see Figure 28. The EDC survey noted that the total number of custom mills had increased, while the number of customers had declined as customer groups such as restaurants and local households migrate to commercial mills (EDC 2001, pg. 7).

698. According to the JICA survey, most mills were installed after 1995 (JICA 2001). However, there are very few mills that were installed new, most being second-hand. The JICA study found that the majority of the mills are of Chinese, Vietnamese or Japanese manufacture, being imported from Viet Nam (60 percent) and China (30 percent) with Japanese machinery imported via either Viet Nam or China. As Table 94 shows, the

majority of funding comes from own funds and/or relatives with very little funds borrowed from banks or other institutions.

699. The Consultant Team interviewed several millers in each of the surveyed provinces (Kampong Speu, Svay Rieng, Battambang and Kampong Thom). Table 108 shows the flow of intra- and inter-provincial sales by millers. By far the majority of rice is sold in the local provincial markets with some of the more commercialized mills in Battambang selling to Phnom Penh and Siem Reap. Figure 29, Figure 30 and Figure 31 show the flows diagrammatically. As far as was able to be ascertained by the team, the direction and destination of the flows have not dramatically changed since the ACI (2002) report although the volumes of the flows have increased in line with increases in farm productivity.

J.2.5.1 Costs and Margins

700. The cost structure for millers differs somewhat for custom and commercial mills. The major cost for custom mills is petrol, though shadow prices for household labor and depreciation can be derived. Field interviews suggest that custom mills typically require 3-4 liters of petrol per day. At the April 2006 price for petrol (roughly $0.80 per liter), this implies that the fuel costs for a custom mill are roughly US$3.20 per day. This is a substantial increase from the 2002 value of $1 per day. Most labor on custom mills is household labor; field interviews reveal that the hired wage rate for mills is roughly 150,000 Riel/month or approximately 5,000 Riel/day, including provisions for lunch. Depreciation costs vary widely by the capital outlay of the custom mills. Field interviews found investment costs of customs millers varied from less than US$600 to US$3,000. Assuming a depreciation rate of 10 percent per year (10-year life span for the mill) implies depreciation of US$60 to US$300 each year.

701. Custom mills derive income primarily from bran and husk sales; see Table 92. While not all bran is sold commercially (many custom millers feed the bran to their fattening pig enterprise), the value of the bran represents the opportunity cost for custom millers. In addition, some millers are also farmers themselves and thus derive income from sales of paddy or rice from their own production.

702. JICA surveyed 47 custom mills and 74 commercial mills throughout Cambodia, obtaining detailed production data (capacity and yearly throughput, cost of investment and number of employees). Combining these data with average prices and costs in each province, along with detailed cost of production data supplied from the National Rice Millers Association of Cambodia (JICA 2001, pg. B54, Table 28), it is possible to derive approximate gross margins for the custom and commercial mills surveyed by JICA; see Table 99 and Table 100. The data indicate that gross margins for custom mills in 2001 were approximately US$7 per tonne (US$244 per miller per year), and US$220 per tonne (US$35,500 per miller per year) for commercial mills.

703. Margins for 2002 are shown in Table 117, with milling costs calculated on the basis of commercial mills outlined in Table 100. Table 117 shows that profit in 2002 was around 14.9 percent of the sale price, while the marketing margin was 9.12 percent. This does not take into consideration the value of by-products, which, when included, raise the marketing margin to 19.6 percent.

704. As noted above, the Consultant Team interviewed millers in Kampong Speu, Svay Rieng, Battambang and Kampong Thom to get an idea of current milling margins. The

financial analysis for these millers is presented in Table 101 to Table 107. While the margins and returns to millers varies dramatically according to individual circumstance and size of operations, on average millers were making around 15.6 percent gross margins, similar in magnitude to the gross margins for millers in 2002.

705. As expected, purchases of paddy comprise the majority of the cost of milling, 94.6 percent. Fuel is the most expensive component of actual milling, some 4.1 percent of total costs or 74.5 percent of milling costs. Sacks and bags comprise 1 percent of total costs or 21 percent of milling costs, while labor comprises just 3.6 percent of milling costs. Official and unofficial taxes are a minor component of milling costs (0.7 percent), despite frequent complaints from millers as to the size of the taxes. Only in Kampong Thom do millers pay a substantive amount of tax, comprising 1.6 percent of total milling costs.

706. The conclusions from analyzing the margins for millers are:

1. Gross income from milling activities is large but margins are relatively low.
2. Storage decisions might cause tremendous changes in gross income.
3. Small and medium mills market only to the domestic market.

707. These are discussed in detail below.

708. Gross income from milling activities is much larger than in the case of production activities by farmers. However, Small mills have relatively low margins. When compared these margins to larger mills, however, one should take into account the actual costs of structures and capital and the depreciation factors which are much higher in the case of larger mills.

709. As in the case of traders, storage decisions might cause tremendous changes in gross income. The medium mill in Kampong Thom has a volume of sales which is 15 times the volume of sales of the small mill in Kampong Speu, yet the gross income is 33 times higher. Part of this difference is explained by better quality provided by the medium mill when compared to the small mill. However, a large part of the difference is due to storage decisions.

710. In the case of large mills, the gross margin is deceptively high (almost 12 percent). In fact the mill is operating at only 10 percent of capacity (see Box 24 explaining the story behind it). When depreciation of fixed assets is taken into consideration, the net margins might be much smaller and possibly negative.

711. Small and medium mills market only to the domestic market. The quality of rice they are able to provide is of insufficient quality and consistency for exports. On the other hand, the larger mill has the capacity of providing quality rice, but it is not doing so, mainly because of bottlenecks at the supply side or at the marketing side.

Box 24 How Large Mills Cope with Changing Paddy Prices?

During the period 2002 to 2005, paddy prices have increased substantially, mostly as the result of imports of paddy from Viet Nam and Thailand. This increase in paddy prices has been often indicated as the major reason for the stagnant growth of the milling industry in Cambodia. The analysis of a large mill visited by the Consultant's Team during the field work however suggests that other reasons may play a role in explaining the low performance of the milling industry. The mill visited by the Team is one of the largest mills in Cambodia: it has a capacity of about 40,000 tons per year of milled rice, is endowed with modern equipment able to produce milled rice of good quality acceptable in international markets, and has excellent facilities located along one of the main national roads. Moreover, the owner of the mill has access to considerable finance from his own funds. The conditions of the mill would seem excellent to embark on exports of rice. This, however, has not occurred. During the last year, the mill was operating at 10 percent capacity, producing and selling only about 4,000 tons.

During the period 2002 to 2005, prices of paddy have indeed increased considerably, even when one takes into account inflation. The paddy prices over the period have increased by 25 percent in real terms; see Figure 21. Over the same period, the decrease in revenues of the mills has been dramatic, dropping by 75 percent from US$5.2 million in 2002 to US$1.3 million in 2005; see Figure 22.

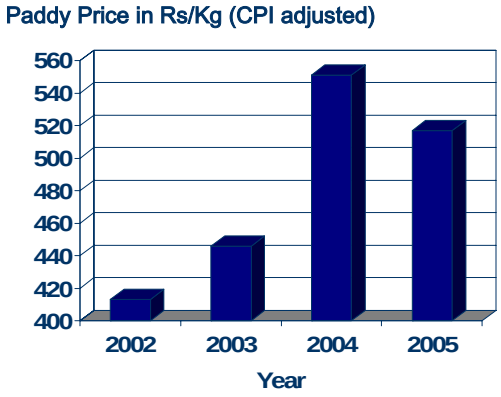


Figure 21 Change in real Paddy Prices

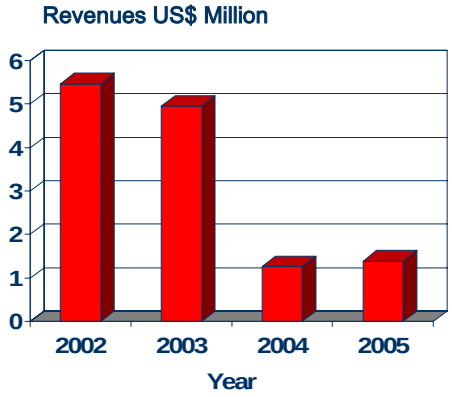


Figure 22 Change in Revenues

On the surface, it would then seem that there is a close relationship between paddy prices and revenues of the mill. In fact, the situation is rather different. An analysis of revenues of the mill, made available by the owner, showed that the high revenue in 2002-03 were due to the existence of a major contract with the Government. That contract value was about $4million. In 2004 the mill lost the contract and therefore could only sell to the domestic market (about $1million). There is a strong hypothesis that the mill was established in the expectation that the large government contracts could last, which in fact did not happen. Faced with a declined contract, the mill so far has not been able to reach foreign buyers. Yet, if the mill has to survive, it will have to develop backward linkages with farmers and forward with foreign buyers.

Source: Diagnostic Study Fieldwork

J.2.5.2 Constraints

712. The constraints present in the milling sector differ for custom mills and commercial mills. Custom mills are primarily constrained by a consistent flow of paddy to be milled by the custom miller. As a result, custom mills will remain idle for lengthy periods of time, depriving the miller of revenue from the milling of paddy. As a result, it is difficult for custom millers to obtain enough income to modernize their facilities to improve technology and compete with other commercial millers (see Table 120) (JICA 2001).

713. Custom mills are also facing increasing competition from small commercial mills. Both JICA (2001) and EDC reports that the number of custom mills has declined as a

result of this competition (EDC 2001). EDC (2001)notes that the custom mills it surveyed estimated a 33 percent decline in the number of customers served by these mills over the next several years.

714. Commercial mills, by contrast, face a number of significant constraints that are summarized in Table 122. Constraints in the milling sector can be summarized into three major themes: limited access to working capital, quality constraints, and technological constraints. In fact, the three types of constraints are inexorably linked, primarily through the credit constraint. Limited working capital impedes the ability of millers to improve mill technology and work with farmers to supply higher quality paddy.

715. The most widely perceived constraint by commercial millers is a lack of adequate working capital for purchasing paddy. At harvest time, commercial mills face a sizable surplus of paddy to be milled that cannot be easily absorbed by Cambodian millers. In order to purchase paddy at harvest, commercial mills require large amounts of liquid working capital, in the form of cash. However, because most mills sell milled rice throughout the year on credit to wholesalers and traders, millers face difficulties in absorbing the large amount of paddy available at harvest time. This situation contributes to the flows of paddy to neighboring countries such as Viet Nam and Thailand.

716. As a result of the lack in working capital, there is a significant gap between paddy production and utilized milling capacity. As shown in Table 93, almost 40 percent of the paddy production (nearly 850,000 tonnes) cannot be milled at estimated levels of capacity utilization. This estimate assumes a milling capacity of 1.1 tonnes per hour, with mills operating 6-hour work days, 25 days per month, and for 10 months per year. However, JICA (2001) also reports that total potential milling capacity is about 4 million tonnes of paddy, implying that the utilized milling capacity in Cambodia is only 33 percent. The implication is that capacity is not a major issue in Cambodia; rather it is finding ways to increase capacity utilized.

717. Another major constraint for Cambodian millers concerns the quality of the paddy milled. Cambodian millers complain that the quality of milled rice, in terms of the percentage of broken rice and moisture content, is compromised by poor seed quality and mixed paddy varieties. Cambodian farmers will often use multiple varieties of seed in their paddy production, which results in higher losses for millers as the rollers used in the milling process are better suited for paddy of a relatively uniform length. Even when pure varieties of seeds are used by farmers, paddy collectors generally have limited incentive to segregate the paddy collected from farmers, so that the varieties sold by collectors to millers will usually consist of many mixed paddy varieties. Post-harvest technologies, particularly drying, are inadequate and result in high levels of moisture that leads to high levels of broken rice.

718. The lack of simple objective methods for moisture measurement is often a source of heated discussions between farmers on one side and traders and millers on the other side. Farmers dry paddy or other raw materials mostly on-farm without the use of dryers. This often implies high moisture contents during the wet season or as a result of a sudden rain. Traders and miller often have an incentive to overestimate moisture content because that implies a lower price paid to farmers. In the table below, moisture content for paddy is sometimes underestimated (14 percent moisture content would be considered appropriate for milling) and sometimes is overestimated. Lacking simple tools like a moisture meter, a simple and relatively inexpensive devise to measure moisture, the results are not surprising; see Table 109 and Table 110. In spite of alleged experience, visual methods

can be deceiving. Obviously, moisture is an issue not only because of negotiations about prices, but also more fundamentally because it leads to losses both in processing and in terms of storage (higher content of moisture is a more fertile environment for insects and bacteria to grow and damage the produce).

719. Low levels of technology also constrain millers. The majority of machines used in Cambodia are second-hand machines from Viet Nam and China. High levels of broken rice (25 percent and higher) are not uncommon. Many mills lack the technology to separate rice by percentage broken as in other countries, such as Viet Nam. The technology constraint is amplified by the inability of rice millers to obtain capital to modernize their facilities. Low levels of technology have been purported to prevent millers from accessing international markets. One miller in Battambang noted that while there was ample capacity in that province, the main issue to raise the level of quality was the need for one or two mills that had the technology to meet international standards (ACI 2002).

720. A final constraint in the milling sector concerns issues of market access. A number of rice millers are interested in diversifying towards overseas markets, but are constrained by the ability to consistently supply these markets with rice of a consistent level of quality. Millers are also constrained by limited knowledge of overseas markets and suppliers.

721. Through individual and group interviews millers and food processors have indicated the following constraints:

1. High Costs
    a. Credit
    b. Energy
    c. Transportation

2. Supply Chain
    a. Procurement of raw material of consistent quality
    b. Competition from neighboring countries

3. Technology and Know-how
    a. Outdated technology
    b. Labor skills

4. Competition
    a. Foreign inflow of products
    b. Competition in paddy procurement by neighboring countries

5. Quality
    a. Low quality of the product they are able to produce
    b. Lack of appropriate technologies and methods to improve quality
    c. Lack of institutional mechanisms to improve quality
    d. Ineffectiveness of quality control by government agencies

6. Public and Private Services
    a. Ineffectiveness of Public Services
    b. Ineffectiveness of Associations and Chambers

722. These are discussed in more detail in Section J.2.12

Box 25 Profile of Angkor Kasekam

Angkor Kasekam is one of the largest commercial mills in Cambodia, with a mill capacity of 30 tonnes per hour. Established in 2000, but not operational until 2001, Angkor Kasekam is unique in terms of their integrated supply chain on the production side. Angkor Kasekam specializes in the production of organic Neang Malis rice from Battambang province and engages in contractual agreements with farmers to produce this pure variety.

Farmers who contract with Angkor Kasekam must first apply to be a member of a commune-level farm association, which requires approval by the association head, village chief, commune chief, and village representatives who are members of the association. Once approval has been granted, the farmers are subject to strict contractual obligations. For instance, farmers are provided free seed, with the provision that for every 50 kg of seed distributed, they are to return 100 kg to the company.

In exchange for these conditions, farmers are guaranteed a premium price for their paddy, although a schedule of deductions is published that deducts from the paddy price products with high levels of moisture content, immature grains, and foreign matter. The company also maintains a private extension service which works with farm associations in 65 communes to promote proper farming techniques and monitor supply.

For the year 2001, the company reports that 27,000 households were affiliated with the company on 17,000 ha. For 2002, these numbers nearly doubled to 50,000 households on almost 30,000 ha. Estimated production this year (2002) is 50,000 tonnes. The majority (95 percent) of Angkor Kasekam's production is destined for export markets, including Hong Kong and several markets in the EU.

The price paid for Angkor Kasekam's rice fetches a high premium on international markets, with fob Sihanoukville prices reported at $460 per tonnes ($100 per tonnes more than the best Thai Jasmine varieties). Angkor Kasekam has been a victim of its success, as one of the constraints cited were working capital bottlenecks needed to purchase paddy from greatly expanded production.

One of the interesting facets about Angkor Kasekam is their ability to develop and enforce contractual arrangements in a country where high transactions costs and an underdeveloped legal and institutional framework impede the enforcement and application of many basic laws. Reliance on existing communal structures appears to prove critical to these relationships, though further research is needed to understand these dynamics. In addition, through the use of their own company-specific extension service, they have found means to ensure quality along the supply chain.

Such supply-chain management techniques draw parallels to those used by multinational and agribusiness companies in Latin America in the 1990s, which integrated their supply chains in response to a lack of public grades and standards necessary to export their production (Reardon, Codron et al. 1999). While these extension services are limited in the sense that they only apply to a narrowly-defined, organic variety, the production lessons are still valuable for farmers given the lack of comprehensive public extension services in Cambodia.

The challenge for Angkor Kasekam and other companies with similar business models is the need for the development of an appropriate enabling environment, in terms of institutions and infrastructure, to facilitate and manage these relationships. More importantly, while these models may facilitate private sector trade, particularly for exports, they do not necessarily have a major impact on the poor who have little in the way of marketed surplus to sell, highlighting the important role needed for government, multilateral institutions, and private institutions to better integrate the poor into the market.

Source: (ACI 2002)

J.2.6 Wholesalers and Retailers

723. Wholesalers and retailers of rice in Cambodia are compromised mainly of two types: rice shops, which specialize in both the wholesale procurement and sales of rice, and market stalls that sell limited varieties of rice in the market. JICA also considers as retailers those wholesalers who make some retail sales (JICA 2001). A summary of the characteristics of retailers in Cambodia is provided in Table 112. The size of the urban population of each town restricts the number of rice sellers. Except for Phnom Penh and Sihanouk Ville, the number of rice sellers in provincial towns is very limited. The exact

number of retailers is unknown, though JICA estimates the number of rice sellers in the major markets at between 150-200. Wholesale retailers typically sell between 150 and 400 tonnes of rice per year. By contrast, market stalls generally handle much smaller quantities of rice sales. Rice stalls will sell roughly 1 tonne of rice per month. Most consumer purchases from wholesale retailers are bulk purchases of 50-kg bags of rice, though some consumers will buy smaller amounts. One retailer interviewed by ACI (2002) noted that she charged a 5 Riel/kg premium for the sale of smaller quantities. Sales from market stalls are generally smaller amounts (5-10 kg).

724. Market retailers usually have a permanent stall inside the market or on the periphery. The rent will vary according to position. Retailers of rice in the bigger markets usually have a large stock and some may act as wholesalers.

725. Wholesale retailers in Phnom Penh interviewed by ACI (2002) supplied seven varieties of rice – four varieties of Cambodian rice and three varieties of Thai rice. The most commonly found varieties of Cambodia rice are Neang Minh, Phka Neay, and Somaly, with sales of Arohom and IR-66 also common. The varieties of Thai rice sold are invariably 100 percent (i.e., 100 percent whole grain), 75 percent, and 45 percent. Sales of Somaly and Thai 100 percent are low, given that they are high value varieties. Price differences between varieties are about 100-200 Riel/kg, due in appearance, proportion of broken rice, and production area (i.e. taste); JICA (2001) notes that there are no formal standards for judging such gradations in quality.

726. Sales of Thai rice are particularly common in Phnom Penh, with retailers stocking between 20 and 50 percent of their inventory in Thai rice. ACI (2002) noted that consumers often mix Cambodian and Thai rice varieties to achieve a preferred texture and flavor; JICA confirms this behavior among both consumers and restaurants. The exact quantity of Thai rice consumed in Cambodia is unknown. However, JICA (2001) estimates that 7 percent of domestic rice consumption is Thai rice, suggesting that total imports of Thai rice are approximately 130-135,000 tonnes in 2006.

727. JICA (2001) found preferences for higher quality rice varieties, such as Somaly, Phka Neay, and Neang Menh from Battambang mainly in urban areas where consumers have high incomes; see Table 113. JICA (2001) observed greater consumption of lower quality rice varieties, such as IR-66, local varieties, and mixed varieties, in provincial areas and city outskirts, with purchases made among lower income groups. IR rice from the southern part of the country has the poorest reputation and is typically consumed by low-income groups and for institutional lunches (JICA 2001).

J.2.6.1 Costs and Margins

728. Retailers purchase rice from wholesalers when required. The quantity purchased depends on the size of the shop and the turnover of business. Margins differ depending on the negotiating ability of the buyer and retailer. Margins also differ depending on the price of the rice (and quality differences). Higher quality rice usually attracts higher margins and retailers value add by cleaning the rice and mixing before sale. A popular mix is to mix Cambodian rice with Thai Jasmine rice (usually 50:50), to obtain the desired flavor and texture.

729. The “look” of the rice is an important factor in determining price (quality) in the market. With the exception of wet season rice from Battambang, foreign matter and colored grain are sometimes removed before retailing. Wholesalers and retailers will

charge for cleaning and sorting rice, with typical fees of 1000 Riel per bag paid by the consumer (ACI 2002).

730. Sellers report price margins to be low, generally between 20-50 Riel/kg (Food and Agriculture Organization 1997, pg. 29). A comparison of costs and margins from (Vuthy 2001) which shows net retail margins of approximately 9 percent. ACI (2002) notes that the gross margin cited by wholesale retailers was 20 Riel/kg. These are about the same as the Consultant Team found for 2006. Operating costs are also low, as wholesale retailers will sell from their own store or home and use hired labor only for the handling of rice; handling fees are about 200 Riel per 50 kg bag (ACI 2002).

731. Marketing margins for retailers in 1998 were around 8.7 percent (see Table 116). Margins calculated by ACI (2002)indicate that margins are around 3.2 percent (see Table 117). Part of the difference between margins in 1998 (Table 116) and 2002 (Table 117) was been the reduction in rice and paddy prices. However, the data in Table 116 is based on prices for Phka Khney rice while Table 117 is the average rice price.

J.2.6.2 Constraints

732. Limited information is available on constraints in the retail sector; a summary of identified constraints is provided in Table 120 and Table 123. One of the issues faced by retailers is related to competition and distribution. Retailers, particularly in remote areas, are hampered by poor infrastructure and fragmented distribution systems that impede the ability of retailers to procure rice. Retailers are also constrained by a distribution system that is relatively concentrated among a minority of traders and wholesalers. Combined with significant competition in the retail sector, these result in low margins for retailers.

J.2.7 Rice Exporters

733. Exports of milled rice from Cambodia are small. ACI (2002) estimated that exports were in the order of 60,000 tonnes in 2002. Current Consultant Team estimates suggest that around 50,000 tonnes is currently being exported; see Figure 34. This from 2002 because the main exporter, Angkor Kasekam Roongroeung, has difficulties in sourcing supplies and accessing new markets.

J.2.7.1 Costs and Margins

734. Most exports of Cambodian rice currently serve high-value niche markets. ACI (2002) interviews with two exporters suggest that the prices of Cambodian rice sold on world markets is considerably higher than world prices. In 2002 Angkor Kasekam was selling a high-value, organic rice at US$460 per tonne. Another company was contracting in a like fashion, albeit through more conventional production practices. Nevertheless, the price received for their rice likely exceeded US$300 per tonne (ACI 2002).

735. As noted in ACI (2002), despite the high costs of transportation and unofficial fees, exporters have a relatively profitable business, in 2002 yielding a net profit of nearly 11 percent. Most costs are comprised of paddy purchases and depreciation. The Consultant Team did not have time to investigate the rice exporting side of the industry in great detail but exporting miller interviews indicate high gross margins of around 27-28 percent when combined with their domestic sales.

J.2.7.2 Constraints

736. Rice exporters face significant constraints; see Table 120 and Table 124 for a summary. Exporters are particularly hampered by the high transaction costs imposed by poor road and rail infrastructure and port clearance of rice destined for export markets. ACI (2002) noted that unofficial costs accounted for nearly 50 percent of the costs faced by exporters in moving product from the mill to overseas markets and results in diminished competitiveness in overseas markets. While the unofficial costs have decreased significantly, "official" costs which have replaced them have not really changed the underlying cost structure. While most rice exports from Cambodia are currently high-value varieties and thus not price sensitive, such costs nonetheless impede the ability of exporters to diversify sales to more price-sensitive markets. More importantly, such costs restrict the ability of Cambodian exporters to expand exports of lower-quality varieties.

737. Rice exporters are also constrained by the inability of mills to supply appropriate quantities of rice of a standardized quality. A number of rice millers and exporters remarked that while there was latent demand for Cambodian rice among overseas buyers, particularly in Asia, it is difficult for millers and exporters to obtain enough rice that is of an appropriate standard to meet these orders. This is due to a combination of low mill technology and mixed paddy varieties and is exacerbated by limited access to capital. Integrated channels of distribution to ensure higher quality in Cambodia are only in their infancy and have not yet developed to meet export standards.

J.2.8 End Users and Processors of Rice

738. The Consultant Team was not able to get first hand information about end users in the rice value chain and has had to rely on the JICA (2001) study which carried out an investigation of consumers in the rice industry.

739. Table 114 shows that variety and fragrance were the two most important characteristics of rice to purchasers. Table 115 shows that consumers preferred Phaka Kagney, Neang Minh and Somaly varieties while restaurants preferred to purchase Phaka Kagney, a mix of Thai Jasmine and a Local variety, other local varieties, and Neang Minh for their customers.

740. JICA (2001) found that 55 percent of consumers preferred traditional varieties of rice over new varieties. Those that chose:

1. Mixed Rice cared about price and not about the variety or the percentage broken.
2. IR are sensitive to whiteness (color) but do not care about place of production.
3. Rice based on fragrance choose Somaly and Phaka Kageny.
4. Neang Minh and IR do not care about fragrance.
5. Finally, the higher the income, the less Neang Minh rice was purchased.

741. The JICA (2001) study noted that almost all restaurants have a fixed place of purchase or seller. About 60 of restaurants either have sellers come to them or they order by telephone. Most purchase directly from rice shops or rice sellers in the market (44 and 38 percent respectively). In the case of direct purchases from rice mills (10 percent of respondents to the JICA (2001) survey), most respondents have a relative who own/manages the rice mill. The quantity purchased varies depending on the size of the restaurant. The average quantity purchased per time was 364 kg and the maximum was

1500 kg. However, a small-scale restaurant purchases just enough quantities for a day's operation at a market nearby everyday.

742. Prices for rice vary according to retailer, variety and quality and the negotiating ability of the buyer and retailer.

743. The kind of rice used at each restaurant is fixed. In almost all restaurants, their selection was based on good taste/customers' choice, but not on price. Table 115 shows that Phaka Kagney is most popular rice used in restaurants, like consumers own preferences. The major difference between consumers and restaurants is the use of blended rice. Blends of Thai and local varieties, or a blend of local varieties are the second and third most popular types of rice served at restaurants. A blend of Thai fragrant broken rice with various local varieties is made to add fragrance and to increase softness. This practice corresponds to the survey of consumers, where fragrance is an important criterion for choosing rice, and softer rice is highly prized both in quality and price.

The Consultant Team interviewed several processors of rice and other processed products derived from the rice-based value chain (including rice noodles, fermented soybeans, and sauce manufacturers).

744. Table 82 illustrates revenues, costs, gross income, and margins (gross income as a percentage of revenue) for selected food processors. Rice noodle manufacturers have a healthy gross margin of 23 percent, followed by fermented soybean (15-16 percent) and then sauce manufacturers (6.3 percent).

745. The conclusions from analyzing the margins for processors are:

1. Gross income from processing activities is generally larger than in the case of production activities by farmers.

2. All of the food processors encountered by the Consultant's Team are small scale.

3. They fund activities with their own funds.

4. They are able to obtain moderate gross income by meeting consumer demand for processed foods and are able to compete with imported products.

5. They are able to move to a higher scale of production is limited by capital, technology know-how, and constraints in the supply chain (procurement of raw material).

J.2.8.1 Constraints

746. Through individual and group interviews food processors have indicated the following constraints:

1. High Costs
   a. Credit
   b. Energy
   c. Transportation

2. Supply Chain
   a. Procurement of raw material of consistent quality
   b. Competition from neighboring countries

3. Technology and Know-how
   a. Outdated technology
   b. Labor skills

4. Competition
   a. Foreign inflow of products
   b. Competition in paddy procurement by neighboring countries

5. Quality
   a. Low quality of the product they are able to produce
   b. Lack of appropriate technologies and methods to improve quality
   c. Lack of institutional mechanisms to improve quality
   d. Ineffectiveness of quality control by government agencies

6. Public and Private Services
   a. Ineffectiveness of Public Services
   b. Ineffectiveness of Associations and Chambers

747. These are discussed in more detail in Section J.2.12

J.2.9 Marketing Margins

748. Costs of production and marketing margins are estimated for each level of the marketing chain and detailed in the appropriate sections. Marketing margins and profits at each level of the marketing chain are detailed in Table 116 and Table 117 for the years 1998 and 2002 respectively. Table 116 shows the marketing margins for Phkar Khgney variety rice with 1998 prices while Table 117 shows the marketing margins for average rice with 2002 prices. JICA estimated marketing margins for Phaka Khgney and Neag Minh varieties for 1998-1999; see Figure 32 and Figure 33. A summary table of these marketing margins is presented in Table 118. All three sources agree on the marketing margins accruing to producers (ignoring the cost of inputs). There are some differences in margins accruing to other levels of the marketing chain, due to differences in grouping together collectors and traders with other levels of the chain. Broadly speaking, the three sources are consistent in estimating margins.

749. In 2002, farmers and millers had the largest marketing margins (16 and 9 percent respectively, see Table 117). Wholesalers had the third largest marketing margin, 7 percent, while retailers had a 3 percent margin. In terms of profitability, producers and millers again had the highest profit margins, 21.7 and 14.9 percent respectively. Collectors and transporters had the lowest profit margins, while retailers had the third lowest profit margins.

750. The estimated marketing margins for 2006 are presented in Table 119. The results suggest that the percent of total profit accruing to stakeholders along the chain has not changed all that much since 2002. However, the profit within each stakeholder category has increased for most stakeholders. For example, in 2002 the percent of total profit accruing to farmers was around 40 percent. In 2006 this increased slightly to 42 percent. At the same time, the gross margin from farming operations was around 21.7 percent in

2002 and increased to 50.4 percent in 2006. This appears to be a result of efficiency gains at the farm level, with yields increasing (at least in the example, from 2 tonnes per hectare up to 3 tonnes per hectare).

751. Marketing margins for stakeholders have also changed. Previously farmers in 2002 were obtaining 15.71 percent of the final retail price, while in 2006 they are now getting 29 percent. All other stakeholders increase their marketing margin, with the total margin increasing from 27.49 percent in 2002 to 42.4 percent in 2006.

752. ACI (2005) reports marketing margins for different crops (rice, vegetables, fish, etc.) based on early 2005 data. These are presented in Table 54. For wet season rice farmers accrue almost 50 percent of the marketing margin (in Table 119 this is separated into cost of inputs as well as farmer returns). Collectors obtain a marketing margin of 5.3 percent, processors 12.9 percent, transporters 5 percent, wholesalers 9.9 percent and retailers 16.2 percent.

753. In essence, margins change according to the specific circumstances and increase in periods of rising prices and decrease when prices are falling.

754. These results are not surprising, and follow the established Industrial Organization literature. Margins are greatest where few firms are operating and economies of scale exist (see (Spulber 1999)). This is the case with Millers, whereas retailers and transporters face high levels of competition. Farmers appear to have the largest profitability on a per tonne basis (but are still poor due to small levels of output). Farmer profitability is due to relatively high levels of protection due to infrastructure constraints as well as increasing productivity at the field level.

J.2.10 Marketing Chain

755. The marketing chain for Cambodia during the 2004-05 crop year is detailed in Figure 34[46]. This is an updated version of the ACI (2002) spreadsheet model taking into account changes in production, consumption and marketing flows. There are two parallel channels of distribution for paddy and rice in Cambodia: subsistence production and marketed production. JICA (2001) reports that only 40 percent of paddy is marketed commercially, which allows for approximately 2.07 million tonnes of available paddy (i.e., net of post-harvest losses) to the subsistence channel and 1.38 million tonnes of marketed paddy.

756. Subsistence paddy is taken directly from farmers to either custom mills or small commercial mills for milling into white rice. Collectors are typically not involved in this channel. The quantities milled by custom mills at any given time are small and frequent, depending on when rice producers require rice for consumption. Millers will mill rice for farmers without charge, provided the farmer allows the miller to keep the bran; this is used to augment the custom miller's livestock operations and/or for commercial sales to the animal feed industry. If the farmer wishes to keep the bran, they are usually assessed a fee of 500 Riel per 15 kg of rice. Given an estimated recovery rate of custom mills of 63 percent (JICA 2001), approximately 1.3 million tonnes of milled rice are consumed on-farm.

[46] Readers of the Microsoft Word version of this report will note that they can double-click Figure 34 to enter the Excel spreadsheet. The Chain flows have been calibrated for 2004-05 and Users can change the date at the top of the spreadsheet to see the flows for previous years (using the 2004-05 calibrated percentages). All data and coefficients in grey boxes can be modified to suit User's needs.

757. The marketed paddy channel commences with sales to either collectors or mills directly. JICA reports that 2/3rds of farm sales of paddy are made to collectors, with 20 percent to mills and 13 percent to other sources (JICA 2001). Collectors will then sell paddy to commercial mills. However, it is estimated that between 400,000-800,000 tonnes of Cambodian paddy is exported to Viet Nam and Thailand depending on the year. These sales start ostensibly from collectors, who sell paddy to traders for shipment to Viet Nam and Thailand. Millers report to receive approximately one-half of these purchases from farmers and the remainder from collectors (JICA 2001).

758. As noted in Figure 34, approximately 800,000 tonnes of paddy are available for commercial milling. This is equivalent to 500,000 tonnes of milled rice, using the 66 percent recovery rate cited by JICA (2001) for commercial mills. Milled rice is generally marketed to traders, though there are some instances of direct sales to retailers (mainly in rural areas), wholesalers, and exporters. Traders will sell to wholesalers, who sell to retailers and institutions such as the World Food Program, and directly to retailers. Retail sales of domestically produced rice are estimated at 403,000 tonnes, which are augmented (primarily in Phnom Penh) by imports of Thai rice of roughly 133,000 tonnes.

759. Compared with the situation in 2001 as described by ACI (2002), there are some substantive differences in paddy and rice flows.

760. Firstly, the level of exports of rice has dramatically decreased with the main export miller, Angkor Kasekam Roongroeung, running into commercial difficulties in sourcing both paddy at the farm level as well as finding export markets. There are new millers which have expanded their operations into the export field, such as Men Sarom and Pui Poi, but their exports have not been able to compensate for the reductions in Angkor Kasekam Roongroeung's operations.

761. Secondly, interventions by WFP in the Cambodia rice market have substantially dropped off. In 2001 WFP was importing some 44,000 tonnes of rice and buying a further 13,000 tonnes on the local market. In comparison, during 2004-05 WFP purchased only 3100 tonnes on the local market and imported only 7500 tonnes.

762. Thirdly, the flows of paddy for export to Vietnam and Thailand have increased substantially as production of paddy has increased in Cambodia. Domestic market sales in Cambodia are constrained by the size of the population and while the FAO/MAFF official consumption figures of 143 kg of rice per person per year can be debated, the fact of the matter remains that domestic absorption of surplus production is limited and export markets for rice and paddy will remain vital. The production of paddy in 2004-05 was 4,170,284 tonnes, substantially below that of 2003-2004 (4,710,957 tonnes). While the model has been calibrated for the 2004-05 year, early indications from MAFF regarding the size of the 2005-06 harvest indicate production in the order of 5.9 million tonnes. With such a large harvest, constrained domestic consumption and limited official exports of rice, the requirement to distribute the surplus paddy will put significant pressure on millers and traders. While most of the surplus paddy is currently being shipped to Vietnam there are concerns that regional paddy markets will not be able to absorb such volumes without flow on effects to the domestic market.

J.2.11 Marketing Flows of Paddy and Rice

763. Rice and paddy trade flows vary depending on the supply and demand conditions in different provinces and on the prices in neighboring countries. Trade flows are predicated

not only on surpluses and shortfalls in each region but also demand for specific rice varieties and qualities. Major trade flows are shown in Table 111 and Figure 30.

764. Only specific varieties such as Somaly, Phaka Kagney, Neang Minh, Srov Krahome, Srov Sor, and IR66 are marketed on a specific variety basis. Many other wet season varieties are marketed “Mixed rice” since they are mixed together at the collector stage from many small plots of individual varieties (JICA 2001).

765. Somaly, Phaka Kagney and Neang Minh are produced in the northwest and have an established reputation for high quality and good taste. These are sold to urban areas in Phnom Penh, Sihanouk Ville and the provincial towns of Takeo, Kandal, Seam Reap and Kampong Cham. Other local varieties are marketed only within the Province and/or to neighboring provinces (JICA 2001).

766. One of the difficulties in estimating trade flows within Cambodia and to neighboring countries is the lack of adequate data on the amount of paddy actually sold by farmers. The majority of farmers keep paddy for their own consumption and only sell their harvest when they are short of cash or have surplus to their requirements. JICA (2001) estimates that only about 40 percent of the total paddy harvested actually enters the marketing chain, the rest stored on-farm until ready to mill at the local village custom mill. As Table 49 shows, most of the paddy is sold to collectors who then sell onto the mills. The volume of paddy sold is relatively small, only averaging 1.6-1.7 tonnes per farmer.

767. As noted in Section J.2.5, commercial mills sell their products to wholesalers and traders, who then distribute milled rice to other wholesalers, retailers, and end-users (see Table 96). Most milled rice is consumed locally within the province it is produced, with medium and larger mills selling rice to traders with distribution networks outside the province, in Phnom Penh, and abroad. Most commercial rice millers provide credit to rice traders who obtain rice from their mills and sell to wholesale shops on 10-15 days interest free consignment terms. With the lack of legally enforceable contracts, traders and millers usually form close relationships over long periods of time. Traders pay for the previous shipment when they come to collect the next shipment of rice off the millers.

768. Battambang and Banteay Meanchey only have outflows of rice despite being close to Thailand. The main reason for this is that both provinces produce high quality wet season rice varieties that were more in demand than Thai Jasmine rice. Conversely, even though Takeo province produces most of the rice surplus in the country, there is a flow of wet season rice from Battambang to Takeo Town to meet consumer demands for high quality rice. Similarly, there is a flow of Thai Jasmine, Battambang wet season rice, and Somaly from Banteay Meanchey into Seam Reap for the large tourist trade (see Figure 29) (JICA 2001).

769. Exports fall into two categories, official and unofficial. Official exports of rice are through Sihanoukville Port while unofficial exports of rice and paddy are through border gates into Thailand and Viet Nam. Although import and export statistics are available from the Foreign Trade Department of the Ministry of Commerce, the Customs Department of the Ministry of Economics and Finance, the Port Authority, and CAMCONTROL, there is no consistency in the data collection and hence the reliability of the data is uncertain.

770. Unofficial exports of rice to Viet Nam and paddy to Viet Nam and Thailand are known to occur but the volumes are unknown. Estimates of export volumes of rice to Viet Nam

are more difficult to obtain, since there is a 30 percent import tax imposed on rice imports and most is therefore smuggled.

771. Volumes of Thai Jasmine rice being shipped into Cambodia for local consumption is also difficult to estimate. The major markets that could demand and afford Thai rice are very limited. Phnom Penh, Sihanoukville and Seam Reap are the major centers where Thai rice is shipped to. JICA (2001) also mentions that provincial towns in the Southeast and Coastal areas are consumers of Thai rice. Best estimates of Thai Jasmine imports put the figure between 130-135,000 tonnes for the 2004-2005 crop year; see Figure 34.

772. Exports of paddy to Thailand and Viet Nam are also difficult to estimate. The main reason for the export of paddy to Viet Nam is lack of a domestic market for dry season IR rice. In contrast, the main reason for the export of paddy to Thailand is infrastructure constraints and the associated cost of transportation to southern urban centers like Phnom Penh. A general consensus is that 65 percent of the marketed paddy is shipped to Thailand and Viet Nam, with 10 percent of this going to Thailand and 90 percent going to Viet Nam. The type of exported paddy differs between regions, with southern provinces shipping IR66 dry season rice and the northern provinces shipping wet season rice. As noted in Figure 34, around 600,000 tonnes of paddy are available for export.

773. ACI (2002) found that transportation costs make the sale of northern provinces wet season rice unprofitable if sold at standard market prices for IR64 in Viet Nam. However, wet season rice sells at a premium in Viet Nam, and at higher market prices it would be profitable to sell wet season rice. In contrast, dry season IR66 rice from the southern provinces of Cambodia is competitive with IR64 prices in Viet Nam, particularly with the prices in the border provinces of An Giang and Dong Thap.

774. The main routes for paddy exports to Thailand originate in Banteay Meanchey, Battambang and Seam Reap provinces (ACI 2002)). High quality wet season rice like Somaly and Domaly are grown in the Northern provinces and these are exported to Thailand (see Table 111 and Figure 30). The lack of commercial mills in Banteay Meanchey and poor road infrastructure creates incentives for traders to export paddy into Thailand. The JICA study reported that in 2001 there were only two commercial rice mills between Sisophone and Poipet, and no commercial rice mills to north of Sisophone up to the Thai border (JICA 2001).

775. JICA (2001) also reported that since Battambang province had large numbers of commercial mills there was a regular trade between middlemen and Thai importers. JICA reported that Bavel district was a major surplus area in the province where middlemen regularly compared price information between the Thai border and rice mills along NR5 highway and shipped paddy to the more profitable destination. Given the large number of mills in Battambang it may appear to be contradictory that there is a large cross-border trade with Thailand. However, as Table 93 and Table 98 show, even though there were 207 commercial mills registered in Battambang in 2000, the total capacity of custom and commercial mills was only 151,000 tonnes compared with a supply of 280,000 tonnes. The shortfall in capacity, mainly due to the lack of working capital to purchase paddy, results in a large trade in paddy between Cambodia and Thailand.

776. Most of the paddy exported to Vietnam is dry season rice of the IR variety. The amount of paddy exported depends almost solely on the differential in the paddy price between Viet Nam and Cambodia. Millers interviewed by Consultant team in the southern

provinces said that the ex-mill paddy price in Cambodia followed the paddy price in Viet Nam, and if millers were unwilling to pay those rates they could not purchase any paddy.

777. JICA (2001) noted that Vietnamese traders come up the main and sub streams of the Bassac and Mekong Rivers and in Takeo Province several ports along the rivers and the NR2 highway are used as loading places. In Kandal province, paddy is loaded along the banks of the Bassac River. In Viet Nam, paddy and rice are moved by barge through a dense network of irrigation and waterway canals and large-scale export factories are located only 30-40km across the border.

J.2.12 Major Constraints along the Value Chain for Rice

778. The priority constraints indicated by various stakeholders in the value chain are summarized in Table 125.

779. The headings refer in the priority constraints are general headings. These are discussed below in detail.

780. **Irrigation and Water Management**. This constraint refers to several aspects, all included under this heading. It refers to:

1. Lack of water during the dry season and the difficulty and risk of conducting cultivations without assured access to water
2. Water management during the wet season, where both drainage and water control might be the key issues
3. Efficiency in water use, including pumping efficiency, alternative methods of irrigation (surface, groundwater, drip, sprinkle)
4. Water conservation and design of poulder, reservoir
5. Irrigation schemes
6. Water Use Groups formation and management capacity
7. Maintenance of irrigation systems and water use fees

781. **Technology**. This constraint also includes several aspects such as:

1. Know-how about use of available technology
2. Management of plant nutrients, pests and diseases, soils
3. Postharvest technology use (threshing, drying, storing, handling)
4. Processing technology (on-farm processing, off-farm processing)

782. **Marketing**. Under marketing different aspects are included:

1. Access to new markets for processors and millers (including exports)
2. Market information and intelligence
3. Organization of markets
4. Linkages between farmers and processors
5. Linkages between farmers, traders, and consumers
6. Marketing Groups
7. Contracts
8. Horizontal and vertical integration

783. **Quality**. Low quality is generally perceived to be the problem, but the specifics include:

1. Absence of grades and standards
2. Lack of knowledge about quality insurance systems
3. Ineffective current quality control system

784. **Capital**. Capital constraints have been indicated by traders, millers, and processors as a major constraint. Interestingly ***none of the stakeholders in Table 125 has indicated capital as the main constraint***. This constraint includes the following aspects:

1. High interest rates for credit
2. Low saving mobilization
3. Lack of access to investment and working capital
4. Cumbersome procedures to access credit

785. **Coordination**. This constraint has been highlighted by both public and private organizations. It highlights the difficulty of sharing information among organizations and agencies involved in program planning and implementation. This is the case both at the central level and the local level. The process of decentralization and devolution of decisions to local governments (Provincial Rural Development Committee - PRDC, Commune Council - CC, Village Development Committee - VDC) have to a certain extent addressed this issue, but more remains to be done. It is generally perceived that coordination is higher at the local level than at the central level.

786. **Competition**. This constraint has been highlighted by traders, millers, and processors. It is not clear why this is a constraint. Competition would be expected in an open market economy like Cambodia. What respondents have repeatedly indicated is:

1. High paddy prices resulting from competition in procurement by Vietnamese and Thai traders
2. Inflow of smuggled products from across the border

J.3 Vegetable Value Chain

J.3.1 Vegetable Production in Cambodia

787. Trends in vegetable production are difficult to interpret. Over the period 1995-2004 there have been only 3 years where growth in production has been positive; 1995/96, 1999/00 and 2003/04 (29.4 percent, 7.7 percent and 28.2 percent respectively), see Table 36. Over the longer term, average growth in production has been 0.5 percent, with the period 1995-2000 being 1.6 percent and 2000-2004 being -0.9 percent. It is possible that actual production is grossly underestimated because of home garden cultivation that goes unrecorded. However, competition by imported vegetables from Vietnam might contribute to market instability and therefore fewer incentives for farmers to engage in risky vegetable production. Most of the increases in production have been due to yield, which grew an average of 3.1 percent over the period 1995-2004 compared with -2.2 percent growth in area under cultivation. Table 292 and Map 43 to Map 48 show the provincial distribution of vegetable production in the wet and dry season. National yield averages are around 3.8-3.9 t/ha over the year, although it does not make much sense to compare productivity across different crops in the vegetable grouping.

788. There are differences in the distribution of wet and dry season production of vegetables, depending on access to water from Tonle Sap. In the wet season the major production areas of vegetables (greater than 1000 ha) are Kampong Cham (3,785 ha), Kandal (2,094 ha), Kampot (2,091 ha), Kompong Thom (1,414 ha), Kampong Speu (1,231 ha), Takeo (1,192 ha), and Battambang (1,059 ha). In the dry season the major production areas are Kampong Chhnang (2,822 ha), Kandal (2,636 ha), Kampong Cham (2,224 ha), Seam Reap (1,151 ha), Kompong Thom (1,120 ha), and Battambang (1,005).

789. According to the 2004 CSES (NIS 2004), out of the 3.023 million households in Cambodia, 7.6 percent of them were involved in vegetable production (229,748 households). This comprised of 122,464 households undertaking wet season vegetable production (5.7 percent of 2.1485 million households) and 107,502 households undertaking dry season production (12.3 percent of 0.874 million households). After cereal production and fruits and nuts cultivation, vegetable production is the third most important agricultural activity undertaken in Cambodia in terms of population.

790. Gross value of vegetable production in 2004 reached 31.281 billion riel (US$7.6 million) for wet season production and 57.894 billion riel (US$14.1 million) for dry season production (NIS 2004, pg. 19).

791. Also in the 2004 CSES, average yield per square meter by gross output of vegetable production ranged from 906 riel/m^2 (US$0.22) in the wet season down to 296 riel/m^2 (US$0.07) in the dry season. This compares with fruits and nuts (1,833 and 440 riel/m^2 for wet and dry season respectively) and cereals (1,313 and 1,282 riel/m^2 respectively) (NIS 2004, pg. 20).

J.3.2 Producers

J.3.2.1 Overview

792. The Consultant Team surveyed farmers in four provinces; Kampong Speu, Svay Rieng, Battambang and Kampong Thom. An overview of their production statistics is provided in Table 50 and Table 51. On average, farmers had 4.48 hectares of land, of which 4.11 hectares was devoted to rice production. This is substantially greater than

average land holdings for rice producing farmers country-wide and reflects both sampling bias as well as differences across provinces. In Kampong Speu, for example, average rice areas were 1.09 hectares while in Svay Reing they were 8.15 hectares. The areas devoted to vegetables were quite small, ranging from 24m^2 up to 2000 m^2.

793. The following sections detail the characteristics of vegetable production in Cambodia and specifically for the farmers interviewed by the Consultant Team.

J.3.2.2 Input Traders

794. Ypma (2005) conducted a survey of input suppliers in Svay Rieng Province[47]. Input supply is a specialized activity and farmers indicate that they have to purchase input products from the markets; rather than mobile traders going from farm to farm. This implies that collectors do not function as selling agents of inputs.

795. In Svay Rieng the Chipou market is specialized in wholesale activities revolving around both outputs and inputs with a much higher concentration of wholesalers and input dealers than the other markets surveyed. At the Chipou market, 18 wholesalers and 15 input dealers carry out business. Although input dealers were found at all the other markets surveyed, with the exception of Kroulko market, the numbers were less, with 6 for Veal Yun and 4 for Brasotr market. Only one input dealer was a pure wholesaler and sold only to retailers while all other input dealers sold all their produce directly to farmers.

796. Inputs are primarily sourced from Vietnam with five out of the seven dealers listing Vietnam as a source of inputs. Second is Neak Loeung market which is mentioned twice, Veal Yun market in Svay Rieng town and Phnom Penh are both mentioned once as a source of vegetable inputs while. Reinforcing the dominance of Vietnam on the input side of agriculture in the delta provinces of Cambodia

797. From the collected information, it was found farmers buy their inputs directly from input dealers. From the seven input dealers interviewed only one reported selling to retailers. The primary input, seed, was only available from two of the interviewed input dealers. While all input dealers interviewed sold fertilizers and pesticides, these products create application problems for the farmers because they are labeled in Vietnamese and/or Thai.

798. The products considered as inputs were seeds, fertilizers and pesticides. Only one input dealer sold all three products while four input dealers sold 2 products and two input dealers were specialized in one product sold pesticides and the other sold fertilizers. Five out of the seven input dealers surveyed also sold non Agricultural produce, while other activities included the sales of Rice seeds and animal feeds

799. Table 148 gives an indication of the size of input dealers in Svay Rieng. Provided that they deal in all three categories of inputs then on average they would derive an income of US$27 per day from selling inputs. Most do not sell seed decreasing average income from US$27 to US$22 per day. This supports the need to sell other items than vegetable inputs or even agricultural inputs. The profits per unit are very similar between dealers with 3 fertilizer dealers reporting profit margins between 42 and 46 Riel/kg the only divergent result was 20 riel/kg. The fertilizer wholesaler refrained from giving profit margin information however if the margin of 43 Riel/kg is adopted the monthly income from

[47] Some 28 percent of the input dealears in the province were covered.

fertilizer sales would amount to 5,140 dollars per month from sales almost 520 tonnes/month with a loss of 7.5 percent

800. The small amount of inputs sold in Svay Rieng is supported by the data from the national statistics bureau listing Svay Rieng amongst the provinces with the smallest acreage of vegetables in both 2003 and 2004. The small turnover and small margins indicate that input dealers do not have the facility to provide inputs on credit. However exceptions such as the wholesaler would be able to inject credit into the system.

J.3.2.3 Fertilizer Inputs

801. Between 1979 and 1993 the government was responsible for most of the import and distribution of agrochemicals, in particular, fertilizers and pesticides. Limited amounts were imported and distributed by non-governmental organizations. Fertilizer imports from 1980-1989 during the Vietnamese occupation were of the order of 35-40,000 tonnes per year and from 1991 to 1996 FAO, Japan and ADB made donations of inorganic fertilizer (92,966 tonnes). Between 1993 and 2000 the Ministry of Agriculture, Forestry and Fisheries' Agriculture Inputs Company (AIC) imported and distributed 131,424 tonnes and 89,353 tonnes of various types of fertilizers, respectively.

802. The official imports of fertilizer through Phnom Penh and Sihanoukville ports, which averaged almost 20,000 tonnes per year from 1990-1999. By 1996 the private sector had largely assumed responsibility for fertilizer imports and was seen to be generally quite efficient in terms of amounts, kinds, availability and prices of inorganic fertilizers (Young, Raab et al. 2000, pg. 14).

803. Compared with other countries in Asia, Cambodia has one of the least productive growing environments, largely due to the infertile soils. Most soils are acutely deficient in phosphorous and there is widespread nitrogen deficiency (Young, Raab et al. 2000, pg. 13). As a consequence the yields are low and large amounts of fertilizer are needed in order to boost productivity. However, fertilizer inputs are low compared with comparable agroecological zones in Thailand and Vietnam. Fertilizer application rates are around 40-100kg/ha but AQIP survey results presented in Table 46 indicate that farmers apply 30 percent more fertilizer to their improved variety crops (Agriculture Quality Improvement Project 2002).

804. Part of the low level of fertilizer use is due to the expense of fertilizer. The prices vary between locations, currently ranging from 28-65,000 Riel/50kg sack, and reflect the distance from the Vietnamese border.

805. Most farmers apply available manure in preference to inorganic fertilizer, and only apply inorganic fertilizer when they have sufficient surplus cash to do so. As most of the rice production occurs in the wet season, farmers usually have surplus cash in the beginning of the dry season (after wet season harvest) to afford fertilizer purchases for the dry season crop. However, due to the limited extent of dry season production most farmers do not have surplus cash at the planting of the wet season crop in order to purchase fertilizer for application at this time.

806. The main concern about fertilizer raised by farmers and traders is the variability in fertilizer quality and the lack of crop response to fertilizer applications in some instances. The popular belief is that fertilizer contamination, product tampering and substitution and mixing of low quality fertilizer with higher quality fertilizer are the main causes.

807. For farmers, the cost of fertilizer comprises around 20-35 percent of the total cost of production, including the imputed labor cost. Most farmers use limited amounts of fertilizer due to cash constraints. Correspondingly, yields are low.

J.3.2.4 Pesticide Inputs

808. The sub-decree "Standards and Management of Agricultural Materials" was promulgated in October 1998. However, it is not fully followed and enforced. Pesticides and other agricultural chemicals are available on all markets, and even at communal trading points. The sub-decree requires that whosoever dealing with manufacture, formulation, import, storage, and sales or transactions of agricultural materials in Cambodia (including pesticides, and fertilizers) register the products with the Ministry of Agriculture, Forestry and Fisheries (MAFF). As far as the law is concerned only about six firms have registered. All are international companies from Thailand, Vietnam, Japan, Germany, and Israel.

809. Between 1980 and 1993 official imports of pesticides by the Agricultural Import Company totaled 0.56 million liters and 470 tonnes of pesticides, averaging 40,000 liters and 36 tonnes per year. During 2001 imports of MAFF registered pesticides and herbicides from the 6 registered companies were 63 tonnes and 11,000 liters. However, the volume of pesticides available on markets is far more than this and the Bureau for Agricultural Materials and Standards (BAMS) of MAFF estimates that at least 80 percent of pesticides are smuggled across from Thailand and Viet Nam. Estimates of the amount of pesticides used by farmers is nearly impossible to obtain, given that most of the pesticide imports are unofficial imports through Thailand and Viet Nam.

810. Pesticides are sold under more than one hundred trade names made from 68 common/generic names, mostly consisting of Class IA and IB chemicals[48]. Usually, labels are in Thai, Vietnamese, English, and French, and sometimes German. Hence, most of the farmer users do not know the proper usage and handing of the different types of pesticides.

811. Farmers appear to prefer hazardous pesticides since they deliver immediate effects on pests/insects. There is a lack of understanding about correct application rates and the hazards of mixing chemicals together. Most farmers do not wear protective clothing, and have almost no knowledge of the impacts of the chemicals on their health, consumers, and environment.

812. Use of pesticides is dependent on the growing season. Most farmers do not use much pesticide during the wet season when pest populations are low. However, application rates are higher for the dry season and early wet season when pest populations are at or near the peak of their annual cycle (Agriculture Quality Improvement Project 2002, pg. 15).

813. For farmers, the cost of pesticides comprises around 5-15 percent of the total cost of production, including the imputed labor cost. Most farmers use small amounts of

[48] A Lutheran World Service survey in 1996 Specht, J. (1996). Pesticides in Cambodia. Phnom Penh, Cambodia, Lutheran World Service. showed that Class IA, and Class IB chemicals had a 70 and 13 percent market share respectively. WHO classifies pesticides in Class-IA (extremely toxic), Class-IB (highly toxic), Class-II (moderately toxic), and Class-III (slightly toxic).

pesticides on their vegetables due to cash constraints and because appropriate chemical pesticides are difficult to source in the local market.

J.3.2.5 Irrigation Inputs

814. The majority of agricultural production is from rain-fed production systems and in a majority of years, incremental yield due to irrigation is small. The benefits of supplementary irrigation to early wet season or late wet season crops are high in drought years as well as for the production of dry season crops. Irrigated dry season crops usually produce higher yields but there is a confounding effect with increased fertilizer use.

815. The use of irrigation is limited due to a widespread disintegration of irrigation infrastructure through years of mismanagement, destruction and neglect. Based on estimates of potential surface irrigation resources, Cambodia is presently only utilizing between 50-60 percent of the potential irrigation resource. As Table 47 shows, if available surface water was fully utilized up to 1.67million hectares could be irrigated. The Mekong would provide 44 percent of this water, while the Tonle Sap tributaries would provide a further 21.5 percent. As Table 47 shows, all but 8.5 percent of the water resources for this would come from the Mekong basin and it uncertain what the implications for downstream users (and countries) would be. Most of the projected water use demand over the next 10 years comes from irrigation users (55 percent), with a further 16 percent coming from increased domestic use.

816. Table 48 shows that in 1996 Cambodia had 946 irrigation systems in place irrigating 256,000 and 143,000 hectares of wet and dry season production respectively. This is only 2.3 percent of the total land area (12.4 percent of wet season and 55.2 percent of dry season cropping area). Of these 946 irrigation schemes, many are not operational or functional. In 1993/94 only 21 percent of the 841 irrigation schemes throughout Cambodia were actually operating (ACI 2002).

817. Of more importance is the potential use of shallow groundwater resources. Table 48 shows that shallow groundwater resources cover 27.6 percent of the total area. Groundwater resources are a potentially important source of irrigation although they have largely been unused for irrigation purposes (most being used for village and family domestic use). Data on the extent of use of groundwater for irrigation is unavailable. The Ministry of Water Resources and Meteorology is responsible for water policy and roughly estimates that 17.6 billion cubic meters of groundwater is available for extraction in Cambodia (ACI 2002). MOWRAM believes that provinces currently using groundwater for irrigation include Prey Veng, Svay Rieng, Takeo and Battambang. The former three use groundwater for rice cultivation, while the latter for fruit tree crops. However, the areas covered are very small. Five districts in Prey Veng, three in Svay Rieng, and two in Takeo are currently using ground water resources (ACI 2002).

818. MOWRAM believes that extensive use of groundwater resources for agricultural irrigation is not feasible due to the low quantity of water, low and variable flow rates, poor recharging capacity, and absence of reliable aquifer (ACI 2002). Table 47 indicates that flow rates vary between 1.5 to 1296m^3 per day, implying that large scale use of groundwater resources is not a feasible option. However, the use of these resources for supplementary irrigation during the early wet season cropping period may be a viable option, due to the limited extent of early wet season production and the economic viability of investment in tubewells for this type of production system.

819. Costs of irrigation are comprised of the cost of hiring pumping equipment, fuel, and labor itself. Out of total costs of production irrigation costs for vegetable production are around 23 percent for pump hire and 19 percent for fuel (which is also used for other purposes such as farm machinery operations). During the wet season irrigation use is much lower and mainly for supplementary purposes at the tail end of the wet season to correct for seasonal shortages in rainfall.

J.3.2.6 Labor Inputs

820. Generally the labor division between men and women are unequal, with men usually tasked with the heavier manual labor of plowing and women undertaking transplanting and general crop husbandry such as weeding. Men are usually involved in task such as applying pesticides and fertilizer, while both men and women are involved in harvesting and post harvest operations.

821. It is a general facet of smallholder farming systems area that farm labor demand is seasonal and opportunities for off-farm work usually exist only during times of peak own-farm demand. In calculating the shadow wage of labor many studies proceed on the basis that the opportunity cost of labor is zero due to the lack of off-farm opportunities. Under this situation it is reasonable to investigate the assumption that the opportunity cost of own household labor is practically zero. Weeding and other maintenance work are usually carried out during slack periods in the household farming cycle, whether this be slack periods during the day or on a seasonal basis. However, since labor costs (calculated on the basis of a full shadow wage) typically make up 50 percent of the total costs of production, there is a concern that the cost of production will be seriously underestimated if a shadow wage for household labor is not used. The exact wage value used may be subject to debate, but for the purposes of this report the wage rate for hired labor is used as a proxy.

822. For farmers, the cost of labor comprises anywhere from 20 to 86 percent of the total cost of production, including the imputed family labor cost. Most farmers use family labor for agricultural production activities. Weeding (10 percent of total costs), harvesting (12 percent) and land preparation (20 percent) comprise the bulk of labor costs for vegetable production.

J.3.2.7 Production of Vegetables

823. The Consultant team interviewed several vegetable farmers in each of the surveyed provinces as well as obtained secondary data from previous surveys conduced by the consultant team (ACI 2005) and other donor reports. Most of the material obtained by the Consultant team is presented in Section J.3.2.8 and Section J.3.7. Some profiles of vegetable producers are presented in Box 26 to Box 30.

Box 26 Vegetable Farmer in Battambang

Meeting with vegetable farmer in Prek Dach village, Omal Commune, Battambang District, Battambang Province

The farmer is growing rice and vegetables (long yard bean, cabbage and Cancun). The next vegetable crop he will change to another type of beans and vegetables.. He is changing because of the insect load and wants to rotate his crops. He is currently involved in IPM, so knows about this.

He is part of the Cambodian Women in Development Project (himself, not his wife), and is the key person in the village involved in this project.

He has 8ha of land in total, of which 7ha of land is under rice cultivation, 0.5 ha of land is under rice/vegetable rotation and 0.5 ha of land is fully vegetable production. The vegetables are for consumption as well as for sale.

Last year he sold 10 tonnes of rice but this year he only sold 6 tonnes of rice because the yield is lower due to flooding. He gets a higher income from vegetable production than from rice. The yield of rice is around 2-3 tonnes per hectare while vegetables are 7-8 tonnes per hectare. The vegetable is sold in the district market 5 km away - he sells himself, not through a middleman.

He sells the rice to the trader (owner of a rice mill). Gets 5500 baht per tonne (around 550 riel/kg).

Started 3 years ago to grow vegetables. The main reason was to get income every day by selling vegetables, rather than having to wait for the rice harvest to come in. He decided to grow vegetables by himself, without any prompting from outside.

The information about what vegetables to grow depends on the market conditions. He goes to the market to sell and he sees what is selling the most at the highest price.

He also chooses to grow vegetables which are selling for a low price because he thinks that the other people will stop growing the vegetables so he will grow them and get a higher price when the supply is reduced

Price Information is only in the market. He knows about the Phnom Penh price on TV but is not interested in the Phnom Penh price. The TV shows production activity so he gets information from that.

He has also received some booklets about vegetable growing - bean, cucumber, soybean, mungbean, long bean, pumpkin. Very useful information, particularly about disease.

Phkna Khneay rice variety seeding rate is 100kg/ha, yield is 2-3tonnes per hectare with some fertilizer. Get seed from within the district. Keep seed for 3 years then goes to find a purified source - mainly from other farmers. Vegetable seed is bought from the store.

Source: Field Interviews, 22 February 2006

Box 27 Vegetable Farmer Group in Kampong Cham

Meeting with vegetable farmer group in Chrak Pon Village, Soung Commune, Tbong Khmon District, Kampong Cham.

There are 3 households growing vegetables and sharing a spring water source [looks to be groundwater with a watertable 1 meter below the surface, rather than a spring]. There is no restrictions on using the spring as it is a reliable source of water.

Sell vegetables to a collector at Soung Commune market, 3km away. The crops are rotated, but most crops are either cauliflower, chopstick cabbage (Kale?) yard long bean and cucumber. The biggest farmer has 0.2 ha and the smallest farmer has 0.05ha.

Market information - checks price at the market (retailer) and then bargains with the collector.

The market is full and there is no room for additional sellers (no market stalls available) so they cannot sell at

the market themselves, they need to go through a trader. They don't want to go to the market and sell the produce themselves and prefer to sell to a trader - because once the crop is harvested they have to sell everything immediately - whereas they can leave the crop standing until they get a trader to buy it. When the collector comes they can bargain and if they don't agree then they don't sell. Also, if the collector only wants a small amount then they can just harvest a small amount.

Quite often traders from other provinces and districts offer to buy the crop so they can know what the price is in other areas and they can bargain with this information.

The TV and Radio tell the Phnom Penh price but they can use this as a guide to the local price.

They are not recording the fluctuation in the price to make production decisions of when to produce (e.g Chinese New Year the price is higher), but they try to harvest as early as possible since the price is higher then.

Other sources of information - Department of Agronomy IPM program (FAO TCP) - but now finished. They also receive the MMB booklets and pamphlets [the booklets look brand new, but they claim that they have had them for more than 1 year].

They need information on Natural Pesticides, and how to grow other crops.

Have experimented with other crops but these are not suitable for the area so they have decided to stick with the crops they are growing for the time being.

Source: Field Interviews, 16 February 2006

Box 28 Vegetable Farmer in Prey Veng

Meeting with farmer in Krasarchet Village, Romehek Commune, Preah Solceh District, Prey Veng Province

Has 1.5ha of rice land and 0.36 ha of home plot

Rice is grown in rotation with water convolus and water melon. Fish around the field in ponds.

Has chosen 3 varieties of crops to plant and is going to test to see which ones are suitable for the soil conditions. For example, with sugar cane there is a longer growing season and a high fertilizer demand so it is not so suitable in rotation with rice.

Decision making process: watching TV program on a new crop and then deciding to see whether this crop is suitable for the growing conditions. If it increases yields then they will expand production.

Have timed the harvest to coincide with Khmer New Year so the price should be higher.

On the TV, there is a program on agriculture every night after the news. Every week it is on a different channel.

Price information on TV as well as the District Agriculture Office. He visits the market to find out the price for vegetables and rice and compares it against the collectors price in order to negotiate.

Information requirements:
Need Farmer Field School
Need Production technology in order to increase organic yield
Need information about insecticides and vegetable diseases
Need information about fish diseases
Need information about catfish raising

Source: Field Interviews, 15 February 2006

Box 29 Organic Vegetable Farmer in Prey Veng

Meeting with Organic Farmer in Prey Veng. Ban Baung Commune, Peam Rork District

This is a model farmer supported by CAAEP.

Has 3 ha of land and rents 1.5ha more.

Has a Rice-Fish field (trench around rice field) contains silver carp and Tankasis??
Has pond for irrigation as well as fish - tilapia
Watermelon
Cucumber
Bean tree ?? - for green manure, fruit for vegetables, firewood/charcoal

Working with extension workers for 2 years. Also holds a farmer field school here.

Before the help from the extension department the gross income was 3 million - only from rice. Now it is 1.5 million profit, but this does not include the fish which is not yet sold.

Market Information- Mainly obtained from provincial traders. When going to harvest his crop he informs the trader who comes and gives him the price based on the quality. Some information about market demand is obtained from the extension workers.

He has a TV and Radio and is aware of the programs on them for market information. He watches the programs almost regularly, but is sometimes busy on the farm. The program is on from 7-8pm every day.

He wants price information so he can know how much to get from the trader. It is also useful for production plans, as he follows the price fluctuations and estimates when to get the highest price. He does not keep track of the information, but remembers it.

Extension information:
1-2 times per week on TV. For example, fish raising, vegetable growing, transplanting rice etc.

Information is useful and would like to know more about vegetable production, rice, fish, animal husbandry and also about market information and agricultural technology. He wants the broadcasting time expanded and more crops and commodities covered in the booklets and Mass Media Broadcasting.

Source: Field Interviews, 15 February 2006

Box 30 Vegetable Farmer in Prey Veng

Meeting with Vegetable and rice farmer in Prey Veng. Ban Baung Commune, Peam Rork District

Has 2 ha of paddy and 0.7ha of vegetables. Rotating crop. Grows long bean, cucumber and cabbage as the main vegetable crops but also grows sugarcane, cassava and banana as secondary crops.

Has participated in the training course run by CAAEP and has received booklets from the OAE. He has also received some information from TV and Radio.

Gets market information mainly from the trader and the nearby market and then makes a comparison of the price. When he goes to the market the traders there asks him to grade the product and also trim the outer leaves in order to get the higher price. But this reduces the weight of the product. In contrast, when the collector comes to the farm they never grade the crop but he conversely receives a lower per unit price.

Source: Field Interviews, 15 February 2006

824. Ypma (2005) interviewed 18 farmers in Svay Rieng province with 5 producing vegetables in the dry season, 5 producing in the wet season and 8 producing the whole year. The producers in the dry season had a slightly longer growing period then the wet season producers. The average production period for the dry season is 7.4 months and 6.4 for the wet season. The average total area per grower was 1.6 ha with a marketable surplus of 13,300 kg of vegetables in the dry season and 11,200 kg in the wet season and

an average 10 pecent own consumption. The total production is estimated at 27,200 kg an average ≤ 1 tonne per ha. This is well below the average as stated by the AMO statistics of 1.45 tonne/ha for the dry season and 1.8 tonne/ha for the wet season (MAFF 2004).

825. Ypma (2005) asked farmers what crops they usually produced and what their preferred crops were; see Table 149.

826. The crop column in Table 149 lists the crops which the farmers indicated were usually available from them. Each mention received one point. There were no questions as to the acreage per crop. Subsequently, farmers were asked to name their three favorite crops in descending order with the most favorite receiving three points, the second 2 points and the least favorite receiving 1 point. The points are listed in the preference column and the subsequent rankings in Table 149 (Ypma 2005).

827. To provide some indication of the ability of actors to respond to market demand and to indicate vegetable varieties with potential for both traders and producers to focus on, a comparison is made between the availability of vegetables and the actor's preference for vegetables. The assumption is that in most cases the preference ranking should be narrowly correlated with the availability of vegetables (Ypma 2005).

828. There is a clear correlation between preference and availability but for some crops there is a considerable mismatch. Crops with a high preference ranking and a low availability ranking are potentially interesting and could be the focus for further research. For farmers, the crops potentially interesting are Cucumber, Chopstick spinach, Mint, Punley, Ginger and Chunglung (Ypma 2005).

829. Ypma (2005) asked farmers to list the advantages and the disadvantages of their favorite crops. Table 150 provides an aggregation of all the advantages and disadvantages listed by the farmers for all their preferred crops. The advantages or disadvantages were not scored as was the case with the preferred crops the adavatages and disadvantages where the most preferred crop received 3 points the second 2 points and the least preferred favourite crop 1 point. The associated advantages and disadvantages all received 1 point to remove subjective interpretation from the evalution of the perceived farmers advantsges and disadvantages. This approach is also used when discussing the advantages and disadvantges as perceived by traders (Ypma 2005).

830. The advantages can be split into two groups: those related with the crop production and those related with marketing/income. If easy to grow, no insect damage, shelf and short growing period are production related, the total score for this category would be 24. If the same is done for high margin, easy to sell big yield continuous income and shelf life the total is 27. With big yield being slightly ambiguous and easy to grow being the most important advantage mentioned, it is fair to state that criteria involved with crop production have roughly the same weight as those related to income and marketing. However, when considering the disadvantages, it is clear that those relating to production outweigh those related to marketing/income by 28 to 1. Although the lack of quality seeds is the second most important criterion it is ambiguous with both a marketing aspect as well as a production aspect (Ypma 2005).

831. The farmers interviewed by Ypma (2005) sell 50 percent of their crop directly at the market, 20 percent is sold to wholesalers and 20% is sold to retailers. The additional 10% is kept for own consumption. This is contradictory to Figure 35 which show 30 percent sold to consumers, 40 percent to wholesalers and 30 percent to retailers. However, the

phrasing is different as directly at market can include produce taken to market and sold to retailers or wholesalers although the lack of middlemen implies that the farmer always take their own produce to market and therefore this should read to mean that 50 percent is sold directly to consumers. The absence of middlemen is a key issue and merits further research into its accuracy and reasons.

832. As additional sources of income all the vegetable producers interviewed listed rice, some mentioned animal husbandry, water palm and local wine production was listed twice and worker and motorbike taxi driver were listed once as additional sources of income (Ypma 2005).

J.3.2.8 Costs and Margins

833. Table 52 and Table 53 present information from a survey conduced by ABiC for ACI (2005) on the costs, returns and gross margins for different vegetables, while Table 54 presents estimates of marketing margins on a regional basis for the crops[49]. There are too many vegetable crops to go into detail, so for the purposes of exposition, only cabbages and long beans are discussed in detail. From the ABiC survey, estimated gross margins for cabbages are around US$951 per hectare while for long beans they are US$586. In terms of marketing margins, farmers get around 70 percent of the marketing margin for cabbages and 53 percent for long beans.

834. In terms of farm size, Table 126 presents the summary partial budgets for vegetable production systems while Table 127 to Table 145 present the detailed partial budgets based on study team calculations, and include the opportunity cost of household labor. The results are quite different from the ABiC survey, but are presented on a regional basis rather than the national averages calculated in the ABiC survey.

835. Partial budgets for cabbage and long bean are presented in Table 131, Table 132, Table 144 and Table 145. In the case of long beans, partial budgets from Sihanoukville (Coastal zone) and Pursat (Tonle Sap zone) were calculated. The results indicate that small farms in Sihanoukville have gross margins of around US$1196 per hectare, while small farms in Pursat have gross margins of US$962 and medium size farms have gross margins of US$223. In the case of cabbage, partial budgets from Pursat and Battambang, both in the Tonle Sap zone, were calculated. The results indicate that small farms in

[49] See MAFF (2003). Report on the Pilot Cost of Production Survey 2002. Phnom Penh, Cambodia, Ministry of Agriculture, Forestry and Fisheries, Strengthening of Agricultural Planning and Statistics Component: Agricultural Statistics System Establishment Sub-Component. Agricultural Productivity Improvement Project, Sipana, C. and P. Moustier (2004). Socio-Economic Strategies and Results of Vegetable Traders in Phnom Penh (Cambodia). Hanoi, Vietnam, Sustainable Development of Peri-Urban Agriculture in South-East Asia Project (SUSPER), FSP Project 2000-56, Sokhen, C., D. Kanika, et al. (2004). Vegetable Market Flows and Chains in Phnom Penh. Hanoi, Vietnam, Sustainable Development of Peri-Urban Agriculture in South-East Asia Project (SUSPER), FSP Project 2000-56, Ypma, P. (2005). Market Survey of Svay Rieng Vegetable Market. Phnom Penh, Cambodia, Agriculture Quality Improvement Project. for a discussion on vegetable marketing in Cambodia. SUSPER SUSPER (2004). "Sustainable Development of Peri-Urban Agriculture in South-East Asia." SUSPER News **2**(2). conducted a survey of imported vegetables into Phnom Penh and noted that all leafy vegetables originated from Phnom Penh or Kandal Province (less than 50 km from Phnom Penh). In contrast, 75 percent of tomatoes, 95 percent of cabbages and 100 percent of Chinese cabbages are imported from Vietnam. Vegetable imports correspond to the deficit in local production due to heavy rainfall and high temperatures in the rainy season and also to water deficits in the dry season. This indicates that there is little scope for a large export in main types of vegetables from Cambodia to neighbouring countries such as Vietnam until cost of production decreases and seasonal shortfalls are addressed. Interestingly, levels of pesticide residue are similar in imported and locally produced vegetables (both excessive), indicating that there is currently no comparative advantage in “safe vegetable” exports to Vietnam.

Pursat have gross margins of US$387 per hectare, compared with medium size farms which have a gross margin of US$314. In Battambang small farms have gross margins of around US$2150, mainly due to higher seeding rates, and increased use of inputs such as fertilizer and pesticides.

836. In general, vegetable production shows decreasing returns to scale, with small and medium size farms being more suited to vegetable production compared with large farms. Indeed, it was difficult to find large size farms that were in fact undertaking vegetable production. Vegetable production is a labor intensive activity, and therefore smaller farm sizes are more suited to this type of production system, given family household constraints to labor as farm size increases; see Figure 26.

837. Table 146 and Table 147 illustrates a sample of revenues, costs, gross income, and margins (gross income as a percentage of revenue) for different types of vegetable farming systems and commodities assessed by the Consultant's Team during the field work in Kampong Spue, Svay Rieng, Battambang and Kampong Thom. Average gross margins were around $210 per hectare for cauliflower in kampong Speu, $221 per hectare for watermelon in Kampong Speu, while production of Convulvus in Svay Reing had a gross margin of $2,309 per hectare, with similar magnitudes for selected vegetables in Kampong Thom.

838. Gross margins differed significantly between different farmers and between different types of crops. On a percentage of revenue basis margins ranged from 9 percent for cauliflower in Kampong Speu up to 77 percent for Convulvus in Svay Rieng.

839. The conclusions from analyzing the margins for farmers are the following:

1. Vegetable cultivation is generally adding high value for producers.
2. Dryland rainfed agriculture is risky.
3. Margins can be improved by moving to higher valued crops or intensifying agriculture.
4. Diversification into higher valued crops improves incomes.
5. Contract farming provides higher incomes.

840. Diversifying into high value products, such as vegetables, can result in dramatic increases in value. Indications from the field work is that vegetable production can lead to gross income 16 to 30 times higher than in the case of paddy produced during the wet season. Shifting to vegetables and other higher value products is of course partly an issue of technology and partly an issue of market access. The total size of the vegetable market in Cambodia is much smaller than the size of the rice market. However, one should not forget that there is still a large demand for vegetables that is currently met by imports from Viet Nam (estimated at 80 percent of total demand).

841. A well organized contract farming system enables farmers to access credit, inputs, technical advice and marketing information directly from processors or market intermediaries thereby reducing risk and increasing profits. The disadvantages of contract farming are important – including loss of bargaining power, potential reductions in margins, and increased emphasis on improving quality (and associated penalties for non-compliance) – however, the choice to enter into or leave a contract arrangement is there for the farmer to make.

842. There are limited examples of contract farming in Cambodia, despite the potential for dramatic increases in farmer incomes and productivity; see McNaughton et al (2003) for a survey of agribusiness models in Cambodia.

J.3.2.9 Constraints

843. The Consultant Team identified several major constraints to increasing efficiency of producers.

844. The farmers listed insects and irrigation as the main obstacles in producing vegetables, and the lack of capital investment ranked second. When asked about specific methods of assistance, the most popular replies were assistance with general management, improving the farmer's technical knowledge on production techniques and provision/improved access to credit.

845. Through individual and group interviews, farmers have indicated the following constraints:

1. Production Constraints
   a. Irrigation and water use efficiency
   b. Access and quality of inputs (seeds, fertilizers, pesticides)
   c. Plant nutrients and protection management

2. Marketing Constraints
   a. Access to markets
   b. Market opportunities information

3. Postharvest Technology Constraints
   a. harvesting, grading and storage
   b. Primary processing

4. Capacity Constraints
   a. Business Planning
   b. Establishing linkages among themselves and with the market

5. System-wide Constraints
   a. Credit
   b. Infrastructure (rural roads, electrification)
   c. Deforestation
   d. Land titles

J.3.3 Collectors and Traders

846. Farmers tend to do marketing themselves with the number one reply being direct sales to consumers. The second reply was sales to retailers and wholesalers. However, this result needs to be verified for seasonal influences. No middlemen were identified in Svay Rieng as an example but this may well be caused by the decline of vegetable production in the rainy season and the subsequently smaller surplus available for marketing.

847. Farmers who do sell at the farm gate usually sell to wholesaler traders, rather than collectors or other middlemen. Wholesalers will usually come to the farm to inspect the standing crop and negotiate a sale price on a standing-crop basis (i.e. the trader will be responsible for harvesting).

848. Usually prices paid are much lower than that received by farmers who go to the market to sell directly to wholesalers or consumers. However, the standing crop is usually sold on an average price basis whereas wholesalers at the market will grade the harvested crop and deduct for damaged and sub-standard produce. Combined with the significant risk of not being able to sell the entire harvested crop (and thus incur significant post-harvest losses), most farmers prefer to receive a lower average price for a guaranteed sale rather than risk not being able to sell the harvested crop or being penalized for below grade produce.

J.3.4 Wholesalers, Retailers, Importers and Processors

849. Vegetables are either sold by small-scale sellers who may have small amounts of a few types or by large scale sellers who specialize in one type of vegetable. When farmers are found selling their own produce in the markets it is usually small-scale vegetable trade. It is also common for a farmer to sell directly to a market seller (MAFF 1997).

850. Vegetables are usually the most abundant agricultural commodity found in the market in terms of number of sellers. Vegetable sellers are usually found at the edges of markets selling produce from a place on the ground (MAFF 1997).

851. Specialization in one commodity is only common for cabbage, gourd, maize, water convolvulus, masta green and tubers. Only rarely is it seen that large operators deal in more than one or a couple of vegetables (MAFF 1997).

852. Vegetables in the markets are usually from nearby producing areas and are sold to local consumers. Phnom Penh is supplied mainly from Kandal and Kampot in the wet season. Otherwise inter-provincial trade is restricted to a small number of vegetables (MAFF 1997).

853. Locally produced cabbages are sold in the district market of Korki in Kandal Province, which have been transported by farmer using boats. There is also local cabbage production around Battambang town (MAFF 1997).

854. The gourds seen in the markets are locally produced. There are two types of gourd (green and white – wax gourd). The marketing channel is usually short from farmer to market seller to consumer. There is little inter-provincial trade except to supply Phnom Penh. Gourd provides a good example of the large price fluctuations in vegetables according to season. Svay Reing farmers reported getting 7,000 riel per 10 gourds early in the season, falling to 3,000 riel during the peak months (MAFF 1997).

855. In Svay Rieng as an example, that there are no exclusive wholesalers and retailers and very little specialization. Farmers generally buy their inputs from input dealers and sometimes they produce the inputs themselves. This corroborated by the answer of the input dealers stating that they sell primarily directly to farmers with one input dealer selling to retailers. Input dealers source their products from wholesalers who either exclusively deal or do not deal in inputs. Ypma (2005) found that all inputs are imported from Vietnam. Farmers tend to do marketing themselves with the number one reply being direct sales to

consumers. The second reply was sales to retailers and wholesalers. However, this result needs to be verified for seasonal influences. No middlemen were identified in Svay Rieng but this may well be caused by the decline of vegetable production in the rainy season and the subsequently smaller surplus available for marketing. The number of farmers interviewed is relatively small and would not merit this statement on its own however the number of wholesalers and retailers interviewed is significant and no trader indicated collectors as a source of vegetables (Ypma 2005).

856. Anecdotal evidence suggests there is a difference in vegetable trade between the dry and the wet season. With folding in large parts of Svay Rieng, production declines. Other wet season losses are attributed to increased vulnerability to pests and diseases and on some occasion's rain impact damage. It is also likely that transport/marketing losses increase during the wet season as adverse weather conditions leads to worse roads and higher vulnerability to post harvest losses in general for vegetables (Ypma 2005).

857. This is borne out by Table 158 and Table 159 showing an across the board decline in vegetable production in Svay Rieng of between 39 percent and 63 percent across seasons depending on the actor type. The only exceptions are the processors with no significant difference in volumes traded between the dry season and the wet season. An interesting result is that the imported vegetables seem to suffer from the same decline in production as there is no significant substitution of imported vegetables (Ypma 2005).

J.3.4.1 Importers

858. There is very little domestic production of cabbage and most is imported from Vietnam. There are two main routes. First, trucks bring from Vietnam to the market at Nak Loueng along Highway No. 1 and from there they are taken by a collector to Dumkor market, the main cabbage wholesale market in Phnom Penh (some also goes to Chba Ampou market). From Dumkor market they are redistributed to other provinces such as Takeo (Ang Tasom) and Sihanoukville. There is also a large wholesale place at Takhmao market which supplies Phnom Penh and provinces such as Siem Reap. The second route for cabbages to come from Vietnam is by boat in Takeo harbor. From here some are sold direct to Takeo market but most are taken by the Vietnamese traders to Takhmao by road (MAFF 1997).

859. As Table 153 shows, there seems to be no significant difference between the Wet Season and Dry Season for the geographic source of vegetables for any of the listed actor types. As may be expected, the main source of vegetables for importers is Vietnam, with only one of the interviewed importers quoting the local market as a source of vegetables. For wholesalers, the primary source of vegetables is Vietnam, but the local districts, Neak Loeung and Svay Rieng markets combined feature almost as prominently as Vietnam. For retailers the emphasis shifts away from Vietnam and is more focused on the local suppliers and suppliers from Neak Loeung. Processors show a completely different sourcing, with supplies from Vietnam becoming much less important while at the same time sourcing vegetables from a much wider geographic supply base within Cambodia (Ypma 2005).

860. Table 152 provides an overview of the origin of the vegetables found on the market in Svay Rieng. A general observation is that most of the vegetables varieties which are imported have a long shelf life allowing for transport over long distances. Another general

observation is that a number of these vegetables are grown in temperate climates such as Dalat in Vietnam (Ypma 2005).

861. Wholesalers primarily buy their vegetables from importers and/or directly from Vietnam. Few directly buy from farmers and again collectors were not mentioned as a source of vegetables but this could be a seasonal effect. This result is at odds with the results in Source: (Ypma 2005)

862. Figure 35 which shows that 30 percent of vegetable sales are from importers. A ratio representing total of local vegetables available from actors vs. imported vegetables available provides an indication that at least 50 percent of vegetables from wholesalers and importers are from Vietnam; see Table 151 (Ypma 2005).

863. As shown in Table 154, for wholesalers the five most commonly available vegetables are imported from Vietnam. Given the bias towards less important varieties of vegetables it is safe to assume that at least 50 percent of the vegetables on sale from wholesalers are derived from Vietnam. Importers are defined as Cambodian nationals buying vegetables in Vietnam and importing them into Cambodia, while exporters reside in Vietnam and bring the vegetables across the border and return to Vietnam (Ypma 2005). This last category is also much more difficult to capture in a survey as they must be present at the market when the survey is ongoing, to be interviewed. Further investigation is required to resolve this issue.

864. Wholesalers and importers seem to occupy almost the same position in the supply chain with the only difference being the geographic source of the vegetables. This is further borne out by the ratios of local vs. imported vegetables being similar. Wholesalers mention in similar frequency consumers and retailers as buyers of their vegetables. Retailers (20) mentioned purchasing directly from the farmers as their main source of vegetable supply while 16 mentioned wholesalers. Other actors mentioned were importers and surprisingly 5 retailers (12 percent) mentioned that they produced their own vegetables while the retailers sold on to consumers and restaurants (Ypma 2005). Here an anomaly emerged as all the restaurants indicated buying vegetables from wholesalers. Although this can partly be due to the fairly tenuous distinction between wholesalers and retailers (Ypma 2005)

865. Processors seem to occupy a unique position in the value chain. Processors source most of their vegetables from Cambodia but they travel the furthest within Cambodia to buy the required inputs. Again this is supported by Table 153 showing that processors as a category have the highest percentage of local vegetables on sale. They sell primarily to consumers but almost equal second places are retailers and restaurants as buyers of their produce (Ypma 2005).

866. In summary it seems that at least for the wet season there is no important role for the collector and primarily farmers sell their produce themselves to consumers and otherwise to retailers but rarely to wholesalers. Wholesalers source their vegetables from Vietnam either through importers or directly and sell on to consumers and retailers. Based on the geographic sourcing and the trading relationships it is probably not valid to distinguish between importers and wholesalers, the porous nature of the border between Cambodia and Vietnam is a contributing factor (Ypma 2005).

J.3.4.2 Wholesalers

867. Wholesalers listed 28 crops as being usually available from their stall. Table 154 shows the top 15. On average wholesalers will offer 10 to 15 varieties available for sale. This is a large variety and indicates a lack of specialization. In well functioning markets wholesalers are specialists dealing with a few types of vegetables but many different varieties of these types (Ypma 2005).

868. Table 154 indicates the most commonly available vegetables at the wholesaler level. The preference ranking is based on the stated preferences of the actors with 3 points awarded to the favorite vegetable 2 points to the runner-up and 1 point to the third favorite vegetable. The vegetables are listed in their availability rank based on the actors list of the vegetables commonly available from their stall. The percentage indicates the percentage of respondents stating that this vegetable variety is commonly available from their outlet (Ypma 2005).

869. In the case of Cucumber the source can be both Vietnam and Cambodia however through personal communication wholesalers have stated their preference for Cucumbers from Vietnam as these remain white longer as opposed to the cucumbers from Cambodia which turn yellow after a few days. The crops most favored and easily available at wholesale level are crops with a longer shelf life, indicating the importance of proper storage facilities at the wholesale level (Ypma 2005).

870. The vegetables are ranked according to their availability and the discrepancy between the availability ranking and the preference ranking could be an indicator of unsatisfied demand for the vegetable in question. However it is not the same as consumer demand and does not seek to be a proxy of consume demand. The preference ranking indicates the demand at each individual trader category given their constraints. It is clear from this table that the top 5 vegetables are derived from Vietnam. Examples of vegetables with a higher preference ranking then availability ranking amongst wholesalers are Cabbage, Pumpkin and Morning Glory. The next step would be to encourage producers to experiment with these crops if the correct agro-ecological zone is present to profitably produce these vegetables. With Pumpkin and Morning Glory being available locally these could be interesting crops (Ypma 2005)

871. For wholesalers as for all other actors the most important determinant of preference is demand with all crops listed having as most important advantage a high demand. Second most important advantage is good storage characteristics lossely translated as a long shelf life. A short shelf life features as the most important disadvantage amongst all actors (Ypma 2005).

J.3.4.3 Retailers

872. Table 155 shows the top 15 vegetables available from retailers, in total 42 were ranked by the retailers showing as expected a greater diversity than the wholesalers but not to the extent that would be expected in well functioning markets (Ypma 2005).

873. Amongst the retailers the source of the vegetables is much more evenly distributed and may indicate a preference for locally produced vegetables as very common vegetables such as carrot, cabbage and others are carried over from the wholesalers who supply the retailers. However, the additional vegetables not listed at wholesaler level are sourced by the retailer in many cases locally as is borne out by Figure 35 which indicates that retailers buy 30 percent of their vegetables directly from producers (Ypma 2005).

874. It is important to note that the 3rd most popular vegetable amongst wholesalers, Kahn Chaet, is not listed amongst the fifteen most available vegetables and clearly represents an opportunity which requires further investigation similarly for Plov kangl and Pumpkin. Pumpkin indicates that there is a potential undersupply of pumpkin at the wholesale and retail level (Ypma 2005).

875. Again in the deconstruction of the preference ranking it is apparent that high demand is the most important criterion followed by shelf life. Revealingly for Kahn Chaet two equally important disadvantages are cited by the retailers one is storage and the other is difficulties in sourcing the vegetable further indicating that this vegetable is undersupplied to the market (Ypma 2005).

876. Preference and availability are badly matched and this could indicate problem in the continuity of supply due to seasonal influences. Cucumber is universally liked amongst all actors and is by far the most popular vegetable if all the scores are aggregated (Ypma 2005).

J.3.4.4 Processors

877. Processors listed 12 types of vegetables and all are listed in Table 156. In this case the preference listing and availability listing are much more closely matched; this indicates a much better functioning market. It implies that processors have a different supply chain and this is supported by Table 153 which indicates that in general processors derive their vegetables from within Cambodia and less frequently use imported vegetables. However, they have much larger supply area from within Cambodia as compared to the other actors. This may indicate a need for certain varieties of vegetables within a species being more suitable for processing and/or deemed to be more palatable by Cambodian consumers (Ypma 2005).

878. Mustard greens, Cucumber and Radish are the clear top 3 in availability with 56 percent of interviewed processors indicating they usually have mustard greens available and 44 percent indicating they usually have radish products available at number 3. Sandek Bondos and Mor Meanh are at number 4 with only 17 percent indicating that they usually have these products available. Processors in Svay Rieng seem to be relying on a very small product range. A potential cause could be a narrow skills base which does not allow expansion into other products. Further research is required into the operations of the processors in Svay Rieng to better understand their processing enterprises (Ypma 2005).

879. Mustard greens purely by the interest of the processors are pushed to number 4 while Cucumber and Radish are more universally liked amongst actors with Cucumber being the most popular product on at the market. The other 9 products listed by the processors are more specialized and in some cases peculiar to processing (Ypma 2005).

880. The deconstruction of the preference ranking criteria for processors is similar as for wholesalers, retailers and importers but the relative wait of a high demand is less and the relative importance of shelf life increases. It is clear from comments of processors that processing hardly increases with most shelf life's stated to be between 2 days and 1 week with an exception for Taro roots which have a shelf life of 1-2 months when processed additionally an important criteria is the ease of processing (Ypma 2005).

881. Importers listed 16 vegetables as being usually available from them and they indicated a preference for 5. The preference is closely associated with storage

characteristics. The low number of importers counted and interviewed complicates drawing conclusions for this class of actor. It is surprising to see that importers also deal with local vegetables. The large variety of vegetables on sale from importers indicates the same lack of specialization as witnessed from wholesalers. This again seems to signify that a differentiation between importers and wholesalers is artificial. The preference for Bitter gourd and Ginger is noted and may indicate some opportunities for Svay Rieng farmers as these crops are sometimes grown locally in Svay Rieng (Ypma 2005).

J.3.4.5 Costs and Margins

882. As seen in Table 160, wholesalers have a bigger inter seasonal variation in sales than retailers and importers while processors show stability in daily sales. A major concern is the volume of sales, as low volumes will not generate sufficient savings to make investments. This is reflected in Table 161 showing low monthly incomes (Ypma 2005).
883. Wholesalers have average margins of 180 riel per kg in the dry season, falling to 150 riel per kg in the wet season. Retailers make a higher margin of around 250-200 riel per kg (dry and wet season respectively), while processors have a margin of 530-560 riel per kg and importers have a margin on 140 riel per kg for both seasons.

884. As noted above, margins are inversely related to sales; the higher the sales the lower the margins. It is important, therefore to look at the average monthly income; see Table 161.

885. In the dry season, wholesalers have the highest monthly income at US$297, followed by Retailers (US$248), Importers (US$208) and finally processors (US$87). In the wet season Retailers have the highest monthly income at US$132, followed by importers (US$123), wholesalers (US$99) and then finally processors (US$92).

J.3.5 End Users and Consumers

886. Ypma (2005) interviewed 5 restaurants and 20 consumers on their vegetable preferences and the amount of vegetables they consume weekly. The average vegetable consumption per week for the consumers was 1.8 kg per individual with a variation between 28 and 1.4 kg per household. A total of 20 individuals were interviewed doing vegetable shopping for in total 134 household members an average of 95kg vegetables per individual per year. This is higher than the national average previously measuring 70kg of vegetables per year per individual. (Ypma 2005).

887. The restaurants consumed 140 kg of vegetables per week. With an average demand of 20Kg/day and only a limited range of vegetables required to cover most of the requirements of restaurants in Svay Rieng the information needs to supply them is not so large. Targeting restaurants with a package of basic vegetables could therefore be successful. All restaurant owners purchased their vegetables from the market. As source of the vegetables they primarily listed purchases from four wholesalers four from farmers and one restaurant listing retailers as a source of vegetables (Ypma 2005).

888. Table 163 shows that in general, consumers seem to have a fairly small variety of vegetables in their diet with Cucumber and morning glory being the most favored vegetables. The same applies for restaurants but the score tapers off more gradually, indicating that restaurants require a more diversified supply of vegetables. Although with the supply of 10 varieties of vegetables the majority of the demand would be covered (Ypma 2005).

889. Looking at the restaurants, with only a limited variety of vegetables it would be possible to supply the majority of the restaurants with the majority of their vegetable requirements. All restaurants report that they purchase their produce at the market and none receive deliveries. 5 out of the 11 counted restaurants in Svay Rieng were interviewed providing a significant sample size of the demand of the restaurant trade. A further survey should be done to determine the interest of the restaurant trade in home deliveries of vegetables (Ypma 2005).

890. All consumers interviewed (restaurants and households) indicated that all were satisfied with the current services provided. All were satisfied with the variety of the vegetables available at the market. However, 15 out of 20 households interviewed indicated they preferred/liked Cambodian vegetables with the remaining 5 indicating that they liked both Cambodian and Vietnamese vegetables. This is a tantalizing indication that potentially there is support for locally produced vegetables and that this may well be a selling argument (Ypma 2005).

J.3.6 Access to Credit

891. The majority of the transactions in the vegetable value chain are cash, at best one third of the actors provide credit. However, when asked whether they received credit, only 21 percent of retailers and processors said they had access to credit; see Table 162. It is apparent that all actors have problems in accessing credit and farmers in particular. This impacts on the ability of traders to invest and specialize and ultimately it impacts on the ability of farmers to provide inputs. Especially during the planting season, producers can have a cash shortage and with almost no credit available to farmers it is likely that a suboptimal level of inputs will be provided to the crops (Ypma 2005). With small incomes and little access to credit, it is very difficult for traders to invest in efficiency increasing/loss decreasing solutions like storage and/or improved transport (Ypma 2005).

J.3.7 Marketing Margins

892. Stakeholders in the vegetable chain were asked for average margins on product and for total sales volume. As shown in Table 160 and Table 161, the greater the volume, the smaller the margin. This is true if analyzing the differences between actors with importers having a smaller margin, but a higher monthly income than wholesalers, and similarly wholesalers who have a smaller margin, but a higher income than retailers. The inter-seasonal effect does not follow this pattern, while vegetable sales decline the margin also declines slightly on average. This could be driven by demand with consumers only having a limited budget for vegetables and not being able to spend more. With this said, the vegetable traders absorb some of this effect in their margins (Ypma 2005).

893. Table 54 presents marketing margins for selected vegetable crops from a survey conducted in early 2005 (ACI 2005). Margins differ significantly across different vegetables, but it is worth examining a selected number as an example.

894. For leafy vegetables, farmers capture almost 63 percent of the marketing margin, followed by retailers (16 percent), wholesalers (9 percent) and then processors (5.5 percent). Collectors and transporters capture 5 percent of the marketing margin each.

895. For cucumbers, farmers capture 51 percent of the marketing margin, followed by retailers (20 percent), collectors (12 percent), wholesalers (8.5 percent), transporters (7 percent) and processors (5 percent).

J.3.8 Marketing Chain

896. Figure 35 gives an overview of the relative importance of different linkages along the marketing chain. The numbers mentioned in the figure should be taken as an indication of the relative importance of trading channels and not be used to calculate absolute quantities in transit through the separate channel (Ypma 2005).

897. Figure 35 clearly shows the absence of collectors in the system during the rainy season. This is not definite but is corroborated by all the data collected with no farmers mentioning sales to collectors and no trading actor indicating purchases from collectors. Volume in vegetable decreases by 50 percent during the wet season and this could be the main reason that collectors are much less visible in the rainy season than in the dry season (Ypma 2005).

898. The different levels at which traders operate is an indication of the lack of specialization in the market and the relatively small quantities of which actors sell. An extreme example of this is the sales of importers directly to consumers. In more specialized systems this would not be possible and the importer would not consider it an attractive option. This trading with various levels in the supply chain is common amongst all actors (Ypma 2005).

899. The absence of export channels and central wholesale market systems has resulted in fairly weak marketing institution and structure. In a 2002 survey of 190 fruit and vegetables enterprises across the provinces of Kandal, Prey Veng, Syay Rieng, Takeo and Kompong Cham, farmers sold 70 percent of produce to local wholesalers, 10 percent to Phnom Penh wholesalers, and 20 percent were sold directly to consumers (Dao 2004). However, operators within a channel carry out a combination of functions, including farmer/collector, farmer/retailer, or retailer/wholesaler. There were no pre-buying of crops prior to sowing; however, 10 percent of the crops were bought pre-harvest, 60 percent at harvest, and 15 percent at either the collection point or following market sales (Dao 2004). Usually, there are no credits and supplies' inputs provided by the intermediaries, and they do not exert any influence over the farmer's choice of fruit and vegetables grown. No selling groups and/or cooperatives operating amongst the farmers surveyed. Recently, however there are voluntary farmer groups, encouraged by NGO projects, i.e. Agrisud in Kandal and Siem Reap engaging in groups marketing. When the time comes to receiving and disseminating market information about supply/demand and prices, growers are at the most disadvantaged in entire supply chain. In the aggregate, 34 percent of farmers received their information from wholesalers, 40 percent from collectors, 24 percent from others such as neighbors, and only 2 percent from extension workers (Dao 2004).

900. In aggregate terms, the country does not produce sufficient fruit and vegetables for its own markets on a year round basis. More accurately, not enough is being produced within easy access to the main markets because of poor infrastructure. Consequently, the actual area in which produce is being grown to supply existing demand is small. Imports variety from Vietnam and Thailand make up the deficit where these countries have producing areas that are in easy access to Cambodian main markets or where there is a substantial price differential during off-season. Conversely, there are exports to the same two countries during season and of some produce like dry chillies throughout the year. At

the same time, only a fraction of national production capacity is used. Cambodia could easily produce multiples of current horticultural production, used to do so before its troubles got serious and will have to do so again if there is to be development in the rural areas. Only those provinces located close to the main markets have a market incentive at present that is enough to weigh the balance against the high-risk and high-cost of capital required (Dao 2004).

901. Admittedly, there are also provinces that have a long history as well as tradition of growing some produces as such oranges from Pursat and Battambang and/or pepper and durian from Kampot. If there were markets demand there is no reason why produce would not become available and given the fact that climatic and soil conditions are similar to neighboring countries whilst labor costs are lower, produce should be competitive. Having said that, there would be time lags from planting to harvesting for fruits in particular, which could take years to grow such as, is the case for mangoes. In the short term, there is additional produce that can be produced, what is required is a catalyst and conducive conditions. In any case, there is plantings 'activity of fruit trees around the country. The Consultant saw significant areas of durian, coconut, pineapple, banana, and pepper being planted and in various stages of maturity. Clearly, farmers have already started to respond to the limited market growth that is taking place (Dao 2004).

902. There is also relatively new production of oyster mushrooms and to a more limited extent of brown mushrooms and ample evidence of consumer acceptance in the markets. This is in addition to traditional straw mushrooms. Production, at present, is centered surrounding Phnom Penh but is bound to cover the other major markets rapidly. Total production has reached 1.3 tonnes of oyster mushrooms and 0.8 tonnes of brown mushrooms per day or a total of 800 tonnes annually in Kandal Province in addition to straw mushrooms. The development is particularly instructive as to what can be achieved in a relatively brief period given a market opportunity. In this case, development is entirely in the private sector (Dao 2004).

903. Continued improvement in infrastructure is so empirical and its will create a more favorable climate for investment in this sector. For instance, road, air, barge, and rail links along with provision of irrigation water for crops and safe water for processing industries, along with facilities such as packing houses, warehouses, cool stores, refrigerated transport and air cargo facilities all need to be evolving to service a growth industry, such as that envisaged for fruit and vegetables (Dao 2004).

J.3.9 Major Constraints along the Value Chain for Vegetables

J.3.9.1 Major Constraints for Growers

904. A lack of capital and limited access to affordable credit was identified by farmers in particular as being a major impediment to expansion in crop production. The high cost of fertilizer, pesticides, etc. and the absence of government subsidies for these inputs (which are common in neighboring coutries like Vietnam) makes it difficult for farmers to compete with imported products. In some of the more remote production districts, credit is often not available through larger schemes and farmers have to resort to private money lenders who charge exorbitant interest rates (Hickey 2002).

905. The tendency to 'under value' local product compared with imported products is an issue raised by farmers. The perception that imported products are better is still common among consumers, even though the actual quality may be inferior. This compounds the issue of low returns for the grower. A Lack of market information (prices, volumes) or the

inability to analyse the information available also leads to poor marketing decisions, and often results in seasonal oversupply and reduced or failed ability to sell products (Hickey 2002).

906. Pesticide residues, post-harvest losses (linked to poor transport methods and the absence of cold storage), poor appearance of domestic products (often the result of inferior seed) compared with imported products were also issues of importance to farmers. The lack of an effective phyto-sanitary system in Cambodia, and minimal surveillance for exotic pest and disease threats leaves the industry vulnerable (Hickey 2002).

907. Inefficiencies, such as extra labor to carry water for irrigation, and relatively high costs of individual transport to market, along with unofficial taxes all add to the high costs of production and marketing. Farmers in villages some distance from markets often encounter numerous checkpoints, some of which charge an unofficial road tax (Hickey 2002).

908. Individual farmers have little power to negotiate fair prices with collectors, transporters and market sellers. Businessmen also buy up large volumes of some product (i.e. maize in Battambang for export to Thailand), but returns to growers are very low. Collective bargaining through a group would seem to be the logical alternative to farmers operating in islolation. However, there remains a negative attitude towards any group activities resembling the “Krom samaki” or solidarity group system imposed by previous socialist governments (Hickey 2002).

J.3.9.2 Major Constraints for Traders

909. Poor layout and a lack of well defined display areas in most Cambodian markets is seen as one of the major constraints faced by market sellers when trying to attract customers. Fruit and vegetable sales are often relegated to the periphery of main markets, often setlling produce off the ground in crowded conditions that lack basic hygiene (Hickey 2002).

910. Sellers see that farmers need to improve the packaging of fruits and vegetables, so that they arrive in the market in fresh condition, and contained in attractive packaging. There are few, if any, designed drop-off points for perishable products such as vegetables, and the marketplace is organized “chaos” during the early hours of delivery (Hickey 2002).

911. Communication between farmers, collectors, market sellers and consumers needs to improve. At present there is no code of practice for the transfer of information, or settling of grievances between parties involved in the supply chain. There is also the view that farmers don’t understand what the consumer needs are, and therefore are often not supplying the right product at the right time (Hickey 2002).

912. Market sellers also see the need to reduce the amount of imported produce in the market. Shortage of supply from Cambodian farmers seems to be the driver for imports, not necessarily that imports are of higher quality or cheaper at the wholesale level. Processing opportunities for excess produce during times of oversupply would also add value to all players in the chain. Poor business management skills and lack of training in post harvest handling of fresh produce was also noted (Hickey 2002).

J.3.9.3 Major Constraints along the Value Chain

913. The major constraints identified above can be listed in detail below (Hickey 2002):

1. Production Constraints
   a. Seeds
      i. Seeds and planting materials not currently accredited as virus-free, true to type and non-uniformity, minimum germination % guaranteed.
      ii. Seed containers lack labels with Khmer description and language instructions
      iii. Most varieties not selected for suitability to agro-ecological zone.
      iv. Lack of Khmer languare labels for pesticide and fertilizer
      v. No analysis of product on label, or inaccurate labels
   b. Credit
      i. Larger, reputable credit schemes not operating in some vegetable production areas
      ii. Local lending rates are exorbitant, sometimes 3-4 percent per month for one crop cycle.
   c. Information and Knowledge
      i. Lack of information on upland zones and higher altitude locations not utilized
      ii. Lack of farmer skills
      iii. Lack of extension material on growing new crops
      iv. Lack of reliable statistics on import volumes
   d. Pest Management
      i. Lack of knowledge of pests and damage levels
      ii. Lack of understanding of pesticide rotation to avoid resistance build-up
      iii. Lack of observance of withholding period
      iv. Lack of appropriate safety equipment and procedures in the application of pesticides
   e. Irrigation
      i. Existing structures inadequate in key locations for vegetable production
      ii. Few formal water-user groups to manage water resources effectively
      iii. Drainage is periodically difficult
      iv. Traditional growing districts (e.g. Kandal) increasingly subject to flooding.

2. Post-harvest Constraints
   a. Storage and Transport
      i. Low cost packaging materials not available or affordable
      ii. Lack of knowledge of losses incurred by poor storage and transport
   b. Postharvest Treatments
      i. Lack of dipping tanks
      ii. No use of post-harvest fungicides
      iii. Lack of knowledge of benefits of post-harvest treatments
   c. Cool Storage
      i. No small to medium size cool-stores currently used for horticultural produce
      ii. Import duties unreasonably increase expenses for private business investors
   d. Quality Assurance Systems
      i. Quality Assurance is a new concept in Cambodia

ii. Only examples are ISO9000 type systems which are too complex for small scale producers.
iii. Many importing countries (e.g. EU) require some form of quality assurance be in place for export contracts
iv. Cambodia's reputation as an exporter is at risk if lacking appropriate documentation when problems arise (e.g. pesticide residues).

3. Industry Regulation
   a. Phyto-sanitary inspections
      i. Limited ability of current inspections to detect violations
      ii. Inadequate number of checkpoints to adequately secure the border
   b. Pesticide residue testing regimes
      i. CODEX regulations on maximum allowable pesticide residens in feedstuffs not currently applied on imported fruits and vegetables
      ii. Limited testing facilities inside Cambodia
   c. Imported Products
      i. Relatively unhindered entry of produce from neighboring countries
      ii. Importers give preferences to imported product, as they need to sell pre-purchased imports prior to sale of domestic produce regardless of quality
      iii. Border controls not adequately regulated (tariffs not adhered to)
      iv. Cambodian produce is sometimes inferior to imports
   d. Taxation
      i. Unofficial taxes collected by government officials to supplement income
      ii. Domestic production seen as an easy target

4. Industry Development
   a. Access to credit
      i. Private credit scheme rates are exorbitant
      ii. Credit repayments not aligned to production cycle
      iii. Development of small scale industry hampered by a lack of appropriate credit
   b. Land Titles
      i. Lack of security of land ownership is a disincentive for investment in permanent tree plantings
   c. Formation of marketing groups
      i. Currently no formal groups based on commodity
      ii. Communications and road access between growing districts is poor
      iii. Vested interests may limit involvement in commodity based groups, as they may regard other growers etc as competitors.
   d. Market information
      i. Curent AMIS is not reaching farmers in a timely and appropriate manner
      ii. Lack of resources for collection and dissemination of marketing information
   e. Market reforms
      i. Fruit and vegetable sales at markets are often on the periphery of main sales points, lack of definition (mixed with other products) and generally unattractive to consumers
      ii. Certain points of retail sales pose health risks to consumers due to poor hygiene

   iii. Despite good returns by collectors and agents, growers are often paid poor prices. Mark-ups in prices are disproportionate to grower payments.

f. Minimum quality standards
   i. Virtually no surveillance of quality standards for fruit and vegetables in the market place.
   ii. Lack of qualified horticulturalists present in the market as local government has jurisdiction over the marketplace
   iii. Lack of information available on quality standards

g. Gender balance
   i. Women comprise at least 50 percent of the fruit and vegetable farmers and almost 90 percent of the retail and wholesale sellers in the market place, but women are not always given the responsibility to make decisions regarding market strategy or means of transport for produce.
   ii. Literacy in rural women is low compared with the general population

h. Communication
   i. There is currently no formal channel for consumers or market retailers to feed back information to growers on quality, variety suitability, consumer preferences and growth trends in market demand etc.

i. Transportation
   i. 90 percent of transportation of fruit and vegetable is by bicycle or motorbike
   ii. Up to 40 percent postharvest losses result from product deterioration due to poor transport methods
   iii. Roads from most production districts to the market are in poor condition making transport slow and expensive
   iv. Some potentially highly suitable production areas such as Pailin are serviced by poor roads

j. Promotion and advertising
   i. No budget available to fund advertising for fruits and vegetables
   ii. Retail and supermarket industry is not mature enough
   iii. Increased consumption could result in increased imports to meet demand rather than increased sales of Cambodian products
   iv. Profile of fresh produce is low compared with fast food and beverages

k. Research and Extension support services
   i. Few trained specialists existing in MAFF or DAE
   ii. Virtually no PhD or Masters level horticultural graduates in Cambodia
   iii. Linkages to NGO programs on fruits and vegetables are not strong

l. Education and training
   i. University and college courses are not currently orientated towards horticultural disciplines
   ii. There is little opportunity for well paid employment at present in the fruit and vegetable industry.

J.4 Fish Value Chain

J.4.1 Fish Production in Cambodia

914. Fish is a major component of the diet and also a major source of income for a large part of the rural population. It is generally believed that the official statistics of fish catch largely under-estimate the true importance of the sector. Most important is fishing in the Tonle Sap Lake and river, the Mekong and Bassac, but substantial production is also obtained from sea fishing. Paddy fields in the wet season and swampy areas also yield a fairly important fish catch (MAFF 1997).

915. Data from government sources sugges that fisheries from the Tonle Sap Lake contribute more than 50 percent of the total inland fisheries production, or between 200,000 to 218,000 tonnes with an estimated landed value of US$150-250 million (Hap, Chuenpagdee et al. 2006).

916. Sea products include shrimp, prawns, lobsters, and crabs in addition to fish. The fresh-water catch includes minor quantities of shrimp and shells. There is tremendous price variation depending on the species and the state of processing. Among the most expensive are live tiger fish and elephant fish, large prawns and lobsters and the better quality smoked fish (MAFF 1997).

917. Marketing of fish takes many forms, such as fresh fish (on ice), live fish (in tanks or oxygen filled plastic bags), dried (either salted or not), smoked fish and fish paste (prahok). A very typical form of marketing is the shipping of large floating bamboo cages, filled with live fish from the Tonle Sap area to Phnom Penh for sale. Their arrival is timed for a period of shortage, when prices are higher (MAFF 1997).

918. There is both a large domestic fish trade and export (by road, ship and air). Generally it is the more expensive varieties that are exported (MAFF 1997).

J.4.2 Producers

919. In the Tonle Sap Lake there are three types of fishing systems. Current fishing regulations enable small-scale fishers to fish in the Tonle Sap Lake all year round without any permit, while middle-scale fishers may fish only between October and May when the water level in the Tonle Sap begins to recede and the floodplain area is decreasing in size. Large scale fishing or fishing lots are an industrial operation done under a two year leasing system (Hap, Chuenpagdee et al. 2006).

920. The main factors distinguishing these different fishing types, apart from the equipment used, relate to catch quantities, utilization of catches, and the number of households engaged in such fishing. Ahmed *et al.* (1998) estimated that catches from small-scale fishing average around 700 kg per year per household while those from middle-scale fishing are five times as much (Hap, Chuenpagdee et al. 2006). Higher proportions of catches from small-scale fishing are used for household consumption, when compared with middle-scale fishing.

921. The most striking difference relates to the number of people engaged in fishing. Ahmed *et al.* (1998) found that in 1995 around 85,000 households in the five provinces around the lake (Siem Reap, Battambang, Pursat, Kampong Chhnang and Kampong

Thom) were actively engaged in fishing, while only around 9,000 households were engaged in middle-scale fishing. Considering the recent fisheries policy reforms in Cambodia, the current number of households involved in fishing is most likely to have increased (Hap, Chuenpagdee et al. 2006).

922. The demographics of the Tonle Sap Lake communities are worth outlining. Hap *et al*. (2006) report that the average household size is 6 persons; headed mainly by a male member. Over two-thirds of all household members are involved in some sort of work related to harvesting, processing or marketing of fish and the maintenance of fishing equipment.

923. A large number of households live in rural riparian communities and build their houses on water. As such, access to basic services such as schooling is limited and aroundn 20-25 percent of household members have no formal education. This particularly applies to females, particularly female heads of households and partly explains their lower income and socio-economic status (Hap, Chuenpagdee et al. 2006).

924. Rab *et a*l. (2005) distinguishes households around the Tonle Sap Lake by the level of involvement in fishing activities. Fishing villages refer to villages were 80-90 percent of households consider fishing as their primary occupation. Farming villages are those with at least 80 percent of households engaged in farming, while fishing-cum-farming villages are those with households relying on fishing during the wet season and farming during the dry season. Almost all households in fishing villages and around 66 percent of households in fishing-cum-farming villages fish all year round. In farming villages, on the other hand, almost half of the households fish during the closed seas, when the water is high and farming impossible; see Table 165.

925. Average annual catches vary significantly. Specialist fishing households in Kampong Chhnang may catch up to 8 tonnes per year, while in Seam Reap they may catch up to 15.4 tonnes per year; see Table 166. The vast majority of fish caught by specialist fishing households (75-90 percent of the catch) is sold as fresh fish while own consumption is only 2-5 percent of their total catch.

926. Most fish are supplied by the many fishers using small and medium scale equipment. These fishers operate throughout the year regardless of whether it is open or closed fishing season. Fishers may put fish in plastic containers with ice immediately after catching them, store fish in water at the bottom of the boat, or simply put the fish in the boat with no ice or water (Yim and McKenney 2003).

927. Some fishers sort fish by species and size, while others just sell mixed fish. When catches are small (less than 20kgs) fisher usually sell to traders at the fishing grounds (i.e. from boat to boat) rather than bring fish directly to wholesalers or exporters, as this reduces transportation costs. Prices are set through negotiations, with fishers relying on knowledge of the previous day's fish price and word of mouth from other fishers. In cases where the catch is large, fishers may transport fish directly to wholesalers or exporters in the hope of selling the catch for a better price (Yim and McKenney 2003).

928. Although the sale of fish from fishers to traders involves price negotiations, fishers tend to be at a disadvantage due to credit dependency and less market information. Most fishers are in debt to a trader. Fishers borrow money from traders (who themselves are often financed by distributors) to support boat and equipment purchases, fuel costs or other household costs. Traders do not charge fishers and interest rate on the loan, but

require fishers to sell all fish exclusively to them at what may be a somewhat discounted price (which can be viewed as an implicit interest rate). Fishers pay back loans through regular deductions or in a lump sum at the end of the fishing period (Yim and McKenney 2003).

929. To prevent side-selling, traders often purchase fish at the fishing grounds rather than having the fishers travel to the landing sites where other traders operate (Yim and McKenney 2003).

J.4.2.1 Returns to Fishing

930. Hap *et al*. (2006) estimate that the gross income for all fisheries dependent households in the five provinces surrounding the Tonle Sap is around US$215 million, which equates to an annual per capita income of around $172; see Table 164.

931. There is a vast difference between average annual income of households in the lower end of the income range (less than US$1000 per year) and those at the higher end (greater than US$5000 per year). Over 72 percent of households earn under $470 per year, or a per capita income of US$78. Put differently, around 12 percent of households capture almost half of the total gross income from all households. Most likely, households with an average income of less than US$1000 per year are small-scale subsistence farmers and fishers who rely heavily, if not entirely, on aquatic resources for their livelihoods, while those earning high income are middle-scale fishers and fishing lot owners.

J.4.3 Traders

932. Across Cambodia, most fish are marketed from landing sites located at floating villages or harbor points around the Great Lake and along rivers. Fish are sold live in water-filled metal containers, fresh on ice, and in a variety of processed products. For much domestic trade, retailers purchase fish from traders or go to landing sites to buy directly from fishers. However, distribution centers play an important role in fish trade to urban areas, especially to Battambang and Phnom Penh. For trade to Phnom Penh, municipal regulations intended to relieve traffic congestion require fish trucks to stop and sell fish at licensed fish distribution centers a few kilometers outside the capital (Yim and McKenney 2003).

933. As an example of the trade, Yim and McKenney (2003), investigated the marketing chain for fish from Kompong Luong in Pursat province and Kampong Chhnang provincial town into Phnom Penh.

934. Throughout the year hundreds of traders purchase fish from thousands of fishers at the Kompong Luong and Kampong Chhnang landing sites. Although trade activity is affected by changes in catch levels (peak and non-peak periods) during the year, fishers and traders report that regulations requiring a closed season (June-September) have little impact due to a lack of enforcement. Fishers interviewed by Yim and McKenney (2003) reported fishing 200-250 days per year, while traders reported working every day.

935. A typical trader purchases fish on a regular basis from between 30 and 70 fishers. Using a boat, plastic containers and ice, a trader may collect fish for several days before accumulating enough for a shipment to the distribution center. During non-peak periods, traders may share a hired truck when they need to ship fish but have not yet collected

enough to fill a truck on their own. Most traders transport fish at night so that fish arrive at the distribution center outside of Phnom Penh in the early morning (about 2am), where they can be unloaded for sale to retailers, who then bring the fish to market in time for morning customers. A smaller number of traders bring fish for sale to retailers at the distribution center in the early afternoon (Yim and McKenney 2003).

J.4.3.1 Costs and Margins

936. Costs and margins for traders were estimated by Yim and McKenney (2003) and are presented in Table 167. Fish marketing is affected by a number of costs and constraints, including spoilage and weight loss, distribution controls, transportation and ice costs, financing costs and fees charged along the road.

937. Average costs from the landing site to the distribution centers in Phnom Penh are around $268 per tonne. Operating costs and capital expenses comprise just over half of the total costs, while spoilage and weight loss contributes around 21 percent to the total costs and commission fees to the distributors contribute nearly 18 percent (Yim and McKenney 2003).

J.4.4 Distributors

938. The great majority of fish sold in Phnom Penh retail markets have first passed through one of the municipality's three licensed fish distribution centers – Chrang Chamres fish distribution center (Km9 on National Road No. 5), Phnom Penh fish distribution port (11.5km north of Phnom Penh along the Tonle Sap river), and Chbar Ampov fish distribution center (located south of Phnom Penh along National Road No. 1) (Yim and McKenney 2003).

939. Most iced fish transported from the Great Lake by truck for sale in Phnom Pneh are distributed throughn 19 distribution shops at Chrang Chamres. Live fish from the Great Lake are more commonly transported by waterway and distributed through 22 shops at Phnom Penh fish distribution port. Fish brought from other areas south of Phnom Penh for sale in the capital are usually distributed through 10 shops at Chbar Ampov. In addition to these licenced facilities there are a number of unlicensed fish distribution centers operating informally around the Phnom Penh area (Yim and McKenney 2003). Chrang Chamres accounts for the majority of fish distribution activity, followed by Phnom Penh fish distribution center and then Chbar Ampov.

940. In the Chrang Chamres fish distribution center, traders bring fish from Kompong Luong and Kampong Chhnang landing sites all year round. At the distribution center fish are unloaded at a distributor's shop and sold to retailers. Distributors typically work with around 15-25 traders, financing their fish-purchasing activities, providing services such as labor to unload trucks, and in some cases assisting them in price negotitations with retailers. Distributor's most crucial role is in providing the necessary capital to traders for fish purchases (and in turn traders lend some of this capital to fishers) (Yim and McKenney 2003).

941. While amounts loaned out vary significantly, and distributors and traders are reluctant to discuss financial matters, Chea and McKenney (2003) estimate that an average distributor might have between US$10,000-US$50,000 loaned out at any one time. In most cases distributors finance this themselves, but can borrow on a short-term

basis from institutional or private moneylenders to cover short-terms credit needs at the prevailing interest rate (3-5 percent per month) (Yim and McKenney 2003).

942. The relationship between distributors and traders is one based on long term trust relations. In return for financing and other services, traders agree to supply fish exclusively to the distributor in return for the distributor acting as a commission agent between the trader and retailer. Typical commissions are set at 100 riel per kg for fish priced lower than 2000 riel per kg and 200 riel for fish priced higher than 2000 riel per kg (Yim and McKenney 2003).

943. In addition to paying the distributor a commission, traders must pay the distribution center owner a 3 percent fee on all sales. Distribution center staff monitor each sale and record the sale amount and price. The distributor then collects the fee from the trader and settles outstanding accounts with the distribution center staff at the beginning of the next morning (Yim and McKenney 2003).

944. In total, traders are paying around 10 percent of total sales revenue to distributors and the distribution center owner; around 6-8 percent to distributors for financing and services and 3 percent to the center owner (Yim and McKenney 2003).

945. Fish are sold to retailers on a cash or credit basis, depending on the relationship between the retailer and the trader/distributor. Retailers who have established long term relationships are provided one-day credit, making it possible for these retailers to bring their fish to market and pay the distributor the following day. Under this arrangement the distributor will pay the trader immediately, enabling them to return to the landing site to purchase more fish (Yim and McKenney 2003).

J.4.5 Exporters

946. The market structure for fish exports from the Great Lake to Thailand involves thousands of fishers, traders, wholesalers, exporters and Thai market distributors. Credit plays a critical role in this market structure with nearly all fishers and traders dependent on credit to support their businesses and activities. Vertical relationships based on credit ensure that fishers only sell to their trader/creditor and traders only sell to their exporter/creditor, providing stability in the supply of fish for export (Yim and McKenney 2003).

947. For export to Thailand via Poipet, most exporters around the Great Lake purchase fish from traders, store and aggregate fish in containers, and then transport for export. These exporters ensure their fish supply from traders through long term relationships and the provision of credit (Yim and McKenney 2003).

948. Exporters deal with approximately 20 different species of iced fresh fish as well as some live fish and processed fish products (e.g. prahoc). For iced fresh fish exporters usually ship a mixture of several fish species, either by pickup trucks carrying 204 tonnes or larger trucks capable of transporting from 6-15 tonnes (Yim and McKenney 2003).

949. There are now more than 20 companies licensed to export fish from Cambodia. The two companies most well known for exports to Thailand are the Kampuchea Fish Import Export Company (KAMFIMEX) and the Import Export and Civil Development Construction Company (CDCO). In addition to the licensed exporters Yim and McKenney (2003) identified another 25 unlicensed exporters.

950. In contrast to the stability created through credit and financing dependencies, a number of dynamic changes have been taking place within the market structure, as reflected in the collapase of KAMFIMEX's monopoly, the rise of CDCO, and consolidation of unlicensed exporters. Currently KAMFIMEX is no longer active in the fish export trade. These changes are occuring in the context of intensified competition for fish due to a declining supply and pervasive fee charges that reduce profit margins (Yim and McKenney 2003).

951. Profit margins are also under pressure due to the weak price negotiation position of Cambodian exporters within the current market structure. With no other export options except to sell at Long Koeur market in Thailand, and the combined threats of repaying border fees, additional labor costs, and higher spoilage levels if they do not sell on the day they cross the border to Long Loeur market, exporters often find themselves accepting lower prices than expected for their fish. Exporters also suggest the presence of fish distribution facilities in Poipet would allow them to store fish for several days if necessary, making it possible to negotiate better prices with Thai distributors (Yim and McKenney 2003).

J.4.5.1 Costs and Margins

952. Yim and McKenney (2003) found that exporters face significant fee charges that absorb a large proportion of their potential earnings. In 2003 the fees, at US$83 per tonne, add more than 50 percent to the costs of exporting fish. Indeed, fees represent the highest component of export costs, followed by spoilage and weight loss (US$51 per tonne) and transportation (US$26 per tonne).

953. Average profit margins are estimated to be around US$38 per tonne; see Table 170. Yim and McKenney (2003) observe the fact that fee levels in 2003 were more than twice as much as the profit margin earned on fish exports and that this is a strong indication of "rent-seeking" activity.

954. As shown in Table 170, for a typical mixture of fish species exported in January 2003, exporters paid an average purchase price to traders/fishers of R4,370 per kg. These same fish could then be sold at Long Loeur market for an average price of R5,430 per kg, providing a gross margin of R1,060 per kg. However, after subtracting trade costs and fees, earnings for exporters dropped to only R148 per kg (or about US$38 per tonne). Such earnings represent an annual rate of return of roughly 10-60 percent, depending on the exporter. Since annual borrowing costs average 60-72 percent, exporters are running a marginal business.

955. A breakdown of trade costs for exporters is shown in Table 169. Operating costs are around 60 percent of the total cost, of which transportation is 17 percent of the total cost and working capital and ice are 15 percent each. Spoilage and weight loss comprise 34 percent of total costs, while capital costs are only 5 percent.

J.4.6 Retailers

956. From distribution centers outside Phnom Penh, fish are marketed to major urban markets and supermarkets, restaurants, processors, and roadside meal places in and around Phnom Penh. Some fish are also distributed to nearby provinces, such as Kampong Speu, where local fisheries are limited (Yim and McKenney 2003).

957. The major retail markets in Phnom Penh are the Orussey and Thmei markets. During most of the year retailers at these markets sell 2-5 tonnes of iced fish per day to urban consumers, but this amount can increase significantly during peak catch periods (Yim and McKenney 2003).

958. Yim and McKenney (2003) identified 35 fish retailers at Thmei market and 28 fish retailers at Orussey market. All retailers are women, although some get assistance from men with de-scaling fish. Retailers operate their business year round, and rent their shops on a monthly basis, althoughn some rent on a daily basis.

959. Retailers go to the Chrang Chamres fish distribution center to purchase fish around 3-4am in order to prepare the fish for sale by 6-7am. Most retailers operate on a small scale, purchasing 30-70kg of fish per day in a mix of species (less than 5 species), though some retailers target only one specific species. Several retailers also make purchases at 2-3pm for late-afternoon and evening sales (Yim and McKenney 2003).

960. Retail fish sales are highly variable. On the day of purchase from the distribution center they often sell all their fish by lunchtime, but sometimes they still have more than half their fish unsold by the end of the day. Due to this uncertainty, and challenges in keeping fish fresh, retailers normally mark up prices by about 30-100 percent over the price of purchase from distribution centers. These prices are set for early morning customers, but can decline considerably over the course of the morning depending on sales (Yim and McKenney 2003).

961. Fish that are not sold by the end of the day are often processed for further sale, or sold to small restaraunts and roadside meal places at discounted prices, usually at a loss to the retailer (Yim and McKenney 2003). Even when retailers are fortunate enough to sell all their fish by lunchtime, their earnings are quite modest; see Box 31.

Box 31 Case Study of Fish Retailer

A Good Day at Thmei Market

Ms. Sok purchased 34.5kg of three species of fish – Sandai (Wallago attu), Chhlang (Mystus nemurus) and Kes (Miconema spp.) – from Chrang Chamres fish distribution center at a cost of R220,500 (or US$55). Compared with distribution center prices, she marked up fish prices for retail sale by 40-50 percent for each species. Beginning sales at 7am at Thmei market, she sold about two-thirds of her fish (23.5 kg) by 9am at the original marked up prices. Between 9-10am, Ms. Sok discounted her prices by about 10-15 percent and managed to sell an additional 8kg, leaving on 3kg of fish to sell. Finally, discounting to prices equal to or below the fish purchase prices at the distribution center, she sold all remaining fish by 11am.

Ms. Sok considered this to be a good day of fish retailing. Her gross earnings were R28,750) or about US$7). She reported that her gross earnings can range from R10,000-R50,000 (or US$2.50-US$12.50), but more typically are about R20,000-R30,000 (or US$4-US7.50). The costs involved with operating her fish retailing business are estimated to be about R6,000 per day (US$1.50).

Source: (Yim and McKenney 2003)

J.4.6.1 Costs and Margins

962. Costs and margins for retailers were estimated by Yim and McKenney (2003) and are presented in Table 167. Fish retail marketing is affected by a number of costs and constraints including spoilage and weight loss, and retail fees.

963. Average costs from the distribution centers in Phnom Penh to retail markets are around $40 per tonne. Operating costs and capital expenses comprise just over 95 percent of the total costs, while market fees contributes around 5 percent to the total costs (Yim and McKenney 2003).

J.4.7 Marketing Margins

964. To obtain an indication of the marketing margin for fish trade from the Tonle Sap Lake to Phnom Penh, price data was gathered for the marketing of three commonly traded species; Chhlang (Mystus nemurus), Chhkok (Cyclocheilichthys spp.) and Chhdor (Channa micropeltes); see Table 168. Marketing margins ranged from 65-76 percent from fishers to consumers. Fishers obtain between 24-35 percent of the final retail price, while traders obtain 52-56 percent of the final retail price. As noted above, retailer markups are around 30-100 percent of wholesale (distributor) prices but these are necessay given the significant risks involved and the high post-harvest losses (Yim and McKenney 2003).

J.4.8 Marketing Chain

J.4.8.1 Fresh Fish – Inland

965. The biggest production area of freshwater fish is the Tonle Sap and the Mekong/Bassac rivers at Kandal. Fresh fish from Kandal is transported to the Chba Ampou wholesalers and some of the high quality varieties are also exported via Poipet. Fish from the provinces of Pursat, Kampong Chhnang, Kampong Thom and Siem Reap which all border the Tonle Sap, supply both Phnom Penh and Thailand in large quantities. There are also exports of fish to Thailand from Battambang province (MAFF 1997).

966. Chea and McKenney (2003) identified the main route for fish collected from the Tonle Sap Lake into Phnom Penh along National Road No. 5. Landing sites at Kompong Luong in Pursat province is the major assembly area and fish is trucked down Highway No. 5 to Phnom Penh. On the river other landing sites in Kampong Chhnang provide a futher source.

967. Fresh fish from the Tonle Sap mostly enters Phnom Penh via the fish wholesalers at Km9 where they are sold by permanent commission agents to traders from Phnom Penh markets. The main collection centers are the Fish Distribution Port, Chrang Chamres Fish Distribution Center and Chbar Ampov Fish Distribution Center on National Road No. 1 towards Kandal. Export to Thailand is mainly via Poipet. Exporters employ their own agents as collectors in markets bordering the Tonle Sap and also have agreements with independent collectors/traders (MAFF 1997).

J.4.8.2 Fresh Fish – Marine, and Other Seafood

968. The provinces of Kampot and Sihanoukville have major exports of fish and seafood to Thailand as well as supplying Phnom Penh. Kampot also exports live fish by air (via Phnom Penh) to Hong Kong and China. Exports from Kampot to Thailand transit via Sihanoukville. Agents and collectors at the harbor in Kampot buy direct from the fishing boats and transport to Tumnop Rolork harbor in Sihanoukville by pick-up. At this harbor collectors buy seafood from local fishermen as well as from the collectors from Kampot. They build up their stocks until a full boat-load can be exported to Thailand (MAFF 1997).

969. Agents at the harbor also buy seafood such as shrimp to take to processing factories before exporting. Traders also buy fish and seafood for the Phnom Penh markets.

According to the Department of Fisheries in Sihanoukville about 80 percent of sea products are exported to Thailand and 20 percent supplied to Sihanoukville and Phnom Penh (MAFF 1997).

J.4.8.3 Smoked and Dried Fish

970. The main marketing channel for smoked and dried fish is from fishermen/processors to collectors from Pursat and Kampong Chhnang provinces to Orusey market in Phnom Penh, where it arrives every morning by truck. At Orusey, fish is sold mainly to traders for distribution to smaller markets in Phnom Penh and to other provinces such as Kampong Cham, Takeo and Kandal, in addition to direct retail sale to Phnom Penh consumers. There is also some export of dried fish from Siem Reap to Thailand, Some prahok is also exported (MAFF 1997).

J.4.9 Major Constraints along the Value Chain for Fish

J.4.9.1 Spoilage and Weight Loss

971. Spoilage and weight loss rates are around 10-15 percent of total shipment weight from the point of purchase at the village or fishing ground to the point of sale at Chrang Chmares fish distribution center. These losses, which occur due to internal fish matter loss, fish spoilage, evaporation and other factors amount to around US$55 per tonne or 21 percent of the total cost from landing site to distribution center (Yim and McKenney 2003).

972. Retailers do not report any noticeable additional spoilage and weight losses transporting fish from the distribution centers to the retail markets. However, having unsold fish at the end of the day and then selling at below cost to road-side restaraunts does incur a significant loss to retailers. These value-losing approaches are a consequence of not using ice to maintain fish quality and by the end of the day the quality has deteriorated significantly (Yim and McKenney 2003).

973. Retailers indicate that consumer perceptions play a significant role in decisions to use ice. Consumers perceive fish displayed in ice as being “less fresh”, due to the practice of retailers to only use ice when quality has deteriorated. This practice reinforces the view of consumers and makes it difficult to change the high levels of wastage at the retail level (Yim and McKenney 2003).

974. Prior to reaching retailers, ice is used to maintain freshwater fish quality throughout the marketing process. When traders purchase fish at the Great Lake, they immediately store the fish in containers with ice. Fish are then transported with ice to the distribution centers. When retailers purchase the fish they remove any ice prior to transporting to the retail markets so that the fish will be “warm enough” when displayed for sale. No ice is used during the course of the day, but if the retailer decided to keep any fish for sale the next day, these fish will be stored on ice overnight. In the morning, the ice will once again be removed before displaying the fish for sale (Yim and McKenney 2003).

975. Similar to freshwater fish marketed from the Great Lake, ice is used throughout the process of marketing marine fish from the Cambodian coast to Phnom Penh. However, unlike freshwater fish, retailers in Phnom Penh markets display marine fish for sale on ice. Retailers report that customers are accustomed to the use of ice in the storage and display of marine fish. Customers understand that marine fish are caught far from Phnom Penh and therefore need to be kept on ice to preserve freshness. This understanding allows retailers to use ice, preserve quality, and maintain more stable prices for marine fish

throughout the day. In contrast, customers for freshwater fish may believe that the fish are caught from nearby fishing grounds, immediately transported to market, and sold fresh with no need for ice. Although this may have been true in the past, it is no longer the case (Yim and McKenney 2003).

976. In comparison, the 10-15 percent spoilage from the landing site to Phnom Penh is significantly higher than the 3-5 percent rate estimated for fish transportation from the landing sites to Thailand (Yim and McKenney 2003).

977. Given the longer transportation times between the landing sites and Thailand this result may seem surprising, but traders indicate that fish destined for the local market is of lower quality and less fresh than that destined for the higher priced export market and this quality difference accounts for most of the spoilage (Yim and McKenney 2003).

978. Several other factors contribute to higher spoilage and weight loss rates irrespective of final destination (Yim and McKenney 2003):

1. Keeping purchased fish in containers on ice for several days before making a shipment to Phnom Penh;

2. Transporting fish by taking them out of their storage containers at the landing site and loading them into bamboo baskets on trucks rather than shipping in containers; and

3. Multiple handling of fish during loading and unloading at different transaction points in the marketing process.

J.4.9.2 Monopolistic Control of Distribution

979. Each major entry point for fish trade to Phnom Penh is served by one licensed fish distribution center. Fish traded from the Great Lake south to Phnom Penh along National Road No. 5 are distributed throughn Chrang Chamres. Likewise, fish transported by waterway from the Great Lake south to Phnom Penh are distributed through Phnom Penh fish distribution port. Lastly, fish traded from areas south to Phnom Penh are transported along National Road No.1 and distributed through Chbar Ampov fish distribution center. No other fish distribution centers are allowed to operate legally in these areas (Yim and McKenney 2003).

980. Fees at licensed distribution centers are currently set at three percent of sales at Chrang Chamres and Chbar Ampov., and five percent of sales at the Phnom Penh fish distribution port. Traders complain that these fees are much higher than those charged by informal (unlicensed) distribution facilities operating in the area. For example, traders pay an average fee of $22 per tonne on sales made at Chrang Chamres. In comparison, unlicensed facilities operating nearby only charge a nominal parking fee of R3,000-R5,000 per car or pick-up of fish. Quantities traded at these facilities tend to be smaller 9about 300-500kg) in order to avoid attracting the attention of officials, making fees on a per-tonne basis equal to roughly $2-$3, which is about one-tenth of the fees charged at Chrang Chamres (Yim and McKenney 2003).

981. Because traders have been warned that they will be fined if they use unlicensed facilities, trade activity remains limited (less than 1,000 tonnes annually). In comparison

Chrang Chamres supports the distribution of more than 15,000 tonnes of fish each year (Yim and McKenney 2003).

982. Chrang Chamres and unlicensed facilities offer similar services – water, electricity, concrete areas for trade, and labor to unload fish from trucks. At Chrang Chamres, however, there is some dispute about who is responsible for paying for these services. Distributors indicate that the Chrang Chamres owner is responsible for providing labor for unloading trucks and covering electricity and water costs, but in practice the distributors pay for these services and pass the costs onto the traders in higher financing and service fees (who then pass these onto the fishers) (Yim and McKenney 2003).

J.4.9.3 Fees Charged along Trade Route

983. The consultant team did not get any estimates of the fees (official and unofficial) for fish trade in 2006. Field work interviews indicate that the level of unofficial fees has decreased significantly since 2002 and in fact apart from the occasional unofficial payment to police for minor traffic infringements, no trader indicated that unofficial fees were paid. In contrast, new official fees have been instituted along National Road No.5 to Battambang (truck weighing fees), which coincidentally are of the same value as the prior unofficial fees (Yim and McKenney 2003).

984. For the fish trade, Yim and McKenney (2003) identified a set of fees and charges which are interesting to reproduce for historical comparisons, although no current information on whether these fees are still in operation (Yim and McKenney 2003).

985. In marketing fish by road from the Kompong Luong fish landing site to Phnom Penh, traders pay about $9 per tonne in fees to a road investment company near the landing site and at a checkpoint at the Pursay-Kampong Chhnang provincial border (currently there are no provincial checkpoints operating). In addition, traders who transport fish to the Chbar Ampov distribution center (to the south of Phnom Penh) are periodically stopped at Chrang Chamres distribution center and required to pay a $5 per truck fee, even though they are not using the facility and will have to pay the 3 percent commission to Chbar Ampov (Yim and McKenney 2003).

986. Fees on the fish trade from the Great Lake to Phnom Penh are significantly lower than the fees charged on fish exports from the Great Lake to Thailand; at around $83 per tonne (Yim and McKenney 2003).

987. There appear to be three main reasons for this difference (Yim and McKenney 2003):

1. More than half of the fees on fish exports are paid at the border (Cambodian and Thai side).

2. Although a transport permit is required for transporting fish[50], this requirement only appears to be enforced for fish transported for export (where it often serves as a basis for informal fee collection). Fish traded within Cambodia do not need a transport permit. In most cases officials collecting fees can distinguish between shipments for domestic markets and export because they know the

[50] Sub-decree on Transport of Fisheries Products (No. 66 Or-No-Kror, 5 November 1988).

domestic traders and exporters. Where they are not sure, they will decide based on the trade route, means of transport, and/or species being shipped.

3. Fees are lower for domestic trade because the fish traded are, in general, somewhat lower quality than those exported. Because (informal) fees often rise with the estimated value of the fish shipment, it can be expected that in absolute terms fees on domestic fish trade will be less than fees on fish exports.

988. For the export market, from Chhnok Tru in Kampong Chhnang to Long Koeur market in Thailand a typical shipment in 2003 would incur 27 different fee payments to 15 institutions in 16 different places. The most significant fees were paid for issuing and checking transport permits, followed by payments to customs, a road investment company, and a range of institutions with no legal basis for collecting fees. Of the institutions collecting fees, fisheries institutions collect the greatest amount but this represents only 20 percent of total fees. Institutions with no direct role in fisheries management collect 80 percent of fees. More than half of all fees are collected at the border. In contrast, the provincial fisheries office of Kampong Chhnang, which is responsible for fisheries management in the area, collects only about 3 percent of all fees (one percent is recorded as the official fee and 2 percent is collected informally). When comparing actual payments to official fees (if enforced) it is clear that the unofficial fees are less than the entire set of official fees which could be applied. Enforcement of the current regulations and fees would triple the current payments made by exporters, which would surely cause a collapse in fish exports (Yim and McKenney 2003).

J.4.9.4 Transportation and Ice Costs

989. In addition to costs associated with spoilage and weight loss, distribution center charges, and road/checkpoint fees, traders incur a range of more typical business-related costs, including transportation, ice, labor, and equipment. These costs amount to around US$135 per tonne for trade from Kompong Luong and Kampong Chhnang to the Chrang Chamres distribution center, with transportation and ice representing around 90 percent of the costs. In most cases, traders transport fish in two stages – by boat from the village or fishing grounds to the landing site, and by truck from the landing site to the distribution center. The average cost to transport fish over these two stages, including boat depreciation, fuel, and truck rental costs, is about $64 per tonne (Yim and McKenney 2003).

990. The preservation of fish quality during collection, storage and transport requires a substantial amount of ice. Fish may be stored for a few days on ice and transport from the landing site to the distribution center may take several hours (including loading and unloading). For fish purchase at the fishing grounds to unloading at the distribution center, traders use on average about 3 tonnes of ice for every tonne of fish. With ice prices ranging from $16 to $19 per tonne at Kompong Luong and Kampong Chhnang, ice costs average around $56 per tonne of fish traded (Yim and McKenney 2003).

J.4.9.5 Financing Costs

991. Distributors play a critical role in providing financing to traders to support fish purchases and operational costs. While no interest rate is formally charged on this financing, distributors recoup their loans through variable commission fees on each sale. A lack of transparency in borrowing costs may make it difficult for traders to “comparison shop” when they are seeking a loan. However, based on field interviews, Yim and

McKenney (2003) estimate the implicit interest rate is in the rage of 50 to 120 percent. This return to distributors is estimate net of their costs, but some less tangible distributor services (such as price information and negotiation support) cannot be costed. Net of costs, the average distributor earns about $18 per tonne (Yim and McKenney 2003).

992. The tied relationship between a distributor and traders ensures that traders only sell through the distributor. Although the distributor runs some risk that traders will disappear without paying back their loans, this risk appears sufficiently mitigated by the long-term relationships between distributors and traders and the recent use of written loan contracts (Yim and McKenney 2003).

993. In fish marketing it appears that traders' risks are much greater than that of the distributor. Traders bear all the risks of variable prices, spoilage, changes in fees, and operational difficulties. In contrast, distributors receive their commission fees largely based on the amount of fish sold, regardless of whether the trader makes a profit or loss on the sale (Yim and McKenney 2003).

J.5 Tables

Table 35 Performance of Annual Crops Over Time 1991 to 2000

Description		Year 2000				Average Annual Growth Rate (%) for 1991 - 2000							Average Annual Growth Rate (%) for 1996 - 2000						
		Cultivated Area	Harvested Area	Production	Yield	Cultivated Area	Harvested Area	Production	Yield	Source of Growth 1991-2000 (%)			Cultivated Area	Harvested Area	Production	Yield	Source of Growth 1996 - 2000 (%)		
		(Ha)	(Ha)	(Tonnes)	(kg/ ha)					Harvested Area	Yield	Standard Deviation					Harvested Area	Yield	Standard Deviation
Rice	Total	2,318,495	1,903,159	4,026,092	2,115	2.2	1.1	5.9	4.7	19.2	79.9	19.2	2.1	-0.2	3.1	3.4	-6.9	107.2	6.8
	Wet Season	2,058,648	1,647,812	3,212,269	1,949	1.8	0.5	5.2	4.7	10.0	89.5	22.6	1.9	-0.7	2.8	3.5	-26.3	127.2	8.5
	Dry Season	259,847	255,347	813,823	3,187	6.4	6.3	9.2	2.7	69.1	29.0	14.9	3.8	3.5	4.8	1.2	73.5	25.6	11.5
Maize	Total	71,462	57,404	156,972	2,735	3.6	1.5	11.3	9.6	13.7	85.0	41.3	3.4	5.0	23.4	17.5	21.3	75.0	50.5
	Wet Season	67,872	54,041	151,885	2,811	3.8	1.6	11.5	9.7	14.0	84.6	45.8	4.7	7.0	26.0	17.8	26.8	68.4	54.6
	Dry Season	3,590	3,363	5,087	1,513	0.6	0.6	6.0	5.5	9.2	90.3	62.2	-11.4	-12.3	-6.4	6.7	191.5	-104.3	25.1
Yellow Maize	Total	44,347	34,671	121,741	3,511	9.0	6.3	17.7	10.8	35.5	60.6	82.3	13.6	9.5	33.6	22.0	28.3	65.4	93.1
	Wet Season	43,894	34,218	120,965	3,535	9.2	6.4	18.0	10.8	35.9	60.2	83.3	14.0	9.9	34.1	22.1	28.9	64.7	94.4
	Dry Season	453	453	776	1,713	-1.3	-1.1	2.0	3.1	-54.9	156.6	55.7	-6.7	-5.8	1.2	7.4	-469.9	604.8	57.0
Cassava	Total	16,279	15,380	147,763	9,607	4.2	3.8	11.4	7.3	33.3	64.2	101.1	2.8	4.4	12.5	7.8	35.0	62.2	116.0
	Wet Season	14,429	13,545	126,815	9,362	5.4	4.9	12.8	7.5	38.3	58.8	105.4	3.8	5.5	12.2	6.4	44.9	52.3	128.1
	Dry Season	1,850	1,835	20,948	11,416	-1.9	-2.0	5.3	7.4	-37.9	140.7	87.8	-3.3	-2.1	14.3	16.8	-14.6	117.1	57.7
Sweet Potato	Total	7,435	7,217	28,178	3,904	-2.1	-1.9	-3.5	-1.6	54.4	46.5	24.6	-6.2	-5.1	-6.4	-1.3	80.9	20.1	13.0
	Wet Season	4,796	4,590	16,943	3,691	-2.3	-2.2	-5.0	-2.9	43.3	58.0	32.5	-7.3	-6.3	-8.7	-2.6	72.2	29.6	14.8
	Dry Season	2,639	2,627	11,235	4,277	-1.8	-1.5	-0.7	0.7	200.8	-102.3	47.0	-4.1	-3.0	-2.1	0.9	143.4	-44.8	15.8
Vegetable	Total	33,755	32,143	195,894	6,094	1.8	1.5	-2.1	-3.5	-71.7	169.2	16.0	-4.1	-3.9	0.3	4.4	-1,310.1	1,467.2	18.4
	Wet Season	19,400	17,823	112,276	6,300	-0.4	-1.3	-2.7	-1.5	46.7	54.0	70.2	-5.4	-6.7	-0.5	6.7	1,487.0	-1,486.6	10.1
	Dry Season	14,355	14,320	83,618	5,839	5.7	6.0	-1.1	-6.7	-548.8	612.0	49.4	-2.3	0.5	1.4	0.9	34.5	65.2	43.7
Mung Bean	Total	24,991	22,895	15,100	660	-2.0	-1.8	1.7	3.6	-108.2	212.1	37.9	-0.5	-1.9	-5.0	-3.2	37.0	64.2	44.9
	Wet Season	18,400	17,811	12,072	678	-3.0	-2.3	1.0	3.4	-223.3	331.0	70.2	3.7	3.6	9.6	5.8	37.7	60.2	85.4
	Dry Season	6,591	5,084	3,028	596	1.2	0.2	4.7	4.5	3.9	95.9	172.1	-8.4	-13.1	-24.0	-12.5	54.5	52.3	36.4
Sugar cane	Total	7,723	7,480	164,176	21,949	2.6	2.5	1.4	-1.1	178.5	-76.6	38.1	-1.9	0.2	-4.1	-4.3	-3.9	103.8	19.7
	Wet Season	5,414	5,229	117,256	22,424	2.3	2.1	1.8	-0.3	118.7	-18.3	68.5	-1.9	0.5	-3.6	-4.1	-14.0	113.4	31.8
	Dry Season	2,309	2,251	46,920	20,844	3.5	3.4	0.5	-2.8	724.9	-604.5	16.7	-2.1	-0.6	-5.4	-4.8	11.2	89.3	20.6
Soya Bean	Total	33,256	33,256	28,111	845	9.7	10.1	-2.4	-11.4	-419.4	471.8	58.8	15.0	15.5	10.3	-4.6	151.3	-44.4	60.8
Peanut	Total	10,370	10,271	7,490	729	3.5	4.4	7.2	2.7	60.3	38.1	20.1	0.9	2.7	2.1	-0.6	127.3	-26.6	23.1
	Wet Season	7,611	7,540	5,557	737	4.3	5.4	8.2	2.7	65.6	32.6	42.5	2.2	2.5	15.5	12.6	16.4	81.5	56.7
	Dry Season	2,759	2,731	1,933	708	1.6	1.9	4.8	2.8	40.3	58.5	49.6	-2.2	3.1	-13.7	-16.3	-22.2	118.6	51.7
Sesame	Total	19,222	18,130	9,555	527	2.0	1.4	2.0	0.6	70.2	29.4	28.7	17.3	16.9	20.5	3.1	82.5	15.0	26.5
	Wet Season	18,883	17,791	9,676	544	2.0	1.4	2.3	0.9	59.3	40.1	29.4	17.9	17.6	22.0	3.8	79.9	17.1	25.1
	Dry Season	339	339	179	528	3.9	4.2	6.7	2.4	62.2	36.3	165.4	-2.0	-2.0	0.1	2.2	-1,782.5	1,920.8	83.8
Tobacco	Total	9,678	9,669	7,665	793	-6.3	-6.3	-1.5	5.1	415.1	-336.3	25.9	-6.5	-6.3	-7.1	-0.9	88.6	12.2	22.2
	Wet Season	0	0	0		35.1	32.7	33.1	0.3	98.7	1.0	4,657.6	40.0	34.1	34.1	0.0	99.9	0.1	89.4
	Dry Season	9,678	9,669	7,665	793	-6.3	-6.3	-1.5	5.1	419.0	-340.5	20.2	-6.4	-6.2	-7.0	-0.9	87.7	13.1	21.8
Jute	Total	208	208	180	865	-19.2	-19.1	-19.7	-0.8	96.8	4.0	69.4	-25.6	-25.6	-28.3	-3.6	90.5	12.8	90.3
	Wet Season	208	208	180	865	-18.3	-18.2	-18.9	-0.8	96.6	4.2	75.2	-23.8	-23.8	-26.3	-3.3	90.4	12.6	98.6
	Dry Season	0	0	0		-24.3	-24.3	-23.6	1.0	103.2	-4.3	380.3	-39.6	-39.6	-41.8	-3.7	94.7	8.8	38.6

Geometric Averages
Sources: Based on data from (MAFF 2001; MAFF 2001; MAFF 2002)
Data courtesy of ADB Agricultural Sector Development Program, TA 3695-CAM

Table 36 Growth Rate of Main Crops in Cambodia, 1995-2004

Crop			Growth Rate									Average Growth Rate			Standard Deviation of Growth		
			1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	1995-2004	1995-2000	2000-2004	1995-2004	1995-2000	2000-2004
Rice		Planted Area	4.1%	-4.4%	0.9%	3.0%	7.5%	-3.3%	-5.7%	9.6%	2.5%	1.6%	2.2%	0.8%	5.3%	4.4%	6.8%
		Production	0.3%	-1.2%	2.8%	15.1%	-0.4%	1.8%	-6.7%	23.2%	-11.5%	2.6%	3.3%	1.7%	10.6%	6.8%	15.4%
		Yield	-3.6%	3.3%	1.9%	11.8%	-7.3%	5.3%	-1.1%	12.5%	-13.7%	1.0%	1.2%	0.8%	8.5%	7.3%	11.1%
Subsidiary Crop Production	Maize	Planted Area	-4.2%	0.1%	-9.2%	33.2%	19.4%	12.2%	0.3%	16.0%	-2.3%	7.3%	7.9%	6.6%	13.8%	17.8%	8.9%
		Production	17.0%	-34.0%	14.3%	97.8%	63.6%	18.2%	-19.8%	111.3%	-18.4%	27.8%	31.8%	22.8%	52.2%	50.5%	61.5%
		Yield	22.2%	-34.0%	25.9%	48.5%	36.9%	5.3%	-20.0%	82.1%	-16.5%	16.7%	19.9%	12.7%	37.0%	31.9%	47.6%
	Yellow Maize	Planted Area	-17.5%	15.6%	-26.2%	95.5%	37.8%	24.4%	-0.9%	33.6%	-4.6%	17.5%	21.0%	13.1%	36.7%	48.9%	18.8%
		Production	-5.6%	-44.3%	29.4%	181.0%	122.6%	29.5%	-25.6%	145.0%	-22.2%	45.5%	56.6%	31.7%	83.0%	93.1%	79.6%
		Yield	14.5%	-51.8%	75.4%	43.7%	61.6%	4.1%	-24.9%	83.3%	-18.5%	20.8%	28.7%	11.0%	47.8%	50.4%	49.8%
	Cassava	Planted Area	-1.3%	-24.9%	-16.3%	59.7%	16.0%	-12.5%	37.4%	31.6%	-11.6%	8.6%	6.6%	11.2%	29.0%	33.5%	27.0%
		Production	-15.0%	10.9%	-13.9%	243.5%	-35.3%	-3.7%	-14.2%	171.0%	9.5%	39.2%	38.0%	40.6%	98.0%	116.0%	87.4%
		Yield	-13.8%	47.8%	2.9%	115.1%	-44.2%	10.1%	-37.6%	106.0%	23.9%	23.3%	21.5%	25.6%	57.1%	62.0%	59.7%
	Sweet Potato	Planted Area	7.3%	-15.3%	0.2%	0.0%	-20.4%	-2.8%	12.6%	7.1%	-16.1%	-3.0%	-5.6%	0.2%	11.7%	11.7%	12.6%
		Production	-2.8%	-24.0%	5.4%	6.7%	-13.3%	-6.8%	20.1%	10.7%	0.7%	-0.4%	-5.6%	6.2%	13.2%	13.0%	11.7%
		Yield	-9.5%	-10.2%	5.1%	6.7%	8.9%	-4.1%	6.7%	3.3%	20.0%	3.0%	0.2%	6.5%	9.6%	9.3%	10.1%
	Vegetable	Planted Area	10.5%	-4.4%	-14.2%	-16.7%	7.3%	4.6%	-2.5%	4.8%	-9.7%	-2.2%	-3.5%	-0.7%	9.8%	12.3%	6.9%
		Production	29.4%	0.1%	-13.1%	-16.3%	7.7%	-5.7%	-11.6%	-14.4%	28.2%	0.5%	1.6%	-0.9%	17.8%	18.4%	19.8%
		Yield	17.1%	4.7%	1.3%	0.5%	0.4%	-9.9%	-9.4%	-18.4%	41.9%	3.1%	4.8%	1.1%	17.7%	7.1%	27.6%
	Mung Bean	Planted Area	9.6%	-1.5%	-8.9%	6.6%	-6.8%	17.8%	35.2%	12.9%	-13.0%	5.8%	-0.2%	13.2%	15.2%	8.1%	20.0%
		Production	-29.6%	11.3%	-40.2%	73.7%	-5.1%	13.6%	39.5%	33.0%	42.2%	15.4%	2.0%	32.1%	36.3%	44.9%	12.9%
		Yield	-35.8%	13.0%	-34.4%	63.0%	1.8%	-3.5%	3.1%	17.8%	63.5%	9.8%	1.5%	20.2%	35.6%	40.6%	30.2%
	Total	Planted Area	0.7%	-2.7%	-12.7%	21.9%	14.2%	11.7%	7.0%	18.9%	-6.8%	5.8%	4.3%	7.7%	11.9%	13.8%	10.9%
Industrial Crop Production	Groundnut	Planted Area	19.9%	-17.1%	-1.5%	9.2%	-2.0%	14.9%	16.2%	5.2%	31.9%	8.5%	1.7%	17.1%	14.4%	13.9%	11.1%
		Production	-8.7%	12.7%	-4.9%	39.8%	-19.0%	19.0%	9.3%	89.8%	70.7%	23.2%	4.0%	47.2%	36.9%	23.1%	39.2%
		Yield	-23.8%	36.1%	-3.5%	28.0%	-17.3%	3.6%	-6.0%	80.4%	29.4%	14.1%	3.9%	26.8%	32.7%	26.9%	38.7%
	Soyabean	Planted Area	75.6%	13.4%	-5.8%	13.2%	-5.2%	-3.8%	4.5%	58.7%	60.0%	23.4%	18.3%	29.8%	32.2%	33.4%	34.2%
		Production	64.1%	99.1%	-50.8%	26.5%	-19.8%	-12.3%	56.8%	63.4%	74.6%	33.5%	23.8%	45.6%	50.6%	60.8%	39.3%
		Yield	-6.5%	75.5%	-47.8%	11.7%	-15.4%	-8.8%	50.0%	3.0%	9.1%	7.9%	3.5%	13.3%	36.3%	45.7%	25.6%
	Sesame	Planted Area	41.6%	38.3%	-12.8%	31.6%	-1.2%	4.9%	3.4%	63.0%	89.7%	28.7%	19.5%	40.2%	33.5%	24.8%	43.1%
		Production	39.6%	23.9%	-21.7%	45.2%	33.4%	-9.1%	13.4%	116.2%	150.3%	43.5%	24.1%	67.7%	56.0%	26.8%	77.5%
		Yield	-1.4%	-10.4%	-10.3%	10.3%	35.1%	-13.3%	9.6%	32.6%	32.0%	9.4%	4.7%	15.2%	19.8%	19.0%	21.8%
	Sugarcane	Planted Area	-16.1%	16.8%	-15.4%	19.1%	-8.2%	1.7%	20.6%	1.1%	-29.2%	-1.1%	-0.8%	-1.4%	17.6%	17.4%	20.6%
		Production	-15.4%	9.5%	-29.1%	20.1%	2.7%	3.1%	23.3%	-17.1%	-24.7%	-3.1%	-2.4%	-3.8%	19.2%	19.7%	21.6%
		Yield	0.9%	-6.3%	-16.2%	0.9%	11.9%	1.4%	2.3%	-18.0%	6.3%	-1.9%	-1.8%	-2.0%	9.9%	10.4%	10.9%
	Tobacco	Planted Area	1.8%	8.2%	-7.8%	-39.9%	16.7%	-11.6%	-52.3%	57.1%	-73.3%	-11.2%	-4.2%	-20.0%	39.3%	21.9%	57.5%
		Production	-13.2%	9.1%	-3.3%	-37.3%	20.6%	-39.2%	-46.4%	203.9%	-67.4%	3.0%	-4.8%	12.8%	80.5%	22.2%	128.0%
		Yield	-14.7%	0.8%	4.8%	4.2%	3.3%	-31.2%	12.5%	93.4%	22.3%	10.6%	-0.3%	24.3%	34.7%	8.2%	51.6%
	Jute	Planted Area	85.8%	19.1%	-38.2%	-78.2%	-23.8%	-2.4%	138.9%	1.0%	29.2%	14.6%	-7.1%	41.7%	65.3%	62.5%	66.3%
		Production	151.9%	-2.9%	-52.6%	-76.1%	-31.8%	35.0%	161.7%	-11.8%	56.9%	25.6%	-2.3%	60.4%	84.8%	90.3%	73.3%
		Yield	35.6%	-18.5%	-23.3%	9.6%	-10.5%	38.3%	9.5%	-12.7%	21.4%	5.5%	-1.4%	14.2%	23.1%	24.2%	21.4%
	Total	Planted Area	30.5%	12.2%	-8.7%	5.9%	-2.0%	0.3%	1.8%	43.7%	50.5%	14.9%	7.6%	24.1%	21.4%	15.1%	26.7%
Total			8.4%	1.9%	-11.4%	16.3%	9.0%	8.4%	5.6%	25.3%	10.1%	8.2%	4.8%	12.4%	9.9%	10.4%	8.8%

(MAFF 2005)

Table 37 Characteristics of Rice Production Systems

Rice Production System	Characteristics
Rainfed Upland Rice	<2% of wet season rice cultivation. Mainly in Provinces of Ratanak Kiri, Kampong Cham, Siem Reap, Mondol Kiri, Kampong Thom, Koh Kong, Kampot, Kandal, Preah Vihear and Stung Treng. In Rotanak Kiri and Mondol Kiri, upland rice is the major rice ecosystem, and in Rotanak Kiri the upland rice area is more than twice the area for rainfed lowland rice.
Rainfed Lowland Rice	>90% of wet season rice cultivation. Mainly on the flat plains of Tonle Sap Lake, Mekong River and Tonle-Basac River. The early varieties are grown in high fields, medium varieties in middle fields, and late varieties in low fields of the rainfed lowland areas. In general, the high fields are generally more drought prone while the low fields are more floods prone. • **Early Duration Rice.** 20% of total rainfed lowland rice area. Photoperiod insensitive, less than 120 day maturation. Photoperiod insensitive mainly grown at the beginning of the rainy season enabling farmers to plant medium or late varieties after harvesting, or at flood recession (recession rice). • **Medium Duration Rice.** 41% of total rainfed lowland rice area. Photoperiod insensitive or weakly sensitive. 120-150 day maturation. • **Late Duration Rice.** 39% of total rainfed lowland rice area. Photoperiod sensitive.
Deepwater/Floating Rice	4% of total rice area. Grown in low-lying areas that accumulate floodwater at a depth of 50cm or more and in some places the water depth can be as deep as 4m. The floodwater comes from the Tonle Sap, the Mekong and Tonle Sap – Bassac rivers. Seeding time in the southern provinces including Takaev, Prey Veaeng and Kandal is usually from late April to May, while in the northern provinces such as Bat Dambang, Banteay Mean Chey and Siem Reap, it is from May to mid June.

Dry Season Rice	8-13% of the total cultivated rice area. Photoperiod insensitive varieties that mature not more than 120 days. Its high productivity associated with better water control, higher light intensity during crop growth, development and cultivation of fertilizer-responsive high yielding varieties like IR66, Kru and IR Kesar.
	• **Fully or partially irrigated second crop** after the wet season of rainfed lowland rice production.
	  o **Early dry season rice** where the seedling and vegetative growth depends on late wet season rainfall and residual soil moisture; while the other stages depend on irrigation.
	  o **Late dry season rice** involves the low fields, and the need for irrigation is greater than in the early dry season crop.
	• **Partially irrigated flood recession rice**. Largely the flood receding areas of very deepwater lands around lakes, rivers, and water reservoirs that are not suitable for deepwater rice cultivation because the water rise is too rapid.

Source: (JICA 2001; Sarom, Chaudhary et al. 2001)	

Table 38 Area and Production of Paddy in Cambodia by Province, 2004-2005

Province	Paddy					
	Wet Season			Dry Season		
	Harvested Area	Yield	Production	Harvested Area	Yield	Production
Banteay Meanchey	185,938	1.800	334,695	2,036	3.000	6,108
Battambang	212,031	2.195	465,376	735	3.073	2,259
Kampong Cham	125,747	1.964	246,927	50,046	3.494	174,851
Kampong Chhnang	90,454	1.383	125,056	18,327	3.070	56,264
Kompong Speu	44,444	1.566	69,595	364	2.371	863
Kompong Thom	118,966	1.240	147,544	5,431	3.114	16,910
Kampot	105,968	1.561	165,387	2,480	2.816	6,984
Kandal	34,962	2.069	72,352	53,943	3.675	198,237
Koh Kong	8,326	1.593	13,265	-	-	-
Kratie	20,779	1.774	36,856	8,052	2.162	17,405
Mondul Kiri	4,191	1.151	4,824	-	-	-
Phnom Penh	5,670	1.990	11,284	448	3.319	1,487
Preah Vihear	22,740	1.948	44,306	-	-	-
Prey Veng	186,760	1.742	325,325	61,460	3.124	192,025
Pursat	76,280	1.890	144,169	941	3.390	3,190
Rattanakiri	16,037	1.500	24,056	-	-	-
Seam Reap	171,080	1.345	230,123	11,760	3.005	35,335
Sihanouk Ville	11,499	2.497	28,715	-	-	-
Steung Treng	18,351	1.500	27,527	-	-	-
Svay Rieng	154,165	1.406	216,746	10,611	3.059	32,459
Takeo	157,846	2.162	341,240	66,587	4.396	292,696
Otdor Meanchey	39,820	1.260	50,173	-	-	-
Kep	2,910	1.800	5,238	-	-	-
Pailin	655	2.751	1,802	-	-	630
Total	1,815,619	1.725	3,132,581	293,221	3.175	1,037,703

Area = hectares; Production = tonnes; Yield = t/ha
Source: (MAFF 2006)

Table 39 Food Balance for Rice Production

		Units	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Cultivated Area	Wet Season	ha	1,701,100	1,701,560	2,100,000	1,869,991	1,936,900	1,827,328	1,873,093	1,915,592	2,058,648	1,974,048	1,821,225	2,032,303	2,075,646
	Dry Season	ha	143,000	155,000	160,000	216,000	234,000	248,683	230,920	242,000	259,847	266,869	291,990	283,550	298,529
	Total	**ha**	**1,844,100**	**1,856,560**	**2,260,000**	**2,085,991**	**2,170,900**	**2,076,011**	**2,104,013**	**2,157,592**	**2,318,495**	**2,240,917**	**2,113,215**	**2,315,853**	**2,374,175**
Destroyed Area	Wet Season	ha	155,723	27,935	424,300	160,950	287,900	142,422	127,697	69,150	410,836	250,663	112,022	65,267	260,027
	Dry Season	ha	3,000	5,000	-	1,000	1,000	5,000	13,750	9,000	4,500	9,959	6,982	8,550	5,098
	Total	**ha**	**158,723**	**32,935**	**424,300**	**161,950**	**288,900**	**147,422**	**141,447**	**78,150**	**415,336**	**260,622**	**119,004**	**73,817**	**265,125**
Yield	Wet Season	t/ha	1.211	1.200	1.031	1.640	1.673	1.586	1.647	1.805	1.949	1.901	1.706	1.951	1.725
	Dry Season	t/ha	2.500	2.500	3.094	3.000	3.000	3.046	2.928	3.039	3.187	3.204	3.181	3.175	3.536
	Total	**t/ha**	**1.318**	**1.307**	**1.211**	**1.792**	**1.837**	**1.771**	**1.788**	**1.943**	**2.115**	**2.070**	**1.917**	**2.101**	**1.977**
Harvested Area	Wet Season	ha	1,545,377	1,673,625	1,675,700	1,709,041	1,649,000	1,684,906	1,745,396	1,846,442	1,647,812	1,723,385	1,709,203	1,967,036	1,815,619
	Dry Season	ha	140,000	150,000	160,000	215,000	233,000	243,683	217,170	233,000	255,347	256,910	285,008	275,000	293,431
	Total	**ha**	**1,685,377**	**1,823,625**	**1,835,700**	**1,924,041**	**1,882,000**	**1,928,589**	**1,962,566**	**2,079,442**	**1,903,159**	**1,980,295**	**1,994,211**	**2,242,036**	**2,109,050**
Production	Wet Season	tonnes	1,871,000	2,008,350	1,728,480	2,802,827	2,759,000	2,672,597	2,873,906	3,332,900	3,212,269	3,275,953	2,915,900	3,837,957	3,132,581
	Dry Season	tonnes	350,000	375,000	495,000	645,000	699,000	742,321	635,965	708,000	813,823	823,063	906,609	873,000	1,037,703
	Total	**tonnes**	**2,221,000**	**2,383,350**	**2,223,480**	**3,447,827**	**3,458,000**	**3,414,918**	**3,509,871**	**4,040,900**	**4,026,092**	**4,099,016**	**3,822,509**	**4,710,957**	**4,170,284**
Supply	Post Harvest Conversion Factor	Percent	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%
	Post-Harvest Losses	tonnes	377,570	405,170	377,992	586,131	587,860	580,536	596,678	686,953	684,436	696,833	649,827	800,863	708,948
	Paddy	tonnes	1,843,430	1,978,181	1,845,488	2,861,696	2,870,140	2,834,382	2,913,193	3,353,947	3,341,656	3,402,183	3,172,682	3,910,094	3,461,336
	Milling Conversion Factor	Percent	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%
	Rice	tonnes	1,179,795	1,266,036	1,181,113	1,831,486	1,836,890	1,814,004	1,864,443	2,146,526	2,138,660	2,177,397	2,030,517	2,502,460	2,215,255
Consumption	Population	Person	9,430,000	9,500,000	9,700,000	10,470,000	11,034,000	11,640,000	12,186,000	12,351,000	12,573,000	12,802,000	13,040,000	13,287,000	13,327,946
Food Requirement	Per Capita Food Requirement	Tonnes /hd/yr	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143
	Rice	tonnes	1,348,490	1,358,500	1,387,100	1,497,210	1,577,862	1,664,520	1,742,598	1,766,193	1,797,939	1,830,686	1,864,720	1,900,041	1,905,896
Surplus	**Rice**	**tonnes**	**-168,695**	**-92,464**	**-205,987**	**334,276**	**259,028**	**149,484**	**121,845**	**380,333**	**340,721**	**346,711**	**165,797**	**602,419**	**309,359**
	Paddy	**tonnes**	**-263,586**	**-144,476**	**-321,855**	**522,306**	**404,731**	**233,569**	**190,384**	**594,270**	**532,377**	**541,736**	**259,057**	**941,280**	**483,373**

Source (MAFF 2001; MAFF 2001; MAFF 2002; MAFF 2004; MOP and NIS 2004; MAFF 2005) Updated Conversion Factors

Table 40 Relative Adoption of Traditional and Improved Varieties of Rice

Crop Season	Traditional Varieties				Improved Varieties			
	Households	Area	Production	Yield (t/ha)	Households	Area	Production	Yield (t/ha)
Wet Season	83%	86%	79%	1.4	19%	14%	21%	2.1
Dry Season	5%	3%	2%	2.8	96%	97%	98%	3.4
Early Wet Season	13%	12%	0%	1.5	87%	88%	100%	2.4
Total		52%	33%	1.4		48%	67%	3.1

Source: (Agriculture Quality Improvement Project 2002, pp.11-12 Table 3-4)

Table 41 Farmer Reasons for Adoption of IR66

• Premium prices for paddy and straw in the dry season shortage • Acceptable quality • Mature quickly • Good Yields	• IR66 grown in Early Wet Season can be sold for seed at high prices for Dry Season cropping because IR66 cannot be stored from one season to the next. • Acceptable market prices • Responsive to fertilizer
Source: (Young, Raab et al. 2000, pp. 10-12)	

Table 42 Historical Profiles of CAR Varieties

Variety	Duration	Original Name	Year Released
CAR1	Medium	Pram'bei kuor	1995
CAR2	Medium	Sambark Krarham	1995
CAR3	Medium	Srar-aerm cheab chan	1995
CAR11	Medium	Barnla Phdau	1997
CAR4	Late	Charng kaom ropeak	1995
CAR5	Late	Karn-tuy tuok	1995
CAR6	Late	Seo nam'ng	1995
CAR7	Late	Chungkung kreal	1996
CAR8	Late	Phka sla	1996
CAR9	Late	Srau kul	1996
CAR12	Late	Koon trei khmau	1997
CAR13	Late	Neang minh tun	1997

Source: (Cambodia-IRRI-Australia Project 1996, pg. 6); (Cambodia-IRRI-Australia Project 1997, pg. 33)

Table 43 Characteristics of Selected Rice Varieties Released by CARDI

System		Variety	Line Designation	Year Released	Yield* (t/ha)	Maturity (Days)	Resistance to Brown Plant Hopper**	Milling Recovery	Head Rice Recovery	Amylose Content	Raw Rice Acceptability	Cooked Rice Acceptability	Aroma/ Scent
Rainfed Upland		Rimke	ITA150	1991	2.5-4.0	90-95	-	69%	48%	22%	Average	Good	None
		Sita	ITA257	1991	2.5-4.0	90-100	-	67%	37%	19%	Average	Good	None
Rainfed Lowland	Early Maturity	IR66	IR32307-107-3-2-2	1990	4.0-6.5	105-115	MS	69%	64%	24%	Very Good	Good	None
		IR72	IR35366-40-3-3-2-2	1990	3.5-6.0	110-120	S	73%	58%	24%	Good	Average	None
		Kru	IR13429-150-3-2-1-2	1990	3.5-6.0	110-115	MR	72%	65%	24%	Very Good	Good	None
		IR Kesar	IR48525-100-1-2	1993	4.0-6.0	105-120	MR	70%	61%	22%	Very Good	Very Good	None
	Medium Maturity Photoperiod Sensitive	Riang Chey	Moo ha pharl -1	1999	3.5-5.5	Nov 5-11	MS	68%	61%	23%	Good	Good	None
		CAR1	Pram'bei kuor-PPD 679	1995	2.5-4.0	Nov 2-9	S	68%	57%	23%	Good	Good	None
		CAR2	Sammbark krarharm-PPD 597	1995	2.5-4.0	Nov 6-12	S	68%	58%	22%	Average	Good	None
		CAR3	Srar-aerm cheab chan-Germ. B-293	1995	2.5-4.5	Oct 30- Nov 7	HS	74%	54%	21%	Average	Good	None
		CAR11	Barnla phdau-PPD 367	1997	2.5-4.5	Nov 5-11	S	67%	59%	24%	Very Good	Good	None
		Phka Rumduol	Somaly-1771	1999	3.5-5.5	Oct 30- Nov 7	S	68%	53%	23%	Excellent	Very Good	Scented
	Late Maturity	CAR4	Charng kaom ropeak - Germ.90 B-528	1995	2.5-5.0	Nov 8-15	MS	70%	66%	21%	Good	Good	None
		CAR5	Karn-tuy took-PPD 156	1995	2.5-4.5	Nov 10-17	S	69%	66%	21%	Good	Good	None
		CAR6	Seo nam'ng-Germ. B-429	1995	2.5-5.0	Nov 9-16	S	72%	67%	22%	Good	Good	None
		CAR7	Chungkung kreal-PPD 723	1996	2.5-4.0	Nov 15-21	HS	73%	63%	25%	Good	Good	None
		CAR8	Phka sla-PPD 364	1996	2.5-4.5	Nov 19-26	S	69%	62%	23%	Good	Good	None
		CAR9	Srau kul-PPD 86	1996	2.5-4.5	Nov 10-17	S	70%	61%	24%	Good	Good	None
		CAR12	Koon trei khmau-Germ.A 66	1997	2.5-4.5	Nov 17-24	MR	67%	58%	26%	Good	Good	None
		CAR13	Neang minh tun-PPD 375	1997	2.5-4.5	Nov 19-26	S	68%	57%	23%	Good	Good	None
Deep Water		Don	HTAFR 77022-45-3-2-1	1991	2.0-4.5	Nov 20-27	-	71%	57%	22%	Good	Good	None
		Tewada	Tewada	1991	2.0-4.0	Nov 12-19	-	68%	50%	27%	Very Good	Good	None

*Experimental Yields; **HS: Highly Susceptible; MS: Moderately Susceptible; S: Susceptible; MR: Moderately Resistant; R: Resistant
Source: (Sarom, Chaudhary et al. 2001)

Table 44 Source of Seeds

Seed Source	Province (number of plots)				
	Kandal	Prey Veng	Svay Rieng	Takeo	Total
Kept own seed	52%	75%	74%	56%	66%
Bought from farmers	35%	7%	5%	13%	12%
Bought from Seed Company	1%	0%	2%	1%	1%
Bought from other source	1%	1%	1%	1%	1%
Seed exchange	8%	16%	12%	28%	18%
Other source	2%	0%	5%	1%	2%
Seed Source	Traditional Varieties (hectares)				
	Wet Season	Dry Season	Early Wet Season		Total
Kept own seed	82%	10%	89%		80%
Bought from farmers	4%	36%	11%		5%
Bought from Seed Company	0%	0%	0%		0%
Bought from other source	0%	0%	0%		0%
Seed exchange	14%	54%	0%		14%
Other source	0%	0%	0%		0%
Seed Source	Improved Varieties (hectares)				
	Wet Season	Dry Season	Early Wet Season		Total
Kept own seed	43%	46%	72%		48%
Bought from farmers	19%	26%	3%		22%
Bought from Seed Company	0%	3%	4%		3%
Bought from other source	0%	4%	0%		3%
Seed exchange	35%	16%	21%		20%
Other source	0%	5%	0%		4%

Source: (Agriculture Quality Improvement Project 2002, Appendix 1)

Table 45 Utilization of Production

Utilization of Paddy	Households %	Production %	Production kg/ha
Seed	93%	7%	272
Consumption	97%	50%	2,076
Sold (Milling)	54%	37%	1,556
Sold (Seed)	4%	1%	42
Sold (Debt Repayment)	24%	5%	223
Total		100%	4,168

Source: (Agriculture Quality Improvement Project 2002, pg. 15 Table 8)

Table 46 Fertilizer Application Rates

Type of Fertilizer	Improved Varieties	Traditional Varieties	Overall
Urea	97	62	80
DAP	82	58	69
16-20-0	102	77	87
KCL	59	59	59
15-15-15	45	46	45
16-16-8	117	73	95
Other	93	78	81
Total Chemical	595	453	516
Manure	4874	2051	2537

kg/ha

Source: (Agriculture Quality Improvement Project 2002, pg. 14 Table 6)

Table 47 Irrigation Specifications

Potential of surface freshwater for irrigation	**Irrigation potential, ha**	
Mekong main stream	734000	44.0%
Mekong tributaries	253000	15.2%
Mekong flooded area	179000	10.7%
Tonle Sap tributaries	358900	21.5%
Outside Mekong basin	142400	8.5%
Total	1667300	100%
Optimal yield of wells	**Yield, cubic meters/day**	
Svay Rieng, Prey Veng and southern Kandal	500-800	
Peri-urban areas, northern Kandal, Takeo and Kampong Speu	1.5-150	
Kampong Cham	3-1296	
Kampong Chhnang	11.5-173	
Water uses	**Water quantity, million cubic meters/year**	
Domestic water	136	17.0%
Livestock	100	12.5%
Crops, forest, etc.	455	56.9%
Industry	30	3.8%
Miscellaneous	79	9.9%
Total	800	100%
Projected demand in 10 years with population 30% higher	**Million cubic meter/year**	
Domestic water use increased by 100%	272	16.40%
Livestock increased by 50%	150	9.04%
Irrigation increased by 100%	910	54.85%
Industrial use increased by 200%	90	5.42%
Miscellaneous increased by 200%	237	14.29%
Total	1659	100%

Data source: JICA/MRD 1999 & 2002
Data source: ADBTA 3292—CAM, 2001

Table 48 Existing Irrigation Schemes in Cambodia

Province	System	Total land area ('000 ha)	Irrigated area (hectares)						Estimate of shallow well area	
			Potential		Current (% of Potential)				Shallow well area	Proportion of shallow well to total area
			Wet season	Dry season	Wet season		Dry Season		('000 ha)	(%)
Banteay Meanchey	12	993.7	38750	1580	9120	23.5%	93	5.9%	447.1	45
Battambang	16	1043.3	87330	4165	23990	27.5%	507	12.2%	521.6	50
Kampong Cham	79	979.9	38400	20241	25840	67.3%	7267	35.9%	392	40
Kampong Chhnang	18	552.1	15975	1940	5665	35.5%	1514	78.0%	331.2	60
Kampong Speu	95	701.7	33357	3402	19175	57.5%	756	22.2%	140.3	20
Kampong Thom	64	1381.4	70269	5962	44211	62.9%	3532	59.2%	621.6	45
Kampot/Kep/Sihanoukville	32	607.7	14940	10415	10395	69.6%	3035	29.1%	151.9	25
Kandal/Phnom Penh	139	385.8	19780	38612	18737	94.7%	26340	68.2%	347.2	90
Koh Kong	5	1116			2720				0	0
Kratie	165	1109.4	4606	4968	2547	55.3%	3297	66.4%	110.9	10
Mondulkiri		1428.8								0
Oddar Meanchey										
Pailin										
Preah Vihear		1378.8								0
Prey Veng	111	488.3	25172	31141	10362	41.2%	22525	72.3%	439.5	90
Pursat	47	1269.2	56762	1865	6278	11.1%	30	1.6%	317.3	25
Ratanakiri		1078.2								0
Siem Reap	34	1257.1	51100	11020	45825	89.7%	10120	91.8%	381.7	30.4
Stung Treng	9	1109.2			2300		540		83.2	7.5
Svay Rieng	20	296.6	5631	4007	4879	86.6%	3602	89.9%	266.9	90
Takeo	100	356.3	10400	2202	24076	231.5%	60332	2739.9%	285	80
Total	946	17533.5	472472	141520	256120	54.2%	143490	101.4%	4837.4	27.6

Data source: ADBTA 3292—CAM, 2001
Data source: Briese, 1996 (ADBTA: 2554—CAM) quoted in Sir MacDonald & Partner (ADBTA: 3292—CAM)

Table 49 Farmer Consumption and Sales of Paddy

Province	Own Consumption	Sold	Percentage of Sales			Volume of Paddy Sold (tonnes)	
			Collectors	Mills	Other	1998/1999	1999/2000
Kandal	75%	25%	34%	13%	53%	0.87	1.30
Prey Veng	47%	53%	70%	16%	14%	1.59	1.37
Kampong Cham	43%	57%	69%	19%	12%	2.39	2.59
Svay Rieng	81%	19%	59%	15%	26%	1.13	1.41
Takeo	40%	60%	81%	4%	15%	1.42	1.22
Kampong Speu	66%	34%	96%	4%	0%	0.56	0.61
Kampong Chhnang	63%	37%	61%	34%	5%	1.00	0.96
Battambang	32%	68%	52%	45%	3%	2.76	3.14
Seam Reap	89%	11%	57%	29%	14%	0.81	0.68
Total	60%	40%	67%	20%	13%	1.63	1.71

Source: (JICA 2001)

Table 50 Average Land Holdings for Value Chain Respondents by Province

	Kampong Speu	**Svay Rieng**	**Battambang**	**Kampong Thom**	**Average**
Rice Area (Ha)	1.09	8.15	1.30	4.50	4.11
Other Area (Ha)	0.33	0.10	0.00	0.88	0.37
Total Area of Land (Ha)	1.42	8.25	1.30	5.38	4.48

Source: Study Team Value Chain Questionnaire

Table 51 Average Rice Production Statistics for Value Chain Respondents

Rice Production Statistics	Season		
	Dry Season	Wet Season	Average
Area Planted (ha)	7.10	0.95	1.92
Yield (Tonnes/per Ha)	3.67	2.22	2.45
Total Production (Tonnes)	32.25	1.85	6.65
Consumption (Tonnes)	2.33	0.88	1.11
Milling Fee (Riels/kg)	41.67	12.89	16.27
Bran Kept as Payment by Millers (%)	0%	25%	21%
Seed Kept (Kg)	1846.67	89.91	367.29
Payment in kind (Tonnes)	0.00	0.00	0.00
Sold (Tonnes)	28.07	0.89	5.18
Selling Price (Riels/kg)	510	393	411
Own Consumption Only (%)	0%	56%	47%

Source: Study Team Value Chain Questionnaire

Table 52 Returns and Production Costs

Crop Name	Total Gross Return	Production Costs			Gross Margin			
		Material Input Costs	Labor Costs	Total	Estimate 1		Estimate 2	
Tobacco (traditional)	13,894,000	375,950	180,000	555,950	13,338,050	$3,334.51		
Lettuce	6,035,000	303,438	272,313	575,750	5,459,250	$1,364.81	4,109,250	$1,027.31
Eggplant	5,500,000	348,500	124,000	472,500	5,027,500	$1,256.88		
Cabbage	4,418,750	402,833	213,667	616,500	3,802,250	$950.56		
Water melon	3,934,000	396,625	211,042	607,667	3,326,333	$831.58		
Sweet pepper	3,975,000	456,156	196,000	652,156	3,322,844	$830.71		
Tomato	4,000,000	575,000	260,000	835,000	3,165,000	$791.25		
Tobacco (modern)	3,600,000	412,000	542,500	954,500	2,645,500	$661.38		
Chinese cabbage	3,000,000	163,750	315,000	478,750	2,521,250	$630.31		
Long bean	2,886,000	266,248	274,650	540,898	2,345,102	$586.28	2,271,170	$567.79
Corn	2,831,393	349,279	185,964	535,243	2,296,150	$574.04	2,142,381	$535.60
Cucumber	2,770,800	479,946	275,625	755,571	2,015,229	$503.81		
Sesame	2,725,875	553,500	164,875	718,375	2,007,500	$501.88	2,004,875	$501.22
Cauliflower	2,100,000	164,000	356,500	520,500	1,579,500	$394.88		
Vegetable (mix)	1,732,200	413,292	183,333	596,625	1,135,575	$283.89		
Soy bean	1,686,000	370,580	242,535	613,115	1,072,885	$268.22	1,070,785	$267.70
Floating rice	1,521,767	275,962	221,604	497,566	1,024,201	$256.05		
Sugar cane	1,826,667	588,333	287,375	875,708	950,958	$237.74	536,438	$134.11
Mung bean	1,407,250	299,850	189,646	489,496	917,754	$229.44	890,421	$222.61
White Yam	1,329,700	229,531	235,000	464,531	865,169	$216.29		
Cassava	1,500,728	290,713	419,250	709,963	790,766	$197.69		
Dry season rice	1,590,036	376,984	431,521	808,506	781,530	$195.38		
Peanut	1,308,438	341,613	216,819	558,431	750,006	$187.50		
Jute	1,143,950	113,750	334,813	448,563	695,388	$173.85		
Wet season rice	1,379,433	336,459	407,820	744,278	635,155	$158.79	560,568	$140.14
Receding rice	1,206,375	377,438	365,000	742,438	463,938	$115.98		
Upland rice	870,625	194,962	237,975	432,937	437,688	$109.42		

Riel per hectare; 4000 Riel=US$1
Source: ABiC Survey 2005, cited in (ACI 2005)

Table 53 Production Cost Computation

Crop Name	Unit	Quantity	Total Production Costs, Rl/ha	Gross Margin, Rl/ha	Production cost, Rl/t	Production cost, Rl/kg	US$/t
Tobacco (modern)	t	0.6	954,500.0	2,645,500.0	1,590,833.333		
Sesame	t	0.8	718,375.0	2,007,500.0	862,912.913	862.913	215.73
Dry season rice	t	1.3	808,505.6	781,530.1	603,362.367	603.362	150.84
Soy bean	t	1.2	613,115.0	1,072,885.0	528,547.414	528.547	132.14
Mung bean	t	1.0	489,495.8	917,754.2	470,669.071	470.669	117.67
Receding rice	t	2.1	742,437.5	463,937.5	353,541.667	353.542	88.39
Peanut	t	1.6	558,431.3	750,006.3	349,019.531	349.020	87.25
Wet season rice	t	2.4	744,278.5	635,154.9	304,787.762	304.788	76.20
Upland rice	t	1.6	432,936.7	437,688.3	270,585.417	270.585	67.65
Jute	t	2.0	448,562.5	695,387.5	224,281.250	224.281	56.07
Floating rice	t	2.5	497,565.8	1,024,200.8	196,666.337	196.666	49.17
Sweet pepper	t	3.4	652,156.3	3,322,843.8	191,810.662	191.811	47.95
Tobacco (traditional)	t	2.9	555,950.0	13,338,050.0	191,048.110	191.048	47.76
Cauliflower	t	3.5	520,500.0	1,579,500.0	148,714.286	148.714	37.18
Corn	t	3.8	535,242.9	2,296,150.0	140,483.690	140.484	35.12
Vegetable (mix)	t	4.9	596,625.0	1,135,575.0	122,342.789	122.343	30.59
Long bean	t	4.9	540,898.0	2,345,102.0	110,387.3	110.4	27.6
Tomato	t	8.0	835,000.0	3,165,000.0	104,375.000	104.375	26.09
Cabbage	t	6.0	616,500.0	3,802,250.0	102,069.536	102.070	25.52
Chinese cabbage	t	5.0	478,750.0	2,521,250.0	95,750.000	95.750	23.94
Sugar cane	t	9.4	875,708.3	950,958.3	92,864.086	92.864	23.22
Cucumber	t	9.7	755,570.8	2,015,229.2	77,733.625	77.734	19.43
Water melon	t	10.2	607,666.7	3,326,333.3	59,575.163	59.575	14.89
White Yam	t	9.6	464,531.3	865,168.8	48,275.526	48.276	12.07
Eggplant	t	10.0	472,500.0	5,027,500.0	47,250.000	47.250	11.81
Lettuce	t	13.4	575,750.0	5,459,250.0	42,966.418	42.966	10.74
Cassava	t	16.9	709,962.5	790,765.5	42,071.852	42.072	10.52

Source: ABiC Survey 2005, cited in (ACI 2005)

Table 54 Marketing Margins for Selected Crops

Region	Crop	Farmer	Collector	Processor	Transporter	Wholesaler	Retailer	Crop	Farmer	Collector	Processor	Transporter	Wholesaler	Retailer
Northeast	Wet Season Rice	41.2	2.8	37.1	7.4	4.8	6.8	Bamboo	56.6	7.5	7.6	10.8	10.3	9.5
Mekong		59.5	5.5	6.2	5.6	10.9	10.0							
Coastal		47.9	5.6	16.3	4.9	8.4	16.7							
Tonle Sap		46.8	5.7	4.0	3.0	13.6	26.9		67.5	45.0		6.3	10.5	9.5
Overall		**49.9**	**5.3**	**12.9**	**5.0**	**9.9**	**16.2**		**22.5**	**15.0**	**-**	**2.1**	**3.5**	**3.2**
Northeast	Corn	71.5	4.8	5.0	5.8	11.5	5.3	Honey	75.6	10.4		4.0	4.8	7.6
Mekong		57.6	5.7	8.1	5.7	12.6	9.7		58.0	5.0		13.0	21.0	3.0
Coastal		62.5	10.0		2.5	12.5	12.5							
Tonle Sap		59.6	10.2	2.8	3.0	6.6	17.7		50.0	5.9	0.4	0.6	7.9	35.3
Overall		**62.1**	**7.8**	**4.6**	**4.3**	**9.5**	**12.6**		**69.4**	**9.0**	**0.4**	**5.4**	**7.6**	**10.9**
Northeast	Soybean	68.8	5.8	3.0	5.0	11.2	7.4	Wild Mushroom	73.7	5.3		3.3	12.7	6.7
Mekong		71.4	7.1	12.4	1.0	1.0	7.1		46.0	1.0	3.0	25.0	8.0	17.0
Coastal														
Tonle Sap									50.0	12.5	9.3	10.0	7.3	20.0
Overall		**69.2**	**6.0**	**5.4**	**4.3**	**9.5**	**7.4**		**67.3**	**5.7**	**6.1**	**9.0**	**11.4**	**9.6**
Northeast	Mung bean	65.0	13.0	2.0	7.0	4.0	9.0	Wild Vegetables	65.8	9.8		5.3	12.7	8.2
Mekong		62.1	5.9	6.4	7.7	7.4	10.7		56.3	6.8	3.7	7.3	16.4	9.8
Coastal														
Tonle Sap		58.9	10.2	1.4	1.2	9.5	18.1		47.7	18.9	2.2	12.5	5.4	13.5
Overall		**60.6**	**8.9**	**3.3**	**4.1**	**8.2**	**14.6**		**60.3**	**11.0**	**2.9**	**7.6**	**12.0**	**9.6**
Northeast	Cassava	14.5	1.5	57.5	7.0	11.0	8.5	Medicinal Plants	52.0	2.0			15.0	31.0
Mekong		58.3	13.7	10.8	6.8	10.4			66.6	4.4	9.0	5.0	7.0	8.0
Coastal														
Tonle Sap														
Overall		**40.8**	**8.8**	**29.5**	**6.9**	**10.6**	**8.5**		**59.3**	**3.2**	**9.0**	**5.0**	**11.0**	**19.5**
Northeast	Sugar Cane							White Yam	46.0	2.5		11.5	20.0	20.0
Mekong		60.7	4.3	3.5	9.7	7.5	16.1							
Coastal														
Tonle Sap		46.4	15.1	2.7	5.9	11.2	18.6							
Overall		**52.1**	**10.8**	**2.9**	**7.4**	**9.7**	**17.6**		**46.0**	**2.5**		**11.5**	**20.0**	**20.0**
Northeast	Peanut	54.0	3.5	24.5	5.0	4.5	8.5	Dry						

Table 54 Marketing Margins for Selected Crops

Region	Crop	Farmer	Collector	Processor	Transporter	Wholesaler	Retailer	Crop	Farmer	Collector	Processor	Transporter	Wholesaler	Retailer
Mekong		62.7	5.8	5.4	6.1	9.9	10.2	Season Rice	71.0	5.0	5.0	9.0	5.0	5.0
Coastal		53.6	7.1	10.7	3.6	10.7	14.3							
Tonle Sap		66.1	9.8	1.6	2.7	7.5	11.5							
Overall		**61.8**	**7.3**	**7.6**	**4.1**	**7.9**	**10.9**		**71.0**	**5.0**	**5.0**	**9.0**	**5.0**	**5.0**
Northeast		72.2	4.8	5.3	4.2	7.6	8.0							
Mekong		84.8	3.0	3.0	1.5	4.5	3.0							
Coastal	Sesame							Bamboo shoot	53.0	12.0	1.0	8.0	19.0	7.0
Tonle Sap									37.6	37.6	3.0	3.1	11.5	7.1
Overall		**74.3**	**4.5**	**4.8**	**3.8**	**7.1**	**7.2**		**45.3**	**24.8**	**2.0**	**5.6**	**15.3**	**7.1**
Northeast		68.0	1.4		8.0	11.2	11.4							
Mekong														
Coastal	Leafy Vegetables							Floating rice						
Tonle Sap		56.5	9.3	5.5	2.0	5.5	21.2		44.3	6.7	4.1	3.4	11.7	29.9
Overall		**62.9**	**4.9**	**5.5**	**5.3**	**8.7**	**15.7**		**44.3**	**6.7**	**4.1**	**3.4**	**11.7**	**29.9**
Northeast														
Mekong														
Coastal	Cauliflower							Sweet pepper						
Tonle Sap		51.5	6.2	1.0	1.8	5.8	33.3		68.5	12.5	1.4	2.1	5.3	10.3
Overall		**51.5**	**6.2**	**1.0**	**1.8**	**5.8**	**33.3**		**68.5**	**12.5**	**1.4**	**2.1**	**5.3**	**10.3**
Northeast														
Mekong														
Coastal	Lettuce	55.0		5.0	5.0	10.0	25.0	Orange						
Tonle Sap		60.8	5.1	1.2	2.9	5.7	24.4		56.7	14.6	2.0	2.9	7.2	16.6
Overall		**59.6**	**5.1**	**2.0**	**3.3**	**6.5**	**24.5**		**56.7**	**14.6**	**2.0**	**2.9**	**7.2**	**16.6**
Northeast														
Mekong														
Coastal	Water Melon	54.1	6.1		7.3	9.3	23.2	Construction wood						
Tonle Sap		50.6	9.4		5.2	5.7	27.9		45.3	7.5	3.7	3.0	17.5	23.0
Overall		**52.4**	**7.7**		**6.2**	**7.5**	**25.5**		**45.3**	**7.5**	**3.7**	**3.0**	**17.5**	**23.0**
Northeast	Tobacco (traditional)	48.5	14.0		10.3	12.3	15.0	First Grade Wood						
Mekong														
Coastal														

Table 54 Marketing Margins for Selected Crops

Region	Crop	Farmer	Collector	Processor	Transporter	Wholesaler	Retailer	Crop	Farmer	Collector	Processor	Transporter	Wholesaler	Retailer
Tonle Sap									36.0	12.6	2.4	2.5	16.5	30.0
Overall		**48.5**	**14.0**		**10.3**	**12.3**	**15.0**		**36.0**	**12.6**	**2.4**	**2.5**	**16.5**	**30.0**
Northeast		41.0	1.0	6.0	1.0	34.0	17.0							
Mekong		71.4	4.3	2.9	2.9	4.3	14.3							
Coastal	Tobacco (modern)							Jute						
Tonle Sap									53.3	8.8	2.3	2.8	8.8	24.1
Overall		**51.1**	**2.1**	**5.0**	**1.6**	**24.1**	**16.1**		**53.3**	**8.8**	**2.3**	**2.8**	**8.8**	**24.1**
Northeast														
Mekong		82.7	7.3	3.7	3.1	7.7								
Coastal	Rubber							Cucumber	56.3	10.6	8.3	9.3	5.1	19.4
Tonle Sap									47.5	13.0	4.2	4.8	11.1	19.5
Overall		**82.7**	**7.3**	**3.7**	**3.1**	**7.7**			**51.3**	**12.2**	**5.0**	**6.7**	**8.5**	**19.5**
Northeast		82.2	4.8	1.7	2.6	6.2	4.0							
Mekong		74.1	1.7	19.7	1.7	6.0	17.7							
Coastal	Cashew	50.0	6.7	5.0	1.7	3.3	33.3	Egg Plant						
Tonle Sap									61.8	8.6	1.8	4.3	3.5	20.1
Overall		**75.9**	**4.2**	**8.2**	**2.2**	**5.8**	**11.2**		**61.8**	**8.6**	**1.8**	**4.3**	**3.5**	**20.1**
Northeast		43.0	5.0	2.0	1.0	17.0	32.0							
Mekong		76.9	4.0	5.5	3.1	2.7	7.6							
Coastal	Pepper	58.3	1.7	3.8	0.6	17.8	20.8	Gourd	43.3		6.7	13.3	3.3	33.3
Tonle Sap									48.3	6.4	3.2	9.7	13.0	19.3
Overall		**62.7**	**3.7**	**4.2**	**1.9**	**11.6**	**17.8**		**45.8**	**6.4**	**4.9**	**11.5**	**8.2**	**26.3**
Northeast														
Mekong														
Coastal	Mango	47.9	5.8	0.7	18.3	7.7	21.9	Long Bean	51.3	15.4		10.3	15.4	7.7
Tonle Sap									53.4	9.1	2.0	2.8	11.2	21.5
Overall		**47.9**	**5.8**	**0.7**	**18.3**	**7.7**	**21.9**		**52.9**	**10.6**	**2.0**	**4.6**	**12.2**	**18.1**
Northeast														
Mekong		76.4	5.5		3.6	5.5	9.0							
Coastal	Durian	54.4	9.8	12.5	7.9	9.8	17.3	Cabbage						
Tonle Sap									70.0	10.0	2.5	3.1	6.8	7.6
Overall		**59.9**	**8.3**	**12.5**	**6.8**	**8.7**	**15.2**		**70.0**	**10.0**	**2.5**	**3.1**	**6.8**	**7.6**

Table 54 Marketing Margins for Selected Crops

Region	Crop	Farmer	Collector	Processor	Transporter	Wholesaler	Retailer	Crop	Farmer	Collector	Processor	Transporter	Wholesaler	Retailer
Northeast														
Mekong														
Coastal	Jackfruit	49.7	1.8	7.1	20.9	9.9	16.8	Coconut	48.3	5.0	8.2	6.8	7.5	26.7
Tonle Sap														
Overall		**49.7**	**1.8**	**7.1**	**20.9**	**9.9**	**16.8**		**48.3**	**5.0**	**8.2**	**6.8**	**7.5**	**26.7**
Northeast		57.0	9.1	17.3	8.6	8.3	9.6		78.5	6.5		5.0	10.5	2.0
Mekong		60.8	15.9	3.5	2.8	3.7	13.3							
Coastal	Fuel Wood	53.7	8.5	6.0	6.7	4.0	21.1	Rattan	62.5	3.3	1.3	4.0	8.8	20.8
Tonle Sap		23.3	13.9	9.7	16.5	15.1	21.3							
Overall		**49.2**	**11.3**	**9.2**	**9.1**	**8.3**	**15.0**		**70.5**	**4.9**	**1.3**	**4.3**	**9.6**	**11.4**

Percent
Source: ABiC Survey 2005, cited in (ACI 2005)

Table 55 Contract vs. Non-Contract Farming: A Case Study of Organic Fragrant Rice (Kampong Speu)

Benefits/Costs	Unit	Drought Conditions Contract Farming			Normal Conditions Contract Farming			Drought Conditions Non-Contract Farming			Normal Conditions Non-Contract Farming		
		Price	Quantity	Value	Price	Quantity	Value	Price	Quantity	Value	Price	Quantity	Value
Benefits													
Main product	tonne	830,000	2.2	1,826,000	830,000	3	2,490,000	575,000	1.2	690,000	575,000	2.5	1,437,500
By-product	tonne	33,000	1.5	49,500	33,000	2	66,000	33,000	1	33,000	33,000	2	66,000
Total benefit				1,875,500			2,556,000			723,000			1,503,500
Costs													
Material/Input													
Seed	kg	830 4/	60	49,800	830	60 8/	49,800	575	80 9/	46,000	575	80	46,000
Fertilizer	kg	1,350	0 6/	-	1,350	0	-	1,350	100	135,000	1,350	100	135,000
Organic manure	ton	100,000	1.2	120,000	100,000	1.2	120,000	100,000	0.3	30,000	100,000	0.5	50,000
Chemical	Liter	23,500	0 7/	-	23,500	0	-	23,500	1	23,500	23,500	1	23,500
Land preparation (D)	ha	140,000 5/	1	140,000	140,000	1	140,000	140,000	1	140,000	140,000	1	140,000
Irrigation/pump hire	hrs	7,000	0	-	7,000	0	-	7,000	0	-	7,000	0	-
Transport to the mill 1/	tonne	20,000	2.2	44,000	20,000	3	60,000	20,000	0 10/	-	20,000	0	-
Total materials				353,800			**369,800**			**374,500**			**394,500**
Labor 2/													
Land preparation	m/d	4,000	2	8,000	4,000	2	8,000	4,000	2	8,000	4,000	2	8,000
Organic manure	m/d	4,000	1	4,000	4,000	1	4,000	4,000	1	4,000	4,000	1	4,000
Fertilizer application	m/d	4,000	0	-	4,000	0	-	4,000	1	4,000	4,000	1	4,000
Nursery raising	m/d	4,000	10	40,000	4,000	10	40,000	4,000	10	40,000	4,000	10	40,000
Transplanting	m/d	4,000	12	48,000	4,000	12	48,000	4,000	12	48,000	4,000	12	48,000
Weeding	m/d	4,000	2	8,000	4,000	2	8,000	4,000	2	8,000	4,000	2	8,000
Chemical application	m/d	4,000	0	-	4,000	0	-	4,000	1	4,000	4,000	1	4,000
Irrigation/water management	m/d	4,000	2	8,000	4,000	2	8,000	4,000	2	8,000	4,000	2	8,000
Harvesting	m/d	4,000	9	36,000	4,000	9	36,000	4,000	9	36,000	4,000	9	36,000
Threshing	m/d	4,000	2	8,000	4,000	2	8,000	4,000	2	8,000	4,000	2	8,000
Transport and storage	m/d	4,000	5	20,000	4,000	5	20,000	4,000	5	20,000	4,000	5	20,000
Marketing	m/d	4,000	1	4,000	4,000	1	4,000	4,000	1	4,000	4,000	1	4,000
Total labor				184,000			**184,000**			**192,000**			**192,000**
Fee for village/commune 3/	riels/t	30,000	2.2	66,000	30,000	3	90,000	-	1.2	-	-	2.5	-
Total costs				603,800			643,800			566,500			586,500
Total benefits-total cost	**Riels**			1,271,700			**1,912,200**			**156,500**			**917,000**
	USD/ha			318			478			39			229
	USD/t			145			159			33			92

1/ Farmers are responsible to bring paddy to the company premises.
2/ Only hired labor reported.
3/ Contract farmers pay a fee of 30 riels/kg of which 20 riels goes to the village and 10 riels to the commune admin.
4/ Price received by farmers for this season crop.
5/ One tractor plowing or two draft animal plowing reported by farmers.
6/ Farmers are not permitted to apply inorganic fertilizer.
7/ No chemical use permitted by the company.
8/ The company gives 20kg seed but seeks 60kg in return after harvest (last year used to be 40kg).
9/ Farmer reported high seeding rate due to concern about low germination.
10/ Non-contract farmers sold their rice at farmgate.
Source: (ACI 2005)

Table 56 Contract vs. Non-Contract Cropping Models

Crop	Performance Measure	Gross Margin per ha (US$)			
		Contract Farming		Non-Contract Farming	
		Drought	Normal	Drought	Normal
Rice (Wet Season)	Yield t/ha	2.2	3	1.2	2.5
	GM/ha	318	478	39	229

GM=Gross margin (Total benefits - total costs).
Source: (ACI 2005)

Table 57 Comparison of Gross Margins Per Hectare by Farm Size and Agroecological Zone

Crop	Farm Size		North-East (Ratnakiri)	North-East (Kratie)	Coastal (Sihanoukville)	Coastal (Kampot)	Tonle Sap (Battambang)	Tonle Sap (Pursat)	Mekong (K.cham, K. speu)
Wet Season Rice	Small	<3.0ha	2	178	166	114	419	331	421
	Medium	3-10ha	71	181	77	48	363	161	42
	Large	>10ha	0	0	0	39	318	143	-4
Dry Season Rice	Small	<3.0ha	0	290	0	0	390.5	0	200
	Medium	3-10ha	0	0	0	0	361	0	38
	Large	>10ha	0	0	0	0	113	0	-41

Source: (ACI 2005)

Table 58 Partial Budget for Wet Season Rice (Battambang Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	3.5	500000	1750000	t	3.3	510000	1683000	t	2.75	500000	1375000
By product	t	2	33000	66000	t	0.97	33500	32495	t	1.67	28600	47762
Revenue	riels			1816000	riels			1715495	riels			1422762
Seeds/Seedlings	kg	96	700	67200	kg	90	638	57420	kg	103	575	59225
Fertilizer	kg	0	1400	0	kg	150	1400	210000	kg	100	1350	135000
Pump hire/irrigation	hr	0	5500	0	hr	30	5500	165000	hr	54	6166	332964
Farm chemicals	liter	0	13750	0	liter	1.8	13750	24750	liter	0	13750	0
Tractor/bullock hire	ha	1	175000	175000	ha	1	217500	217500	ha	1	93750	93750
Total material costs	riels			242200	riels			674670	riels			620939
Land preparation	md	1	4000	4000	md	10	5500	55000	md	0	4250	0
Planting	md	10	4000	40000	md	15	5500	82500	md	12	4250	51000
Weeding	md	0	4000	0	md	2.5	5500	13750	md	2.5	4333	10832.5
Irrigation/water management	md	0	4000	0	md	1.5	7000	10500	md	1.6	4333	6932.8
Chemical application	md	0	4000	0	md	1	5500	5500	md	1	6250	6250
Harvest	md	23	4000	92000	md	14	6200	86800	md	15.5	4250	65875
Threshing/winnowing	md			0	md				md			
Transport	md	1	4000	4000	md	2	5500	11000	md	2.5	4250	10625
Total labor cost				140000				265050				151515.3
Total costs	riels/ha			382200				939720				772454.3
Total revenue-total cost	riels/ha			1676000				1450445				1271246.7
Total revenue-total cost	**$/ha**			**419**				**363**				**318**

Source: (ACI 2005)

Table 59 Partial Budget for Wet Season Rice (Pursat Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	3.375	525000	1771875	t	2.5	500000	1250000	t	2.2	477500	1050500
By product	t	2.4	33000	79200	t	1.85	33000	61050	t	1.67	11700	19539
Revenue	riels			1851075	riels			1311050	riels			1070039
Seeds/Seedlings	kg	90	825	74250	kg	80	625	50000	kg	90	537	48330
Fertilizer	kg	20	1388	27760	kg	70	1400	98000	kg	50	1500	75000
Pump hire/irrigation	hr	0	5500	0	hr	37	5500	203500	hr	11	5500	60500
Farm chemicals	liter	0	12500	0	liter	0	12500	0	liter	0	12500	0
Tractor/bullock hire	ha	1	138800	138800	ha	1	75000	75000	ha	1	62500	62500
Total material costs	riels			240810	riels			426500	riels			246330
				0								
Land preparation	md	0	4750	0	md	6	4250	25500	md	6	3875	23250
Planting	md	26	4750	123500	md	18	4250	76500	md	15	3875	58125
Weeding	md	2	4750	9500	md	3.5	4250	14875	md	1.5	3875	5812.5
Irrigation/water management	md	0	4750	0	md	2	4250	8500	md	3	3875	11625
Chemical application	md	0	4750	0	md	1	4250	4250	md	2	3875	7750
Harvest	md	30	4750	142500	md	23	4250	97750	md	31	3875	120125
Threshing/winnowing												
Transport	md	2	4750	9500	md	3.5	4250	14875	md	6	3875	23250
Total labor cost				285000				242250				249937.5
Total costs	riels/ha			525810	riels/ha			668750	riels/ha			496267.5
Total revenue-total cost	riels/ha			1325265	riels/ha			642300	riels/ha			573771.5
Total revenue-total cost	**$/ha**			**331**	**$/ha**			**161**	**$/ha**			**143**

Source: (ACI 2005)

Table 60 Partial Budget for Wet Season Rice (Sihanoukville Province, Coastal Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	3	450000	1350000	t	2.2	450000	990000				
By product	t	0	33000	0	t	0	33000	0				
Revenue	riels			1350000	riels			990000				
Seeds/Seedlings	kg	50	1200	60000	kg	50	800	40000				
Fertilizer	kg	75	1400	105000	kg	100	1200	120000				
Organic manure	cart	1	20000	20000	cart	0	20000	0				
Pump hire/irrigation or fuel	ha	1	20000	20000	hr			0				
Farm chemicals	liter	1	12000	12000	liter	1	16000	16000				
Tractor/bullock hire	ha	0	75000	0	ha	1	110000	110000				
Total material costs	riels			217000	riels			286000				
				0								
Land preparation	md	6	10000	60000	md	0	5000	0				
Planting	md	35	5000	175000	md	35	5000	175000				
Weeding	md	3	5000	15000	md	5	5000	25000				
Irrigation/water management	md	3	5000	15000	md	0	5000	0				
Chemical application	md	2	5000	10000	md	2	5000	10000				
Harvest	md	28	5000	140000	md	30	5000	150000				
Threshing/winnowing												
Transport	md	11	5000	55000	md	7	5000	35000				
Total labor cost				470000				395000				
Total costs	riels/ha			687000	riels/ha			681000				
Total revenue-total cost	riels/ha			663000	riels/ha			309000				
Total revenue-total cost	**$/ha**			**166**	**$/ha**			**77**				

Source: (ACI 2005)

Table 61 Partial Budget for Wet Season Rice (Kampot Province, Coastal Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	2	500000	1000000	t	1.5	550000	825000	t	1.2	600000	720000
By product	t	0.8	14000	11200	t	0.6	14000	8400	t	0	14000	0
Revenue	riels			1011200	riels			833400	riels			720000
Seeds/Seedlings	kg	75	700	52500	kg	48	650	31200	slek	3	30000	90000
Fertilizer	kg	50	1200	60000	kg	125	1250	156250	kg	100	600	60000
Pump hire/irrigation	hr	0	5500	0	hr	0	5500	0	hr	0	5500	0
Farm chemicals	liter	2	13000	26000	liter	0.5	15000	7500	liter	0	15000	0
Tractor/bullock hire	ha	0	100000	0	ha	1	100000	100000	ha	0	100000	0
Total material costs	riels			138500	riels			294950	riels			150000
Land preparation	md	6	12000	72000	md	7	7000	49000	md	9	4000	36000
Planting	md	30	5000	150000	md	34	4000	136000	md	50	4000	200000
Weeding	md	3	5000	15000	md	4	4000	16000	md	2	4000	8000
Irrigation/water management	md	2	5000	10000	md	2	4000	8000	md	3	4000	12000
Other application	md	2	5000	10000	md	1.5	4000	6000	md	3	4000	12000
Harvest	md	25	5000	125000	md	20	4000	80000	md	25	4000	100000
Threshing/winnowing												
Transport	md	7	5000	35000	md	12.5	4000	50000	md	12	4000	48000
Total labor cost				417000				345000				416000
Total costs	riels/ha			555500	riels/ha			639950	riels/ha			566000
Total revenue-total cost	riels/ha			455700	riels/ha			193450	riels/ha			154000
Total revenue-total cost	**$/ha**			**114**	**$/ha**			**48**	**$/ha**			**39**

Source: (ACI 2005)

Table 62 Partial Budget for Wet Season Rice (Kampong Cham/Kampong Speu Province, Mekong Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	4.5	600000	2700000	t	2.5	350000	875000	t	1.875	452500	848437.5
By product	t			0	t			0	t			0
Revenue	riels			2700000	riels			875000	riels			848437.5
Seeds/Seedlings	kg	80	700	56000	kg	45	500	22500	kg	41	550	22550
Fertilizer	kg	150	1300	195000	kg	75	1500	112500	kg	120	1500	180000
Organic manure	carts	0	2500	0	cart	5	2500	12500	cart	3	7000	21000
Pump hire/irrigation	hr	50	4000	200000	hr	0	4000	0	hr	0	4000	0
Farm chemicals	liter	0		0	liter	0		0	liter	0		0
Tractor/bullock hire	ox-pair	5	10000	50000	ha	15	7000	105000	ha	20	6500	130000
Total material costs	riels			501000	riels			252500	riels			353550
Land preparation	md	0	6000	0	md	0	5000	0	md	14	6000	84000
Planting	md	27	6000	162000	md	30	5000	150000	md	25	4750	118750
Weeding	md	10	6000	60000	md	6	5000	30000	md	8.5	4800	40800
Irrigation/water management	md	0	6000	0	md	2	5000	10000	md	0	4750	0
Other application	md	1	6000	6000	md	1	5000	5000	md	2	5250	10500
Harvest	md	28	6000	168000	md	32	5000	160000	md	28.5	5250	149625
Threshing/winnowing												
meals for workers		30	1500	45000		54	1200	64800		40	1600	64000
Transport	truck load	5	15000	75000	md	12	3000	36000	md	15	3000	45000
Total labor cost				516000				455800				512675
Total costs	riels/ha			1017000	riels/ha			708300	riels/ha			866225
Total revenue-total cost	riels/ha			1683000	riels/ha			166700	riels/ha			-17787.5
Total revenue-total cost	**$/ha**			**421**	**$/ha**			**42**	**$/ha**			**-4**

Source: (ACI 2005)

Table 63 Partial Budget for Wet Season Rice (Ratanakiri Province, Northeast Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	2.375	642500	1525938	t	2	500000	1000000				
By product	t	3.25	33500	108875	t	1.2	33000	39600				
Revenue	riels			1634813	riels			1039600				
Seeds/Seedlings	kg	150	6625	993750	kg	120	600	72000				
Fertilizer	kg	0	1212.5	0	kg	0	1212.5	0				
Pump hire/irrigation	hr			0	hr			0				
Farm chemicals	liter	2.33	10667	24854.1	liter	0	10667	0				
Tractor/bullock hire	ha	1	225000	225000	ha	1	105000	105000				
Total material costs	riels			1243604	riels			177000				
				0								
Land preparation	md	9	5625	50625	md	20	5000	100000				
Planting	md	30	5625	168750	md	60	5000	300000				
Weeding	md	6	5625	33750	md	7	5000	35000				
Irrigation/water management	md	1	7000	7000	md	0	5000	0				
Other application	md	2	5625	11250	md	0	5000	0				
Harvest	md	18	5625	101250	md	20	5000	100000				
Threshing/winnowing												
Transport	md	2	5500	11000	md	9	5000	45000				
Total labor cost				383625				580000				
Total costs	riels/ha			1627229	riels/ha			757000				
Total revenue-total cost	riels/ha			7583.39	riels/ha			282600				
Total revenue-total cost	**$/ha**			**2**	**$/ha**			**71**				

Source: (ACI 2005)

Table 64 Partial Budget for Wet Season Rice (Kratie Province, Northeast Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	2.04	602500	1229100	t	2	632500	1265000				
By product	t	1	20000	20000	t	1.2	20000	24000				
Revenue	riels			1249100	riels			1289000				
Seeds/Seedlings	kg	90	670	60300	kg	90	725	65250				
Fertilizer	kg	0	1262.5	0	kg	90	1262.5	113625				
Pump hire/irrigation	hr			0	hr			0				
Farm chemicals	liter	0	10333	0	liter	0	10333	0				
Tractor/bullock hire	ha	1	240000	240000	ha	1	197500	197500				
Total material costs	riels			300300	riels			376375				
				0								
Land preparation	md	4	5625	22500	md	2	5600	11200				
Planting	md	28	5625	157500	md	20	5600	112000				
Weeding	md	6	5625	33750	md	8	5600	44800				
Irrigation/water management	md	0	5625	0	md	0	5600	0				
Other application	md	0	5625	0	md	2	5600	11200				
Harvest	md	20		0	md	19		0				
Threshing/winnowing												
Transport	md	4	5625	22500	md	2	5600	11200				
Total labor cost				236250				190400				
Total costs	riels/ha			536550	riels/ha			566775				
Total revenue-total cost	riels/ha			712550	riels/ha			722225				
Total revenue-total cost	**$/ha**			**178**	**$/ha**			**181**				

Source: (ACI 2005)

Table 65 Partial Budget for Dry Season Rice (Pursat/Battambang Provinces, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	3.85	575000	2213750	t	3.5	600000	2100000	t	2	450000	900000
By product	t	2	33000	66000	t	1	33000	33000	t	0	33000	0
Revenue	riels			2279750	riels			2133000	riels			900000
Seeds/Seedlings	kg	120	700	84000	kg	80	1000	80000	kg	120	700	84000
Fertilizer	kg	100	1200	120000	kg	50	1215	60750	kg	0	1215	0
Pump hire/irrigation	hr	0	5500	0	hr	45	5500	247500	hr	0	5500	0
Farm chemicals	liter	0		0	liter	0		0	liter	0		0
Tractor/bullock hire	ha	1	140000	140000	ha	1	100000	100000	ha	1	130000	130000
Total material costs	riels			344000	riels			488250	riels			214000
				0								
Land preparation	md	0	5750	0	md	0	5000	0	md	0	4500	0
Planting	md	31	5750	178250	md	14	5000	70000	md	30	4500	135000
Weeding	md	2	5750	11500	md	0	5000	0	md	0	4500	0
Irrigation/water management	md	4	5750	23000	md	4	5000	20000	md	2	4500	9000
Other applications	md	1	5750	5750	md	1	5000	5000	md	0	4500	0
Harvest	md	25	5750	143750	md	16	5000	80000	md	18	4500	81000
Threshing/winnowing												
Transport	md	2	5750	11500	md	5	5000	25000	md	2	4500	9000
Total labor cost				373750				200000				234000
Total costs	riels/ha			717750	riels/ha			688250	riels/ha			448000
Total revenue-total cost	riels/ha			1562000	riels/ha			1444750	riels/ha			452000
Total revenue-total cost	**$/ha**			**391**	**$/ha**			**361**	**$/ha**			**113**

Source: (ACI 2005)

Table 66 Partial Budget for Dry Season Rice (Kratie, Northeast Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	2.8	600000	1680000								
By product	t	1.5	70000	105000								
Revenue	riels			1785000								
Seeds/Seedlings	kg	40	1400	56000								
Fertilizer	kg	100	1200	120000								
Pump hire/irrigation	hr	15	8000	120000								
Farm chemicals	liter	0		0								
Tractor/bullock hire	ha	0		0								
Total material costs	riels			296000								
Land preparation	md	8	7000	56000								
Planting	md	25	5000	125000								
Weeding	md	3	5000	15000								
Irrigation/water management	md	0	5000	0								
Other applications	md	2	5000	10000								
Harvest	md	20	5000	100000								
Threshing/winnowing												
Transport	md	5	5000	25000								
Total labor cost				331000								
Total costs	riels/ha			627000								
Total revenue-total cost	riels/ha			1158000								
Total revenue-total cost	**$/ha**			**290**								

Source: (ACI 2005)

Table 67 Partial Budget for Dry Season Rice (Kampong Cham/Kampong Speu Provinces, Mekong Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	4	500000	2000000	t	2.8	400000	1120000	t	2.3	375000	862500
By product	oxen cart	5	10000	50000	t			0	t			0
Revenue	riels			2050000	riels			1120000	riels			862500
Seeds/Seedlings	kg	71	700	49700	kg	80	550	44000	kg	75	600	45000
Fertilizer	kg	220	1400	308000	kg	128	1200	153600	kg	80	1200	96000
Pump hire/irrigation	hr	10	4000	40000	hr	40	6000	240000	hr	6	7000	42000
Farm chemicals	liter			0	liter			0	liter			0
Tractor/bullock hire	ha	1	146300	146300	ha	1	150000	150000	ha	1	150000	150000
Total material costs	riels			544000	riels			587600	riels			333000
				0								
Land preparation	md	11	13300	146300	md	0		0	md	15	7000	105000
Planting	md	38	5500	209000	md	29	5000	145000	md	22	7000	154000
Weeding	md	15	6000	90000	md	10	5000	50000	md	10	7000	70000
Irrigation/water management	md	3	4000	12000	md	4	5000	20000	md	10	7000	70000
Other application	md	3	6000	18000	md	2	5000	10000	md	2	7000	14000
Harvest	md	32	6000	192000	md	27	5000	135000	md	30	7000	210000
Threshing/winnowing												
Transport	md	10	4000	40000	md	5	4000	20000	md	10	7000	70000
Total labor cost				707300				380000				693000
Total costs	riels/ha			1251300	riels/ha			967600	riels/ha			1026000
Total revenue-total cost	riels/ha			798700	riels/ha			152400	riels/ha			-163500
Total revenue-total cost	**$/ha**			**200**	**$/ha**			**38**	**$/ha**			**-41**

Source: (ACI 2005)

Table 68 Costs and Returns for Rice Production in Kampong Speu Province

Season		Wet Season			Wet Season			Wet Season			Dry Season		
Type of Rice		Khong Malis / Chkma Loet			Damnep Khucoo			Phkar Malis			IR-66		
Revenue/Costs	**Unit**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**
Main Product	tonnes	1.90	550,000	1,045,000	4.13	1,500,000	6,187,500	2.20	600,000	1,320,000	2.5	500,000	1,250,000
By product	tonnes	0	0	0	0	0	0			40,000			40,000
Total revenue				**1,045,000**			**6,187,500**			**1,360,000**			**1,290,000**
Material cost													
Seeds/seedlings	kg	13.30	550	7,315	25.00	1,500	37,500	50.00	1,000	50,000	50	500	25,000
Fuel	litre	117.65	2,500	294,125	117.65	2,500	294,125						
Fertilizer	kg	5294	50	264,700	5294	50	264,700			340,000			340,000
Pump hire/irrigation	hr	0	0	0	0	0	0				30	5,000	150,000
Farm chemicals	litre	0	0	0	0	0	0						20,000
Tractor/bullock hire	ha	17.5	20,000	350,000	17.5	20,000	350,000			220,000			220,000
Farm machinery hire	Riels	0	0	0	0	0	0						
Other material costs	Riels	0	0	0	0	0	0						
Total material costs				**916,140**			**946,325.00**			**610,000**			**755,000**
Labor costs													
Nursery plot establishment	pd	17.6	5,000	88,000	17.6	5,000	88,000	4	3,000	12,000	4	3,000	12,000
Land preparation	pd	0	0	0	0	0	0						
Transplanting	pd	88.24	5,000	441,200	88.24	5,000	441,200	36	4,000	144,000	40	4,000	160,000
Broadcasting	pd	0	0	0	0	0	0						
Weeding	pd	117.6	5,000	588,000	117.6	5,000	588,000						
Irrigation	pd	8.82	5,000	44,100	8.82	5,000	44,100						
Fertilizer	pd	35.3	5,000	176,500	35.3	5,000	176,500	8	3,000	24,000	8	3,000	24,000
Pesticide/herbicide	pd	0	0	0	0	0	0				4	4,000	16,000
Harvesting	pd	29.4	10,000	294,000	29.4	10,000	294,000	20	4,000	80,000	20	4,000	80,000
Post Harvest	pd	8.82	5,000	44,100	8.82	5,000	44,100	10	4,000	40,000	10	4,000	40,000
Other cost	pd	0	0	0	0	0	0			80,000			60,000
Total labor cost				**1,675,900**			**1,675,900.00**			**380,000**			**392,000**
Total costs	Riels/ha			**2,592,040**			**2,622,225.00**			**990,000**			**1,147,000**
Gross Margin	Riels/ha			**-1,547,040**			**3,565,275.00**			**370,000**			**143,000**
	$/ha			**-386.76**			**891.32**			**92.50**			**35.75**
Gross Margin % (incl Labor)				**-148%**			**58%**			**27%**			**11%**
Gross Margin % (excl Labor)				**12%**			**85%**			**55%**			**41%**

Costs and Returns per hectare
Source: Study Team Value Chain Questionnaire – 2 respondents

Table 69 Costs and Returns for Rice Production in Svay Rieng Province

Season		Dry Season			Wet Season		
Type of Rice		Sen Pidor			Sen Pidor		
Revenue/Costs	**Unit**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**
Main Product	tonnes	5.00	520,000	2,600,000	1.50	550,000.00	825,000.00
By product	tonnes			0			0.00
Total revenue				**2,600,000**			**825,000.00**
Material cost							
Seeds/seedlings	kg	200.00	1,000	200,000	80.00	700.00	56,000.00
Fuel	litre	113	2,300	259,900			0.00
Fertilizer	kg	400	1,300	520,000	100	950	95,000.00
Pump hire/irrigation	hr			0			0.00
Farm chemicals	litre			250,000			0.00
Tractor/bullock hire	ha			0			0.00
Farm machinery hire	Riels			0			0.00
Other material costs	Riels			50,000	30	500	15,000.00
Total material costs				**1,279,900**			**166,000.00**
Labor costs							
Nursery plot establishment	pd			0	7	5,000.00	35,000.00
Land preparation	pd	0.5		200,000	7	5,000.00	35,000.00
Transplanting	pd			0	13	5,000.00	65,000.00
Broadcasting	pd	0.25		0			0.00
Weeding	pd			0			0.00
Irrigation	pd	6.25		0			0.00
Fertilizer	pd	1		0	1	5,000.00	5,000.00
Pesticide/herbicide	pd	0.29		0			0.00
Harvesting	pd	0.25		75,000	26	5,000.00	130,000.00
Post Harvest	pd	2		50,000	6.5	5,000.00	32,500.00
Other cost	pd	1		0			0.00
Total labor cost				**325,000**			**302,500.00**
Total costs	Riels/ha			**1,604,900**			**468,500.00**
Gross Margin	Riels/ha			**995,100**			**356,500.00**
	$/ha			**248.78**			**89.13**
Gross Margin % (incl Labor)				**38%**			**43%**
Gross Margin % (excl Labor)				**51%**			**80%**

Costs and Returns per hectare
Source: Study Team Value Chain Questionnaire – 2 respondents

Table 70 Costs and Returns for Rice Production in Battambang Province

Season		Wet Season			Early Wet Season		
Type of Rice		CAR 4			Sen Pidor		
Revenue/Costs	**Unit**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**
Main Product	tonnes	1.90	450,000	855,000.00	3.10	500,000	1,550,000
By product	tonnes			30,000.00			50,000
Total revenue				**885,000.00**			**1,600,000**
Material cost							
Seeds/seedlings	kg	46.00	450.00	20,700.00	200.00	500	100,000
Fuel	litre			0.00			0
Fertilizer	kg	77	1400	107,800.00	100	1,500	150,000
Pump hire/irrigation	hr			0.00			0
Farm chemicals	litre			0.00			0
Tractor/bullock hire	ha			0.00			0
Farm machinery hire	Riels			159,076.00			140,000
Other material costs	Riels	30	500	2,000.00			0
Total material costs				**289,576.00**			**390,000**
Labor costs							
Nursery plot establishment	pd	0.5		0.00			0
Land preparation	pd	2		0.00			0
Transplanting	pd			0.00			0
Broadcasting	pd			150,000.00	0.25		3,500
Weeding	pd			0.00	25	4,000	100,000
Irrigation	pd			0.00			0
Fertilizer	pd	0.5	0.00	0.00	0.5		0
Pesticide/herbicide	pd			0.00			0
Harvesting	pd			75,000.00			200,000
Post Harvest	pd			42,750.00			100,000
Other cost	pd			20,000.00			0
Total labor cost				**287,750.00**			**403,500**
Total costs	Riels/ha			**577,326.00**			**793,500**
Gross Margin	Riels/ha			**307,674.00**			**806,500**
	$/ha			**76.92**			**202**
Gross Margin % (incl Labor)				**35%**			**50%**
Gross Margin % (excl Labor)				**67%**			**76%**

Costs and Returns per hectare
Source: Study Team Value Chain Questionnaire – 1 respondent

Table 71 Costs and Returns for Rice Production in Kampong Thom Province

Season		Wet Season			Wet Season		
Type of Rice		Somaly			Chang Vay Pdao		
Revenue/Costs	**Unit**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**
Main Product	tonnes	2	750,000	1,125,000	2.24	437,500	980,000
By product	tonnes			90,000			100,000
Total revenue				**1,215,000**			**1,080,000**
Material cost							
Seeds/seedlings	kg	60	840	50,400	160.0	563	90,000
Fuel	litre			-			-
Fertilizer	kg			108,000			97,500
Pump hire/irrigation	hr			30,000			-
Farm chemicals	litre			-			-
Tractor/bullock hire	ha			-			-
Farm machinery hire	Riels			-			-
Other material costs	Riels			-			-
Total material costs				**188,400**			**187,500**
Labor costs							
Nursery plot establishment	pd			-			60,000
Land preparation	pd			200,000			150,000
Transplanting	pd			-			90,000
Broadcasting	pd			5,000		pull seedling	69,000
Weeding	pd			80,000			-
Irrigation	pd			-			-
Fertilizer	pd			-			5,000
Pesticide/herbicide	pd			-			-
Harvesting	pd	15	5,000	75,000	12	5,000	60,000
Post Harvest	pd			56,000			40,000
Other cost	pd			30,000			60,000
Total labor cost				**446,000**			**534,000**
Total costs	Riels/ha			**634,400**			**721,500**
Gross Margin	Riels/ha			**580,600**			**358,500**
	$/ha			**145**			**89.63**
Gross Margin % (incl Labor)				**48%**			**33%**
Gross Margin % (excl Labor)				**84%**			**83%**

Costs and Returns per hectare
Source: Study Team Value Chain Questionnaire – 2 respondents

Table 72 Costs and Returns for Rice Production in Cambodia – Selected Provinces

Revenue/Costs	Unit	Kampong Speu		Svay Rieng		Battambang		Kampong Thom		Wet Season		Dry Season		Average	
Main Product	tonnes	2,450,625		1,712,500		1,202,500		1,052,500		1,735,938		1,925,000		1,773,750	
By product	tonnes	20,000		-		40,000		95,000		38,750		20,000		35,000	
Total revenue		**2,470,625**		**1,712,500**		**1,242,500**		**1,147,500**		**1,774,688**		**1,945,000**		**1,808,750**	
Material cost															
Seeds/seedlings	kg	29,954	1.63%	128,000	12.35%	60,350	8.80%	70,200	10.35%	51,489	4.38%	112,500	8.18%	63,692	5.24%
Fuel	litre	294,125	16.0%	129,950	12.5%	-	0.0%	-	0.0%	84,036	7.2%	259,900	18.9%	106,019	8.7%
Fertilizer	kg	302,350	16.5%	307,500	29.7%	128,900	18.8%	102,750	15.2%	178,463	15.2%	430,000	31.3%	228,770	18.8%
Pump hire/irrigation	hr	50,000	2.7%	-	0.0%	-	0.0%	15,000	2.2%	4,286	0.4%	75,000	5.5%	20,000	1.6%
Farm chemicals	litre	6,667	0.4%	125,000	12.1%	-	0.0%	-	0.0%	0	0.0%	135,000	9.8%	30,000	2.5%
Tractor/bullock hire	ha	285,000	15.5%	-	0.0%	-	0.0%	-	0.0%	115,000	9.8%	110,000	8.0%	114,000	9.4%
Farm machinery hire	Riels	-	0.0%	-	0.0%	149,538	21.8%	-	0.0%	42,725	3.6%	0	0.0%	37,385	3.1%
Other material costs	Riels	-	0.0%	32,500	3.1%	1,000	0.1%	-	0.0%	2,429	0.2%	50,000	3.6%	8,375	0.7%
Total material costs		**806,866**	**43.9%**	**722,950**	**69.7%**	**339,788**	**49.6%**	**187,950**	**27.7%**	**461,743**	**39.3%**	**1,017,450**	**73.9%**	**572,884**	**47.1%**
Labor costs															
Nursery plot establishment	pd	50,000	2.7%	17,500	1.7%	-	0.0%	30,000	4.4%	35,375	3.0%	6,000	0.4%	29,500	2.4%
Land preparation	pd	-	0.0%	117,500	11.3%	-	0.0%	175,000	25.8%	55,000	4.7%	200,000	14.5%	73,125	6.0%
Transplanting	pd	296,600	16.1%	32,500	3.1%	-	0.0%	45,000	6.6%	147,675	12.6%	80,000	5.8%	134,140	11.0%
Broadcasting	pd	-	0.0%	-	0.0%	76,750	11.2%	37,000	5.5%	32,500	2.8%	0	0.0%	28,438	2.3%
Weeding	pd	588,000	32.0%	-	0.0%	50,000	7.3%	40,000	5.9%	193,714	16.5%	0	0.0%	169,500	13.9%
Irrigation	pd	44,100	2.4%	-	0.0%	-	0.0%	-	0.0%	12,600	1.1%	0	0.0%	11,025	0.9%
Fertilizer	pd	100,250	5.5%	2,500	0.2%	-	0.0%	2,500	0.4%	48,375	4.1%	12,000	0.9%	41,100	3.4%
Pesticide/herbicide	pd	5,333	0.3%	-	0.0%	-	0.0%	-	0.0%	0	0.0%	8,000	0.6%	1,778	0.1%
Harvesting	pd	187,000	10.2%	102,500	9.9%	137,500	20.1%	67,500	10.0%	151,000	12.9%	77,500	5.6%	136,300	11.2%
Post Harvest	pd	42,050	2.3%	41,250	4.0%	71,375	10.4%	48,000	7.1%	49,931	4.2%	45,000	3.3%	48,945	4.0%
Other cost	pd	35,000	1.9%	-	0.0%	10,000	1.5%	45,000	6.6%	23,750	2.0%	30,000	2.2%	25,000	2.1%
Total labor cost		**1,030,950**	**56.1%**	**313,750**	**30.3%**	**345,625**	**50.4%**	**490,000**	**72.3%**	**713,194**	**60.7%**	**358,500**	**26.1%**	**642,255**	**52.9%**
Total costs	Riels/ha	**1,837,816**	**100.0%**	**1,036,700**	**100.0%**	**685,413**	**100.0%**	**677,950**	**100.0%**	**1,174,936**	**100.0%**	**1,375,950**	**100.0%**	**1,215,139**	**100.0%**
Gross Margin	Riels/ha	**632,809**		**675,800**		**557,087**		**469,550**		**599,751**		**569,050**		**593,611**	
	$/ha	**158.20**		**168.95**		**139.27**		**117.39**		**150**		**142**		**148**	
Gross Margin % (incl Labor)		**26%**		**39%**		**45%**		**41%**		**34%**		**29%**		**33%**	
Gross Margin % (excl Labor)		**67%**		**58%**		**73%**		**84%**		**74%**		**48%**		**68%**	

Costs and Returns per hectare
Source: Study Team Value Chain Questionnaire – 7 respondents

Table 73 Partial Budget for Paddy Collector, Takeo

Collection February - August		Quantity kg	Price Riel/kg	Value Riel
Paddy Collection	Wet Season	45000	500	22500000
	Dry Season	105000	395	41475000
	Total	150000	426.5	63975000
Transport	10km	150000	15	2250000
Total Cost				66225000
Revenue	Wet Season	45000	520	23400000
	Dry Season	105000	410	43050000
	Total	150000	443	66450000
Gross Margin				225000
				$56.25

Source: (ACI 2002)

Table 74 Costs and Returns for Traders – Kampong Speu

	Types of Products	Quantity (Tonnes)	Unit Price (Riels)	Value		Quantity (Tonnes)	Unit Price (Riels)	Value		Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses													
Paddy	IR 66	30	530,000	15,900,000	1.7%			-	0.0%	25	520,000	13,000,000	0.3%
	Chhma Prum	400	650,000	260,000,000	27.8%	60	620,000	37,200,000	13.7%	2,000	800,000	1,600,000,000	40.5%
	Mixed	500	550,000	275,000,000	29.4%	200	530,000	106,000,000	39.1%	1,000	550,000	550,000,000	13.9%
	Neang Malis			-	0.0%	100	700,000	70,000,000	25.8%			-	0.0%
	Phka Malis	500	740,000	370,000,000	39.6%			-	0.0%	2,500	700,000	1,750,000,000	44.2%
	Phkar Khnhey			-	0.0%			-	0.0%			-	0.0%
	Somaly			-	0.0%			-	0.0%			-	0.0%
Rice	Mixed			-	0.0%			-	0.0%			-	0.0%
Fertilizer	Urea			-	0.0%	25	1,200,000	30,000,000	11.1%			-	0.0%
	DAP			-	0.0%	25	800,000	20,000,000	7.4%			-	0.0%
	American			-	0.0%	5	1,200,000	6,000,000	2.2%			-	0.0%
	Other			-	0.0%			-	0.0%			-	0.0%
Sub-total				**920,900,000**	**98.6%**			**269,200,000**	**99.2%**			**3,913,000,000**	**98.9%**
Trading cost													
	Truck			-	0.0%			-	0.0%			-	0.0%
	Labor	1430	3,021	4,320,000	0.5%	415	5,325	2,210,000	0.8%	5525	652	3,600,000	0.1%
	Official fee			-	0.0%			-	0.0%			-	0.0%
	Unofficial fee			-	0.0%			-	0.0%	5525	11	60,000	0.0%
	Other cost	1430	6,238	8,920,000	1.0%			-	0.0%	5525	7,000	38,676,000	1.0%
Sub-total				**13,240,000**	**1.4%**			**2,210,000**	**0.8%**			**42,336,000**	**1.1%**
Total Expenses				**934,140,000**	**100.0%**			**271,410,000**	**100.0%**			**3,955,336,000**	**100.0%**
Revenue													
Paddy	IR 66	30	540,000	16,200,000	1.7%			-	0.0%	25	540,000	13,500,000	0.3%
	Chhma Prum	400	660,000	264,000,000	28.1%	60	630,000	37,800,000	12.9%	2,000	820,000	1,640,000,000	40.3%
	Mixed	500	560,000	280,000,000	29.8%	200	560,000	112,000,000	38.3%	500	560,000	280,000,000	6.9%
	Neang Malis			-	0.0%	100	780,000	78,000,000	26.6%			-	0.0%
	Phka Malis	500	760,000	380,000,000	40.4%			-	0.0%	2,500	710,000	1,775,000,000	43.6%
	Phkar Khnhey			-	0.0%			-	0.0%			-	0.0%
	Somaly			-	0.0%			-	0.0%			-	0.0%
Rice	Mixed			-	0.0%			-	0.0%	300	1,200,000	360,000,000	8.8%
Fertilizer	Urea			-	0.0%	25	1,400,000	35,000,000	12.0%			-	0.0%
	DAP			-	0.0%	25	860,000	21,500,000	7.3%			-	0.0%
	American			-	0.0%	5	1,700,000	8,500,000	2.9%			-	0.0%
	Other			-	0.0%			-	0.0%			-	0.0%
Total Revenue				**940,200,000**	**100.0%**			**292,800,000**	**100.0%**			**4,068,500,000**	**100.0%**
Average Purchasing Price (R/kg)		**644**				**592**				**708**			
Gross Margin		4	4,238	6,060,000		52	51,542	21,390,000		20	20,482	113,164,000	
				$1,515.00	**0.6%**			**$5,347.50**	**7.3%**			**$28,291.00**	**2.8%**

Source: Study Team Interviews

Table 75 Costs and Returns for Traders – Svay Rieng

	Types of Products	Quantity (Tonnes)	Unit Price (Riels)	Value		Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses									
Paddy	IR 66			-	0.0%	500	520,000	260,000,000	18.7%
	Chhma Prum			-	0.0%			-	0.0%
	Mixed	2,000	500,000	1,000,000,000	83.8%	2,000	540,000	1,080,000,000	77.6%
	Neang Malis			-	0.0%			-	0.0%
	Phka Malis			-	0.0%			-	0.0%
	Phkar Khnhey			-	0.0%			-	0.0%
	Somaly			-	0.0%			-	0.0%
Rice	Mixed	200	820,000	164,000,000	13.7%			-	0.0%
Sub-total				**1,164,000,000**	**97.5%**			**1,340,000,000**	**96.2%**
Trading cost									
	Truck	2200	11,000	24,200,000	2.0%	2500	18,000	45,000,000	3.2%
	Labor	2200	1,500	3,300,000	0.3%	2500	3,000	7,500,000	0.5%
	Official fee	2200	1,000	2,200,000	0.2%			-	0.0%
	Unofficial fee			-	0.0%			-	0.0%
	Other cost			-	0.0%			-	0.0%
Sub-total				**29,700,000**	**2.5%**			**52,500,000**	**3.8%**
Total Expenses				**1,193,700,000**	**100.0%**			**1,392,500,000**	**100.0%**
Revenue									
Paddy	IR 66			-	0.0%	500	540,000	270,000,000	19.1%
	Chhma Prum			-	0.0%			-	0.0%
	Mixed	2,000	560,000	1,120,000,000	87.1%	2,000	570,000	1,140,000,000	80.9%
	Neang Malis			-	0.0%			-	0.0%
	Phka Malis			-	0.0%			-	0.0%
	Phkar Khnhey			-	0.0%		-	-	0.0%
	Somaly			-	0.0%		-	-	0.0%
Rice	Mixed	200	830,000	166,000,000	12.9%		-	-	0.0%
Total Revenue				**1,286,000,000**	**100.0%**			**1,410,000,000**	**100.0%**
Average Purchasing Price (R/kg)		**500**				**536**			
Gross Margin		42	41,955	92,300,000		7	7,000	17,500,000	
				$23,075.00	**7.2%**			**$4,375.00**	**1.2%**

Source: Study Team Interviews

Table 76 Costs and Returns for Traders – Kampong Thom

	Types of Products	Quantity (Tonnes)	Unit Price (Riels)	Value		Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses									
Paddy	IR 66			-	0.0%	200	490,000	98,000,000	14.3%
	Mixed	200	490,000	98,000,000	19.7%	900	500,000	450,000,000	65.7%
	Neang Malis			-	0.0%	100	550000	55,000,000	8.0%
Rice	Mixed			-	0.0%	100	780,000	78,000,000	11.4%
Soybean	Grade 1	100	1,000,000	100,000,000	20.1%			-	0.0%
	Grade 2	60	800,000	48,000,000	9.6%			-	0.0%
	Grade 3	40	750,000	30,000,000	6.0%			-	0.0%
Mungbean	Grade 1	15	2,000,000	30,000,000	6.0%			-	0.0%
	Grade 2	15	1,500,000	22,500,000	4.5%			-	0.0%
Sesame	Grade 1	30	2,400,000	72,000,000	14.4%			-	0.0%
	Grade 2	20	2,000,000	40,000,000	8.0%			-	0.0%
Cashewnut	Grade 1	20	1,900,000	38,000,000	7.6%			-	0.0%
	Grade 2	10	1,700,000	17,000,000	3.4%			-	0.0%
Sub-total				**495,500,000**	**99.4%**			**681,000,000**	**99.5%**
Trading cost									
	Truck			-	0.0%			-	0.0%
	Labor	510	6,000	3,060,000	0.6%	1200	3,000	3,600,000	0.5%
	Official fee			-	0.0%			-	0.0%
	Unofficial fee			-	0.0%			-	0.0%
	Other cost			-	0.0%			-	0.0%
Sub-total				**3,060,000**	**0.6%**			**3,600,000**	**0.5%**
Total Expenses				**498,560,000**	**100.0%**			**684,600,000**	**100.0%**
Revenue									
Paddy	IR 66			-	0.0%	200	500,000	100,000,000	14.3%
	Mixed	200	500,000	100,000,000	19.5%	900	515,000	463,500,000	66.1%
	Neang Malis			-	0.0%	100	570,000	57,000,000	8.1%
Rice	Mixed		-	-	0.0%	100	810,000	81,000,000	11.5%
Soybean	Grade 1	100	1,050,000	105,000,000	21.1%			-	0.0%
	Grade 2	60	850,000	51,000,000	10.2%			-	0.0%
	Grade 3	40	800,000	32,000,000	6.4%			-	0.0%
Mungbean	Grade 1	15	2,050,000	30,750,000	6.2%			-	0.0%
	Grade 2	15	1,550,000	23,250,000	4.7%			-	0.0%
Sesame	Grade 1	30	2,450,000	73,500,000	14.7%			-	0.0%
	Grade 2	20	2,050,000	41,000,000	8.2%			-	0.0%
Cashewnut	Grade 1	20	1,950,000	39,000,000	7.8%			-	0.0%
	Grade 2	10	1,750,000	17,500,000	3.5%			-	0.0%
Total Revenue				**513,000,000**	**100.0%**			**701,500,000**	**100.0%**
Average Purchasing Price (R/kg)		**490**				**503**			
Gross Margin		28	28,314	14,440,000		13	13,000	16,900,000	
				$3,610.00	**2.8%**			**$4,225.00**	**2.4%**

Source: Study Team Interviews

Table 77 Costs and Returns for Traders – Kampong Speu Average

	Types of Products	Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses					
Paddy	IR 66	28	525,000	9,633,333	0.6%
	Chhma Prum	820	690,000	632,400,000	36.8%
	Mixed	567	543,333	310,333,333	18.0%
	Neang Malis	100	700000	23,333,333	1.4%
	Phka Malis	1,500	720,000	706,666,667	41.1%
	Phkar Khnhey			-	0.0%
	Somaly			-	0.0%
Rice	Mixed			-	0.0%
Soybean	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Mungbean	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Sesame	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Cashewnut	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Fertilizer	Urea	25	1,200,000	10,000,000	0.6%
	DAP	25	800,000	6,666,667	0.4%
	American	5	1,200,000	2,000,000	0.1%
	Other			-	0.0%
Sub-total				**1,701,033,333**	**98.9%**
Trading cost					
	Truck				0.0%
	Labor	2456.66667	2,999	3,376,667	0.2%
	Official fee				0.0%
	Unofficial fee	5525	11	20,000	0.0%
	Other cost	3477.5	6,619	15,865,333	0.9%
Sub-total				**19,262,000**	**1.1%**
Total Expenses				**1,720,295,333**	**100.0%**
Revenue					
Paddy	IR 66	28	540,000	9,900,000	0.6%
	Chhma Prum	820	703,333	647,266,667	36.6%
	Mixed	400	560,000	224,000,000	12.7%
	Neang Malis	100	780,000	26,000,000	1.5%
	Phka Malis	1,500	735,000	718,333,333	40.6%
	Phkar Khnhey			-	0.0%
	Somaly			-	0.0%
Rice	Mixed	300	1,200,000	120,000,000	6.8%
Soybean	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Mungbean	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Sesame	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Cashewnut	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Fertilizer	Urea	25	1,400,000	11,666,667	0.7%
	DAP	25	860,000	7,166,667	0.4%
	American	5	1,700,000	2,833,333	0.2%
	Other			-	0.0%
Total Revenue				**1,767,166,667**	**100.0%**
Average Purchasing Price (R/kg)		**676**			
Gross Margin		15	15,272	46,871,333	
				$11,717.83	**2.7%**

Source: Study Team Interviews

Table 78 Costs and Returns for Traders – Svay Rieng Average

	Types of Products	Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses					
Paddy	IR 66	500	520,000	130,000,000	10.1%
	Chhma Prum			-	0.0%
	Mixed	2,000	520,000	1,040,000,000	80.4%
	Neang Malis			-	0.0%
	Phka Malis			-	0.0%
	Phkar Khnhey			-	0.0%
	Somaly			-	0.0%
Rice	Mixed	200	820,000	82,000,000	6.3%
Soybean	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Mungbean	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Sesame	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Cashewnut	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Fertilizer	Urea			-	0.0%
	DAP			-	0.0%
	American			-	0.0%
	Other			-	0.0%
Sub-total				**1,252,000,000**	**96.8%**
Trading cost					
	Truck	2350	14,500	34,600,000	2.7%
	Labor	2350	2,250	5,400,000	0.4%
	Official fee	2200	1,000	1,100,000	0.1%
	Unofficial fee				0.0%
	Other cost				0.0%
Sub-total				**41,100,000**	**3.2%**
Total Expenses				**1,293,100,000**	**100.0%**
Revenue					
Paddy	IR 66	500	540,000	135,000,000	10.0%
	Chhma Prum			-	0.0%
	Mixed	2,000	565,000	1,130,000,000	83.8%
	Neang Malis			-	0.0%
	Phka Malis			-	0.0%
	Phkar Khnhey			-	0.0%
	Somaly			-	0.0%
Rice	Mixed	200	415,000	83,000,000	6.2%
Soybean	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Mungbean	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Sesame	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Cashewnut	Grade 1			-	0.0%
	Grade 2			-	0.0%
	Grade 3			-	0.0%
Fertilizer	Urea			-	0.0%
	DAP			-	0.0%
	American			-	0.0%
	Other			-	0.0%
Total Revenue				**1,348,000,000**	**100.0%**
Average Purchasing Price (R/kg)		**520**			
Gross Margin		20	20,333	54,900,000	
				$13,725.00	**4.1%**

Source: Study Team Interviews

Table 79 Costs and Returns for Traders – Kampong Thom Average

	Types of Products	Quantity (Tonnes)	Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses						
Paddy	IR 66	28	200	490,000	49,000,000	8.3%
	Chhma Prum	820			-	0.0%
	Mixed	567	550	495,000	274,000,000	46.3%
	Neang Malis	100	100	550000	27,500,000	4.6%
	Phka Malis	1,500			-	0.0%
	Phkar Khnhey				-	0.0%
	Somaly				-	0.0%
Rice	Mixed		100	780,000	39,000,000	6.6%
Soybean	Grade 1		100	1,000,000	50,000,000	8.5%
	Grade 2		60	800,000	24,000,000	4.1%
	Grade 3		40	750,000	15,000,000	2.5%
Mungbean	Grade 1		15	2,000,000	15,000,000	2.5%
	Grade 2		15	1,500,000	11,250,000	1.9%
	Grade 3				-	0.0%
Sesame	Grade 1		30	2,400,000	36,000,000	6.1%
	Grade 2		20	2,000,000	20,000,000	3.4%
	Grade 3				-	0.0%
Cashewnut	Grade 1		20	1,900,000	19,000,000	3.2%
	Grade 2		10	1,700,000	8,500,000	1.4%
	Grade 3				-	0.0%
Fertilizer	Urea	25			-	0.0%
	DAP	25			-	0.0%
	American	5			-	0.0%
	Other				-	0.0%
Sub-total					**588,250,000**	**99.4%**
Trading cost					#DIV/0!	
	Truck				-	0.0%
	Labor	2456.66667	855	4,500	3,330,000	0.6%
	Official fee				-	0.0%
	Unofficial fee	5525			-	0.0%
	Other cost	3477.5			-	0.0%
Sub-total					**3,330,000**	**0.6%**
Total Expenses					**591,580,000**	**100.0%**
Revenue						
Paddy	IR 66	28	200	500,000	50,000,000	8.2%
	Chhma Prum	820			-	0.0%
	Mixed	400	550	507,500	281,750,000	46.4%
	Neang Malis	100	100	570,000	28,500,000	4.7%
	Phka Malis	1,500			-	0.0%
	Phkar Khnhey				-	0.0%
	Somaly				-	0.0%
Rice	Mixed	300	100	405,000	40,500,000	6.7%
Soybean	Grade 1		100	1,050,000	52,500,000	8.9%
	Grade 2		60	850,000	25,500,000	4.3%
	Grade 3		40	800,000	16,000,000	2.7%
Mungbean	Grade 1		15	2,050,000	15,375,000	2.6%
	Grade 2		15	1,550,000	11,625,000	2.0%
	Grade 3				-	0.0%
Sesame	Grade 1		30	2,450,000	36,750,000	6.2%
	Grade 2		20	2,050,000	20,500,000	3.5%
	Grade 3				-	0.0%
Cashewnut	Grade 1		20	1,950,000	19,500,000	3.3%
	Grade 2		10	1,750,000	8,750,000	1.5%
	Grade 3				-	0.0%
Fertilizer	Urea	25			-	0.0%
	DAP	25			-	0.0%
	American	5			-	0.0%
	Other				-	0.0%
Total Revenue					**607,250,000**	**100.0%**
Average Purchasing Price (R/kg)		**676**	**500**			
Gross Margin		15	12	12,437	15,670,000	
					$3,917.50	**2.6%**

Source: Study Team Interviews

Table 80 Costs and Returns for Traders –Average

	Types of Products	Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses					
Paddy	IR 66	189	515,000	55,271,429	4.3%
	Chhma Prum	820	690,000	271,028,571	21.2%
	Mixed	971	522,857	508,428,571	39.9%
	Neang Malis	100	625000	17,857,143	1.4%
	Phka Malis	1,500	720,000	302,857,143	23.7%
	Phkar Khnhey			-	0.0%
	Somaly			-	0.0%
Rice	Mixed	150	800,000	34,571,429	2.7%
Soybean	Grade 1	100	1,000,000	14,285,714	1.1%
	Grade 2	60	800,000	6,857,143	0.5%
	Grade 3	40	750,000	4,285,714	0.3%
Mungbean	Grade 1	15	2,000,000	4,285,714	0.3%
	Grade 2	15	1,500,000	3,214,286	0.3%
	Grade 3			-	0.0%
Sesame	Grade 1	30	2,400,000	10,285,714	0.8%
	Grade 2	20	2,000,000	5,714,286	0.4%
	Grade 3			-	0.0%
Cashewnut	Grade 1	20	1,900,000	5,428,571	0.4%
	Grade 2	10	1,700,000	2,428,571	0.2%
	Grade 3			-	0.0%
Fertilizer	Urea	25	1,200,000	4,285,714	0.3%
	DAP	25	800,000	2,857,143	0.2%
	American	5	1,200,000	857,143	0.1%
	Other			-	0.0%
Sub-total				**1,254,800,000**	**98.4%**
Trading cost				#DIV/0!	
	Truck	2350	14,500	9,885,714	0.8%
	Labor	1968.571429	3,214	3,941,429	0.3%
	Official fee	2200	1,000	314,286	0.0%
	Unofficial fee	5525	11	8,571	0.0%
	Other cost	3477.5	6,619	6,799,429	0.5%
Sub-total				**20,949,429**	**1.6%**
Total Expenses				**1,275,749,429**	**100.0%**
Revenue					
Paddy	IR 66	189	530,000	57,100,000	4.3%
	Chhma Prum	820	703,333	277,400,000	21.1%
	Mixed	900	546,429	499,357,143	37.9%
	Neang Malis	100	675,000	19,285,714	1.5%
	Phka Malis	1,500	735,000	307,857,143	23.4%
	Phkar Khnhey				0.0%
	Somaly				0.0%
Rice	Mixed	200	568,000	86,714,286	6.6%
Soybean	Grade 1	100	1,050,000	15,000,000	1.2%
	Grade 2	60	850,000	7,285,714	0.6%
	Grade 3	40	800,000	4,571,429	0.4%
Mungbean	Grade 1	15	2,050,000	4,392,857	0.3%
	Grade 2	15	1,550,000	3,321,429	0.3%
	Grade 3				0.0%
Sesame	Grade 1	30	2,450,000	10,500,000	0.8%
	Grade 2	20	2,050,000	5,857,143	0.5%
	Grade 3				0.0%
Cashewnut	Grade 1	20	1,950,000	5,571,429	0.4%
	Grade 2	10	1,750,000	2,500,000	0.2%
	Grade 3				0.0%
Fertilizer	Urea	25	350,000	5,000,000	0.4%
	DAP	25	215,000	3,071,429	0.2%
	American	5	425,000	1,214,286	0.1%
	Other				0.0%
Total Revenue				**1,316,000,000**	**100.0%**
Average Purchasing Price (R/kg)		**646**			
Gross Margin		10	9,829	40,250,571	
				$10,062.64	**3.1%**

Source: Study Team Interviews

Table 81 Location of Sales by Traders - Value Chain Respondents

% of Sales	Location	Kampong Speu			Svay Rieng		Kampong Thom	
	Miller	1	2	3	1	2	1	2
Paddy	Angkor Kasekam Roongroeung		11%	9%				
	Local Market			17%		68%		
	Phnom Penh	30%						
	Thailand							
	Vietnam	70%	89%	74%	100%	32%	100%	100%
Rice	Angkor Kasekam Roongroeung							
	Local Market			100%	100%			100%
	Thailand							
	Vietnam							
Soybean	Local Market							
	Thailand						69%	
	Vietnam						31%	
Mungbean	Local Market						100%	
	Thailand							
	Vietnam							
Sesame	Local Market							
	Thailand							
	Vietnam						100%	

Sales by Volume
Source: Study Team Field Work

Table 82 Costs and Returns for Processors

		Battambang	Kampong Speu	Battambang	Kampong Thom
	Unit	Sauces (Chili,Soy,fish)	Soybeans (popussandeak)	Noodles	Soy bean Fermented
Revenue	Riels	600,000,000	43,200,000	1,175,300,000	16,200,000
Cost	Riels	562,500,000	36,000,000	903,375,000	13,770,000
Gross Income	Riels	37,500,000	7,200,000	271,925,000	2,430,000
	$	$9,375.00	$1,800.00	$67,981.25	$607.50
Margin	%	6.3%	16.7%	23.1%	15.0%

Source: Study Team Field Work

Table 83 Coefficients for Rice Production and Food Balance

	Units	NIS (1999)	MAFF (2000)	MAFF (2001)
Milling Recovery Ratio	%	-	62	
Post-Harvest Losses	%	-	10	
Seed Reserve	%	-	5	
Animal Feed	%	-	2	
Food Requirement	kg/hd/yr	143	162	15:

Source: (National Institute of Statistics 1999), (Ministry of Agriculture Forestry and Fisheries 2001; Ministry of Agriculture Forestry and Fisheries 2001; Mi

Table 84 Milling Recovery by Custom and Commercial Mills

Crop Season	Proportion of Volume	Custom Mills 70%	Commercial Mills 30%	Weighted Average
Dry Season	18%	62.57%	63.85%	62.95%
Wet Season	83%	63.57%	66.94%	64.58%
Weighted Average		63.40%	66.40%	64.30%

Source: (JICA 2001, pg. B-42, Table 18)

Table 85 Milling Efficiency of Custom and Commercial Mills

	Custom Mills	Commercial Mills
Whole Grain	62.34%	59.53%
Broken Rice	8.68%	10.27%
Bran	16.17%	10.93%
Husk	12.53%	19.1%
Other	0.28%	0.17%

Source: (EDC 2001, Appendix 1, pg. 11)

Table 86 Milling Recovery Rates, Selected Custom and Commercial Mills

Location	Size of Operation	Milling Recovery Ratio	Broken Percentage
Takeo	Medium	64%	30-35%
Takeo	Custom		45%
Kandal	Large	64%	
Kampong Speu	Medium	60%	
Kampong Speu	Custom	60%	30-35%
Battambang	Large	65%	
Battambang	Custom	65%	

Source: (ACI 2002)

Table 87 Characteristics of Custom and Commercial Rice Mills, Business Structure, Characteristics and Management Issues

Village/Home Based Rice Mills	Commercial Rice Mills
Individually owned and operate as a family-home based business	Individually owned commercially operated enterprises
Equipment in millers house	Mill and equipment is housed in separate rice mill structure and storage building
Not registered with the provincial DIME	Registered with the provincial DIME and ministry level authority
Not a member of the Provincial Rice Millers Association	Member of Provincial Rice Millers Association
No formal enterprise structure	No formal Enterprise Structure
No employed workers	Employ 6-10 workers and staff when operating
	Employees are generally recruited from nearby villages or relatives. All training is on-the-job training, no formal technical training
	Employees receive hourly, daily or weekly pay with no benefits or security, insurance or annual leave
Low quality milling system, <500kg.hr capacity	Rice milling systems vary in standard depending upon equipment installed. Most commercial mills have a capacity of >500kg/hr
Equipment is often old, powerplants are diesel fueled	Equipment if often old, power plants are diesel fueled
Rice is milled on a contract or "fee for service" basis rather than purchased, milled, packaged and sold to markets	Rice is purchased from farmers and collectors and milled according to the miller's marketing strategy. Paddy is stored at the mill and milled, packaged and sold as price considerations and market demand dictates
Very limited or no paddy storage facilities	Paddy storage for 1-3,000 tonnes of paddy is common
Enterprise is a part-time seasonal activity 3-6 months for part of the day, that is one of a set of 2-3 other family based subsistence business activities. Milling activity is an adjunct to the other micro-business activities	The enterprise is a seasonal, full time activity operating 6-12 months per year
No formal record keeping of operations, no business plan, few have plans to upgrade or expand their operations	Record keeping systems are weak and incomplete, few have formal business plans, but most have plans to develop and expand their business during the next five years
Rice milling is often not the primary business activity of the operator	The milling enterprise is usually the primary business activity of the mill owner.

Based on (EDC 2001, pp. 3-6)

Table 88 Characteristics of Custom and Commercial Rice Mills, Financial Management and Financial Planning Capacity

Village/Home Based Rice Mills	Commercial Rice Mills
Most village millers borrowed from family members to start their business. A few have borrowed from local micro-finance organizations	Most commercial millers borrowed money to start their business
Spouse manages the mill finances, although women have no special or advanced education or training	Spouse manages the mill finances, although women have no special or advanced education or training
Village milling operations have no financial management or control systems although they indicate they recognize its value	Financial management systems are weak with a majority having no forma records. Some prepare income statements or statement of earnings. A growing minority are implementing record keeping and some financial planning into their operations
	Almost none have borrowed money from financial organization or banks
Most indicate that they have financial problems, usually shortage of working capital, lack of collateral, access to loans for new equipment and expanding their other businesses	Most indicate that their main financial problem is lack of working capital for purchasing paddy and no loans are available for longer term (2-3 years) financing to upgrade mill equipment, buildings etc.
	Currency fluctuations affect millers who must purchase fuel in dollars and sell rice in Riel or Dong
	Many recognize working capital shortage problem and have plans to reduce this through operational cost saving measures
Most have never borrowed money	Most have borrowed money, usually to purchase paddy or other working capital purposes
No taxes are paid to the government, some local fees are paid to provincial and district authorities	Most commercial millers pay unofficial taxes to local authorities. These amounts are negotiated and not regulated.

Based on (EDC 2001, pp. 3-6)

Table 89 Characteristics of Custom and Commercial Rice Mills, Mill Production, Technology and Operations

Village/Home Based Rice Mills	Commercial Rice Mills
Most paddy is milled on a fee for service basis for local neighbors	Paddy is purchased for cash from farmers, milled and marketed in local, provincial and Phnom Penh markets
Milled rice produced is usually for local household consumption	
	Due to a lack of working capital many mills purchase relatively small quantities of paddy.
Milled rice is ungraded and is usually 35-45% broken rice of mixed varieties	Commercially milled paddy is comprised of Mixed varieties, Dry season rice and IRRI varieties
	Mill grades are high in broken rice, usually 30-35%.
There is no storage capacity and therefore no inventory management	Inventory management and record keeping is poor.
	Mill equipment is generally from Vietnam, China and Russia. Post harvest technology is low with little control over drying process and moisture content
	Milling technologies are not modern and machinery is old
	There is a shortage of electricity for power supply, and diesel engines are not suitable for modern milling systems
	Generally paddy has not been available in quantities required in all provinces and at the same time low storage and drying technology results in spoilage
	Measurement of moisture content and quality characteristics are through visual inspection

Based on (EDC 2001, pp. 3-6)

Table 90 Technical Characteristics of Custom Mills

Machine Type	Characteristics
Engerberg Compact Mill	• Compact, low cost, easy to operate. • Made in China. Originally a coffee mill. • Processes paddy to white rice in one pass. • Processed husk sticks to white rice and increased production of broken rice. • Bran also contains processed husk and quality of bran is low
Noda Compact Mill	• Made in Vietnam. Husker is a copy of Yanmar Model machine. Milling machine is a copy of Noda type
Satamar Compact Mill	• Made in Vietnam. The milling section is equipped with an aspirator and a rubber roll type husking section is mounted.
Rubber Roll Husker with Engerberg Compact Mill	• Rubber roll type husker above milling machine, compact with a common base. • Separates out husk from processing stage, but rubber roll becomes easily worn. • Friction type milling but one-pass milling so broken rice and whole grain not separated.
Engerberg Compact Mill Husker with Friction Mill	• Uses Engerberg machine for husking rather than rubber roller and a Friction type mill for polishing. • Not compact, requires elevator for loading paddy.
Rubber Roll Husker with Friction Mill	• Uses rubber roll husker and friction type mill
Source: (JICA 2001)	

Table 91 Technical Characteristics of Commercial Mills

Components	Characteristics
Pre-cleaner	• Sifting type, air screen type not used. Cannot remove lighter paddy and reduces milling quality
Husker (stone type or rubber roller or both)	
Paddy separator	• Table shifting machine type.
Milling machine (2-4 stage)	• Vertical emery stone type. Number of milling machines increased as capacity of mill increases to obtain better recovery rates. • Vertical type more suitable for long grain rice, is durable and easy to operate • Stone grinding, while removing the bran, damages the surface of the white rice and reduces the quality.
Grader (sieve or indent type)	• Some millers use length graders to meet demand for high quality rice. • Destoner or color sorter machine rarely installed.
Scale	
Packing machine	
Source: (JICA 2001)	

Table 92 Sales of Milling By-Products - 2001

Uses	Custom Mills			Commercial Mills		
	Husk	Broken Rice	Bran	Husk	Broken Rice	Bran
Brick Factories	1.45%			25.00%		
Wine/Alcohol Makers	43.48%	7.27%		41.67%	43.40%	
Sugar Palm Makers	8.70%			18.33%		
Noodle Makers	5.80%			10.00%	3.77%	
Household	20.29%			5.00%		
Personal Consumption	20.29%	23.64%	39.62%		1.89%	1.67%
Animal Feed		47.27%	60.38%		45.28%	90.00%
Wholesaler					1.89%	1.67%
Export					3.77%	6.67%
Other		21.82%				
No. Respondents	69	55	53	60	53	60
Percentage of Respondents						

Source: (EDC 2001)

Table 93 Estimated Milling Capacity 1998-1999

Province	Available Paddy Tonnes	Commercial Mills		Custom Mills		Total Capacity	Excess Capacity Tonnes
		Number	Capacity	Number	Capacity		
Phnom Penh	12691	69	113850			113850	101159
Kandal	191564	30	49500	1714	115181	164681	-26883
Prey Veng	353534	37	61050	121	8131	69181	-284353
Kampong Cham	364038	49	80850	2363	158794	239644	-124394
Svay Rieng	145831	18	29700	1392	93542	123242	-22589
Takeo	368255	19	31350	1117	75062	106412	-261843
Kampong Chhnang	137199	12	19800	1088	73114	92914	-44285
Battambang	279694	80	132000	282	18883	150883	-128811
Seam Reap	209417	23	37950	956	64243	102193	-107224
Kampong Speu	99184	56	92400	836	56179	148579	49395
Total	2161407	393	648450	9869	663129	1311579	-849828
Country	2913193						

Assuming Commercial Mills: 1.10 tonnes/hr, 6 hours/day, 25 days/month, 10 months/yr

Assuming Custom Mills: 0.3 tonnes/hr, 1.12 hours/day, 20 days/month, 10 months/yr

Source: (JICA 2001)

Table 94 Financial Sources for Millers

Source of Funds	Custom Mills	Commercial Mills
Own	69.4%	85.1%
Bank	0%	1.5%
Relatives	4.1%	0%
Private Company	8.2%	4.5%
Government	0%	0%
Others	2%	1.5%
Own plus Bank	4.1%	3%
Own plus Relatives	12.2%	4.5%
Total	100%	100%
Average Capitalization	$1,000	$37,500
Number of Respondents	49	67

Source: (JICA 2001; Vuthy 2001)

Table 95 Performance of Cambodian Rice Mills 1999

Criteria	Units	Custom Mills	Medium and Large Mills	Range
Capacity	kg/hr paddy	231	713	90-960
Fuel Consumption	litres/tonne	15	17	6-26
Whole Kernels	%	29	29	22-37
Broken Kernels	%	28	31	13-43
Total White Rice	%	57	60	45-68
Bran/Meal	%	21	21	12-29
Husk	%	22	19	15-28
Maintenance (re-facing stones)	(days)		11	8-12
Replacing Rollers	(days)	31	15	6-90

Source: (CIAP 1999, pg. 157)

Table 96 Sales of White Rice by Millers

Sales	Trade Base	Volume Base
Wholesaler	55%	62.3%
Retailer	13.3%	8.1%
Middlemen	11.4%	12.9%
Exporter	1.4%	1.7%
Consumer	16.7%	4.5%
Others	2.2%	10.5%

Source: Source: (JICA 2001; Vuthy 2001)

Table 97 Mill Utilization Rates - 2000

Mill Type	Number of Mills Capacity/Processed	Capacity tonnes/hr	Capacity tonnes/year*	Processed Volume tonnes/year	Utilization Rate %
Custom Mills	43/27	0.3	720	67	9.3%
Commercial Mills	74/61	1.107	2656.8	1611	60.6%

*Assume 8 hour day, 300 days per year

Source: (JICA 2001)

Table 98 Number of Mills by Province - 2000

Mill Type	Commercial Mill	Custom Mill	
Capacity HP	0.3 to >1.0 t/hr 20 to 200 hp	0.2 to 0.3 t/hr 10 to 20 hp	Total
Battambang	207	153	360
Kampong Cham*	49	2,363	2,412
Kampong Chhnang	11	1,090	1,101
Kampong Speu**	59	830	889
Kandal	87	1,688	1,775
Phnom Penh	6	63	69
Prey Veng	50	2,495	2,545
Seam Reap	23	956	979
Svay Rieng	3	1,447	1,450
Takeo	23	1,113	1,136
Total	518	12,198	12,716

* 1998, ** 1999

Source: (JICA 2001; Vuthy 2001)

Table 99 Partial Budgets for Custom Mills

Province	Technical Characteristics			Operating Cost			Labor Cost		Total Cost	
	Capacity	Processing	Number Days of Operation hours per day	Fuel $ 3.00	Depreciation	Total $ 3.00	Total	Total per Tonne	Total	Per Tonne
	Tonnes/hr	Tonnes/yr	4	US$	US$	US$	US$	US$	US$	US$
Phnom Penh	0.3	40	33	$120.00	$0.50	$120.50	$41.67	$1.04	$162.17	$4.05
Kandal	0.3	211	121	$633.00	$0.11	$633.11	$151.49	$1.71	$784.60	$4.72
Prey Veng	0.3	53	50	$159.00	$0.10	$159.10	$61.98	$1.30	$221.08	$4.31
Kampong Cham	0.3	38	33	$112.50	$0.10	$112.60	$41.34	$1.17	$153.94	$4.18
Svay Rieng	0.5	93	54	$280.00	$0.01	$280.01	$67.15	$0.69	$347.16	$3.69
Takeo	0.3	8	6	$22.50	$0.47	$22.97	$7.29	$0.97	$30.27	$4.03
Kampong Speu	0.5	44	98	$133.00	$2.37	$135.37	$122.30	$1.32	$257.67	$4.56
Kampong Chhnang	0.3	17	17	$51.00	$0.10	$51.10	$21.08	$1.27	$72.18	$4.28
Battambang	0.3	200	200	$600.00	$0.13	$600.13	$250.00	$1.25	$850.13	$4.25
Seam Reap	0.2	6	10	$18.00	$0.14	$18.14	$12.50	$2.08	$30.64	$5.11
Cambodia	0.3	68	58	$204.58	$0.40	$204.98	$72.31	$1.25	$277.29	$4.29

Province	By-Product				By-Product Revenue		Total Revenue		Gross Margin	
	Bran		Husk		Bran $ 60.00	Husk $ 2.00	Total	per Tonne	Total	per Tonne
	Tonnes	%	Tonnes	%	US$	US$	US$	US$	US$	US$
Phnom Penh	4	10%	8	20%	$240.00	$16.00	$256.00	$6.40	$93.83	$2.35
Kandal	11	23%	4	13%	$650.00	$7.99	$657.99	$9.17	-$126.61	$4.45
Prey Veng	11	23%	8	16%	$684.00	$16.70	$700.70	$13.99	$479.63	$9.69
Kampong Cham	5	19%	8	17%	$318.75	$16.28	$335.03	$11.59	$181.08	$7.41
Svay Rieng	18	20%	12	13%	$1,106.00	$23.80	$1,129.80	$12.45	$782.64	$8.76
Takeo	2	23%	1	13%	$99.00	$1.85	$100.85	$13.75	$70.58	$9.72
Kampong Speu	5	14%	8	15%	$288.00	$16.80	$304.80	$8.70	$47.13	$4.14
Kampong Chhnang	3	18%	1	10%	$198.00	$2.60	$200.60	$11.20	$128.42	$6.92
Battambang	20	10%	46	23%	$1,200.00	$92.00	$1,292.00	$6.46	$441.87	$2.21
Seam Reap	2	25%	0	6%	$90.00	$0.72	$90.72	$15.12	$60.08	$10.01
Cambodia	8	19%	8	14%	$505.73	$15.95	$521.68	$11.40	$244.39	$7.11

Based on production data from (JICA 2001) and updated prices/costs. Data from Table C4 in JICA Report, dropping incomplete observations

Table 100 Partial Budgets for Commercial Mills

Province	Technical Characteristics		Proportion of Wet Season Purchases	Cost of Paddy			Operating Cost						
	Capacity	Processing		Wet Season	Dry Season	Total	Fuel	Electricity	Bags	Maintenance	Depreciation	Tax	Total
				per Tonne		US$	$2.54	$0.53	$1.00	$1.51	20 yrs	$0.23	$5.81
	Tonnes/hr	Tonnes/yr	%	US$	US$	US$	US$	US$	US$	US$	US$	US$	US$
Phnom Penh	1.1	420	85%	$130.00	$102.50	$52,907.52	$1,066.80	$222.60	$420.00	$634.20	$0.75	$96.60	$2,440.95
Kandal	1.4	1417	32%	$130.00	$102.50	$157,723.81	$3,598.33	$750.83	$1,416.67	$2,139.17	$0.12	$325.83	$8,230.96
Prey Veng	1.7	1540	60%	$127.50	$102.50	$181,065.67	$3,911.60	$816.20	$1,540.00	$2,325.40	$0.08	$354.20	$8,947.48
Kampong Cham	0.4	473	67%	$130.00	$102.50	$57,198.13	$1,200.15	$250.43	$472.50	$713.48	$0.25	$108.68	$2,745.48
Svay Rieng	0.8	1800	87%	$127.50	$102.50	$223,641.17	$4,572.00	$954.00	$1,800.00	$2,718.00	$0.13	$414.00	$10,458.13
Takeo	1.2	1090	67%	$127.50	$102.50	$130,022.10	$2,768.60	$577.70	$1,090.00	$1,645.90	$0.12	$250.70	$6,333.02
Kampong Speu	0.7	500	99%	$130.00	$102.50	$64,798.27	$1,270.00	$265.00	$500.00	$755.00	$0.38	$115.00	$2,905.38
Kampong Chhnang	0.8	933	82%	$130.00	$102.50	$116,838.41	$2,370.67	$494.67	$933.33	$1,409.33	$0.05	$214.67	$5,422.72
Battambang	1.0	1091	98%	$112.50	$100.00	$122,436.71	$2,770.05	$578.00	$1,090.57	$1,646.76	$0.50	$250.83	$6,336.72
Seam Reap	1.6	2375	92%	$112.50	$100.00	$264,678.84	$6,032.50	$1,258.75	$2,375.00	$3,586.25	$0.04	$546.25	$13,798.79
Pursat	1.5	5000	97%	$112.50	$100.00	$560,604.98	$12,700.00	$2,650.00	$5,000.00	$7,550.00	$0.15	$1,150.00	$29,050.15
Banteay Meanchey	2.5	6000	99%	$112.50	$100.00	$674,528.62	$15,240.00	$3,180.00	$6,000.00	$9,060.00	$0.04	$1,380.00	$34,860.04
Cambodia	**1.1**	**1306**	**77%**	**$124.85**	**$101.86**	**$152,080.51**	**$3,317.64**	**$692.26**	**$1,306.16**	**$1,972.30**	**$0.27**	**$300.42**	**$7,589.05**

Province	Labor Cost		Total Cost		Revenue from Rice Sales			By-Product Revenue		Total Revenue		Gross Margin	
	Total	Total per Tonne	Total	Per Tonne	Wet Season	Dry Season	Total	Bran	Husk				
					per Tonne			$75.00	$2.00	Total	per Tonne	Total	per Tonne
	US$	US$	US$	US$	US$	US$	US$	US$	US$	US$	US$	US$	US$
Phnom Penh	$524.65	$1.12	$55,873.12	$132.91	$212.50	$167.50	$57,571.49	$4,725.00	$155.51	$62,452.00	$148.70	$6,578.88	$15.79
Kandal	$1,494.35	$0.80	$167,449.11	$117.94	$212.50	$167.50	$167,575.48	$15,937.50	$571.12	$184,084.10	$129.94	$16,634.99	$12.00
Prey Veng	$1,630.39	$0.72	$191,643.54	$124.10	$212.50	$167.50	$197,480.44	$17,325.00	$594.03	$215,399.47	$139.87	$23,755.93	$15.77
Kampong Cham	$2,079.24	$3.31	$62,022.85	$130.18	$212.50	$167.50	$61,786.37	$5,315.63	$180.17	$67,282.16	$142.40	$5,259.32	$12.21
Svay Rieng	$863.10	$0.57	$234,962.40	$130.62	$212.50	$167.50	$247,773.13	$20,250.00	$664.64	$268,687.77	$149.27	$33,725.37	$18.65
Takeo	$647.78	$0.69	$137,002.90	$125.78	$212.50	$167.50	$142,408.73	$12,262.50	$415.84	$155,087.07	$142.28	$18,084.17	$16.50
Kampong Speu	$352.83	$0.38	$68,056.48	$135.79	$205.00	$167.50	$68,391.39	$5,625.00	$181.05	$74,197.45	$148.39	$6,140.97	$12.61
Kampong Chhnang	$1,278.36	$1.52	$123,539.49	$132.52	$205.00	$167.50	$123,129.50	$10,500.00	$347.22	$133,976.73	$143.55	$10,437.23	$11.03
Battambang	$2,254.57	$1.86	$131,028.00	$119.94	$230.00	$167.50	$166,956.61	$12,268.93	$395.16	$179,620.70	$164.70	$48,592.70	$44.76
Seam Reap	$5,473.76	$1.80	$283,951.39	$119.06	$230.00	$167.50	$356,224.52	$26,718.75	$870.25	$383,813.52	$161.61	$99,862.13	$42.55
Pursat	$5,555.56	$1.11	$595,210.68	$119.04	$230.00	$167.50	$762,682.71	$56,250.00	$1,815.37	$820,748.08	$164.15	$225,537.40	$45.11
Banteay Meanchey	$6,000.00	$1.00	$715,388.67	$119.23	$230.00	$167.50	$921,999.13	$67,500.00	$2,169.53	$991,668.66	$165.28	$276,279.99	$46.05
Cambodia	**$1,770.15**	**$1.25**	**$161,439.71**	**$125.99**	**$215.93**	**$167.50**	**$181,713.09**	**$14,694.26**	**$489.06**	**$196,896.41**	**$148.06**	**$35,456.70**	**$22.07**

Based on production data from (JICA 2001) and updated prices/costs.
Data from Table C5 in JICA Report, dropping incomplete observations and mills that exceed 365 days of milling (either mistyped data or mills that also act as traders)

Table 101 Costs and Returns for Rice Milling – Kampong Speu

	Types of Products	Recovery (%)	Quantity (Tonnes)	Unit Price (Riels)	Value		Recovery (%)	Quantity (Tonnes)	Unit Price (Riels)	Value		Recovery (%)	Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses																
Paddy	IR				-	0.0%				-	0.0%		0	0	-	0.0%
	Phkar Khnhey				-	0.0%				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%				-	0.0%
	Neang Malis		10	700,000	7,000,000	3.3%		35	600,000	21,000,000	10.7%		0	-	-	0.0%
	Mixed		400	470,000	188,000,000	88.9%		300	520,000	156,000,000	79.2%		200	520,000	104,000,000	91.6%
Sub-total					**195,000,000**	**92.3%**				**177,000,000**	**89.9%**				**104,000,000**	**91.6%**
Milling cost																
	Fuel cost		410	30,000	12,300,000	5.8%		335	50,000	16,750,000	8.5%		200	36,495	7,299,000	6.4%
	Labor		410	1,560	639,600	0.3%		335	600	201,000	0.1%		200	1,666	333,200	0.3%
	Sack & Bags		410	7,500	3,075,000	1.5%		335	7,650	2,562,750	1.3%		200	9,000	1,800,000	1.6%
	Tax		410	718	294,380	0.1%		335	416	139,360	0.1%		200	666	133,200	0.1%
	Other cost		410	157	64,370	0.0%		335	833	279,055	0.1%		0	-	-	0.0%
Sub-total					**16,373,350**	**7.7%**				**19,932,165**	**10.1%**				**9,565,400**	**8.4%**
Total Expenses					**211,373,350**	**100.0%**				**196,932,165**	**100.0%**				**113,565,400**	**100.0%**
Revenue																
Paddy																
	IR				-	0.0%				-	0.0%		0	-	-	0.0%
	Phkar Khnhey				-	0.0%				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%				-	0.0%
	Neang Malis		0	-	-	0.0%		35	650,000	22,750,000	9.1%		0	-	-	0.0%
	Mixed		0	-	-	0.0%		0	-	-	0.0%		0	-	-	0.0%
Rice	IR				-	0.0%				-	0.0%		0	-	-	0.0%
	Phkar Khnhey				-	0.0%				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%				-	0.0%
	Neang Malis	60%	6	1,150,000	6,900,000	2.9%	66%	0	-	-	0.0%		0	-	-	0.0%
	Mixed	60%	240	840,000	201,600,000	84.9%	66%	198	1,000,000	198,000,000	78.9%	60%	120	830,000	99,600,000	83.0%
By-Products	Broken Rice	3%	12.3	700,000	8,610,000	3.6%	5%	15	700,000	10,500,000	4.2%	2.5%	5	600,000	3,000,000	2.5%
	Bran	9%	36.9	550,000	20,295,000	8.5%	12%	36	550,000	19,800,000	7.9%	15%	30	580,000	17,400,000	14.5%
	Husk	28%	114.8	-	-	0.0%	17%	51	-	-	0.0%	22.5%	45	-	-	0.0%
Total Revenue					**237,405,000**	**100.0%**				**251,050,000**	**100.0%**				**120,000,000**	**100.0%**
Average Purchasing Price (R/kg)			**476**					**528**					**520**			
Gross Margin			63	63,492	26,031,650			162	161,546	54,117,835			32	32,173	6,434,600	
					$6,507.91	**11.0%**				**$13,529.46**	**21.6%**				**$1,608.65**	**5.4%**

Source: Study Team Interviews

Table 102 Costs and Returns for Rice Milling – Svay Rieng

	Types of Products	Recovery (%)	Quantity (Tonnes)	Unit Price (Riels)	Value		Recovery (%)	Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses											
Paddy	IR		100	530,000	53,000,000	8.7%		2,500	510,000	1,275,000,000	36.6%
	Phkar Khnhey				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%
	Neang Malis				-	0.0%				-	0.0%
	Mixed		1,000	550,000	550,000,000	89.8%		4,000	540,000	2,160,000,000	62.0%
Sub-total					**603,000,000**	**98.5%**				**3,435,000,000**	**98.6%**
Milling cost											
	Fuel cost		300	16,800	5,040,000	0.8%		2,000	14,700	29,400,000	0.8%
	Labor		300	3,636	1,090,800	0.2%		2,000	1,500	3,000,000	0.1%
	Sack & Bags		300	10,000	3,000,000	0.5%		2,000	8,200	16,400,000	0.5%
	Tax		300	227	68,100	0.0%		2,000	153	306,000	0.0%
	Other cost		300	130	39,000	0.0%		-	-	-	0.0%
Sub-total					**9,237,900**	**1.5%**				**49,106,000**	**1.4%**
Total Expenses					**612,237,900**	**100.0%**				**3,484,106,000**	**100.0%**
Revenue											
Paddy											
	IR		100	550,000	55,000,000	8.7%		2,500	550,000	1,375,000,000	35.3%
	Phkar Khnhey				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%
	Neang Malis				-	0.0%				-	0.0%
	Mixed		700	580,000	406,000,000	64.6%		2,000	580,000	1,160,000,000	29.8%
Rice	IR				-	0.0%				-	0.0%
	Phkar Khnhey				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%
	Neang Malis				-	0.0%				-	0.0%
	Mixed	63%	189	800,000	151,200,000	24.1%	65%	1,300	850,000	1,105,000,000	28.4%
By-Products	Broken Rice	2%	6	500,000	3,000,000	0.5%	5%	100	600,000	60,000,000	1.5%
	Bran	5.5%	16.5	600,000	9,900,000	1.6%	15%	300	600,000	180,000,000	4.6%
	Husk	29.5%	88.5	40,000	3,540,000	0.6%	15%	300	50,000	15,000,000	0.4%
Total Revenue					**628,640,000**	**100.0%**				**3,895,000,000**	**100.0%**
Average Purchasing Price (R/kg)			**548**					**528**			
Gross Margin			15	14,911	16,402,100			63	63,214	410,894,000	
					$4,100.53	**2.6%**				**$102,723.50**	**10.5%**

Source: Study Team Interviews

Table 103 Costs and Returns for Rice Milling – Battambang

	Types of Products	Recovery (%)	Quantity (Tonnes)	Unit Price (Riels)	Value		Recovery (%)	Quantity (Tonnes)	Unit Price (Riels)	Value		Recovery (%)	Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses																
Paddy	IR				-	0.0%				-	0.0%				-	0.0%
	Phkar Khnhey		1,000	550,000	550,000,000	24.2%		2,000	570,000	1,140,000,000	62.5%				-	0.0%
	Somaly		1,000	600,000	600,000,000	26.4%		1,000	600,000	600,000,000	32.9%		1,000	550,000	550,000,000	13.1%
	Neang Malis				-	0.0%				-	0.0%				-	0.0%
	Mixed		2,000	490,000	980,000,000	43.1%				-	0.0%		6,500	530,000	3,445,000,000	82.1%
Sub-total					**2,130,000,000**	**93.7%**				**1,740,000,000**	**95.5%**				**3,995,000,000**	**95.2%**
Milling cost																
	Fuel cost		2,480	46,800	116,064,000	5.1%		1,800	35,100	63,180,000	3.5%		4,275	36,400	155,610,000	3.7%
	Labor		2,480	357	885,360	0.0%		1,800	568	1,022,400	0.1%		4,275	288	1,231,200	0.0%
	Sack & Bags		2,480	10,000	24,800,000	1.1%		1,800	10,000	18,000,000	1.0%		4,275	10,000	42,750,000	1.0%
	Tax		2,480	166	411,680	0.0%		1,800	189	340,200	0.0%		4,275	100	427,500	0.0%
	Other cost		-	-	-	0.0%				-	0.0%				-	0.0%
Sub-total					**142,161,040**	**6.3%**				**82,542,600**	**4.5%**				**200,018,700**	**4.8%**
Total Expenses					**2,272,161,040**	**100.0%**				**1,822,542,600**	**100.0%**				**4,195,018,700**	**100.0%**
Revenue																
Paddy																
	IR				-	0.0%				-	0.0%				-	0.0%
	Phkar Khnhey				-	0.0%				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%				-	0.0%
	Neang Malis				-	0.0%				-	0.0%				-	0.0%
	Mixed				-	0.0%				-	0.0%				-	0.0%
Rice	IR				-	0.0%				-	0.0%				-	0.0%
	Phkar Khnhey	62%	620	1,100,000	682,000,000	30.0%	60%	1,200	1,100,000	1,320,000,000	72.4%				-	0.0%
	Somaly	62%	620	1,200,000	744,000,000	32.7%	60%	600	1,200,000	720,000,000	39.5%	57%	570	1,200,000	684,000,000	16.3%
	Neang Malis				-	0.0%				-	0.0%				-	0.0%
	Mixed	62%	1,240	1,000,000	1,240,000,000	39.8%				-	0.0%	57%	3,705	1,100,000	4,075,500,000	69.6%
By-Products	Broken Rice	10%	400	600,000	240,000,000	7.7%	10%	300	700,000	210,000,000	8.6%	9%	675	650,000	438,750,000	7.5%
	Bran	9%	360	550,000	198,000,000	6.4%	12%	360	550,000	198,000,000	8.1%	14%	1,050	600,000	630,000,000	10.8%
	Husk	19%	760	16,000	12,160,000	0.4%	18%	540		-	0.0%	20%	1,500	16,000	24,000,000	0.4%
Total Revenue					**3,116,160,000**	**100.0%**				**2,448,000,000**	**100.0%**				**5,852,250,000**	**100.0%**
Average Purchasing Price (R/kg)			**533**					**580**					**533**			
Gross Margin			211	211,000	843,998,960			208	208,486	625,457,400			221	220,964	1,657,231,300	
					$210,999.74	**27.1%**				**$156,364.35**	**25.5%**				**$414,307.83**	**28.3%**

Source: Study Team Interviews

Table 104 Costs and Returns for Rice Milling – Kampong Thom

	Types of Products	Recovery (%)	Quantity (Tonnes)	Unit Price (Riels)	Value		Recovery (%)	Quantity (Tonnes)	Unit Price (Riels)	Value	
Expenses											
Paddy	IR				-	0.0%				-	0.0%
	Phkar Khnhey		200	550,000	110,000,000	7.2%		1,500	550,000	825,000,000	29.8%
	Somaly				-	0.0%		900	600,000	540,000,000	19.5%
	Neang Malis				-	0.0%				-	0.0%
	Mixed		2,800	470,000	1,316,000,000	86.6%		2,700	490,000	1,323,000,000	47.7%
Sub-total					**1,426,000,000**	**93.8%**				**2,688,000,000**	**96.9%**
Milling cost											
	Fuel cost		1,800	42,500	76,500,000	5.0%		2,040	22,500	45,900,000	1.7%
	Labor		1,800	4,000	7,200,000	0.5%		2,040	4,800	9,792,000	0.4%
	Sack & Bags		1,800	6,000	10,800,000	0.7%		2,040	12,600	25,704,000	0.9%
	Tax				-	0.0%		2,040	1,400	2,856,000	0.1%
	Other cost				-	0.0%		2,040	380	775,200	0.0%
Sub-total					**94,500,000**	**6.2%**				**85,027,200**	**3.1%**
Total Expenses					**1,520,500,000**	**100.0%**				**2,773,027,200**	**100.0%**
Revenue											
Paddy											
	IR				-	0.0%				-	0.0%
	Phkar Khnhey				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%
	Neang Malis				-	0.0%				-	0.0%
	Mixed				-	0.0%				-	0.0%
Rice	IR				-	0.0%				-	0.0%
	Phkar Khnhey	60%	120	950,000	114,000,000	7.5%	40%	600	########	660,000,000	23.8%
	Somaly				-	0.0%	40%	360	########	432,000,000	15.6%
	Neang Malis				-	0.0%				-	0.0%
	Mixed	60%	1680	760,000	1,276,800,000	73.7%	40%	1,080	850,000	918,000,000	29.3%
By-Products	Broken Rice	8%	240	600,000	144,000,000	8.3%	18%	918	600,000	550,800,000	17.6%
	Bran	12%	360	550,000	198,000,000	11.4%	20%	1,020	550,000	561,000,000	17.9%
	Husk	20%	600		-	0.0%	22%	1,122	10,000	11,220,000	0.4%
Total Revenue					**1,732,800,000**	**100.0%**				**3,133,020,000**	**100.0%**
Average Purchasing Price (R/kg)			**475**					**527**			
Gross Margin			71	70,767	212,300,000			71	70,587	359,992,800	
					$53,075.00	**12.3%**				**$89,998.20**	**11.5%**

Source: Study Team Interviews

Table 105 Costs and Returns for Rice Milling – Average of Interviewed Millers in Kampong Speu and Svay Rieng

Location		Kampong Speu					Svay Rieng				
	Types of Products	**Recovery (%)**	**Quantity (Tonnes)**	**Unit Price (Riels)**	**Value**		**Recovery (%)**	**Quantity (Tonnes)**	**Unit Price (Riels)**	**Value**	
Expenses											
Paddy	IR		0	0	0	0.0%		1,300	520,000	664,000,000	22.6%
	Phkar Khnhey				0	0.0%				-	0.0%
	Somaly				0	0.0%				-	0.0%
	Neang Malis		15	433,333	9,333,333	4.7%				-	0.0%
	Mixed		300	503,333	149,333,333	86.6%		2,500	545,000	1,355,000,000	75.9%
Sub-total					**158,666,667**	**91.2%**				**2,019,000,000**	**98.5%**
Milling cost											
	Fuel cost		315	38,832	12,116,333	6.9%		1,150	15,750	17,220,000	0.8%
	Labor		315	1,275	391,267	0.2%		1,150	2,568	2,045,400	0.1%
	Sack & Bags		315	8,050	2,479,250	1.4%		1,150	9,100	9,700,000	0.5%
	Tax		315	600	188,980	0.1%		1,150	190	187,050	0.0%
	Other cost		248	330	114,475	0.1%		150	65	19,500	0.0%
Sub-total					**15,290,305**	**8.8%**				**29,171,950**	**1.5%**
Total Expenses					**173,956,972**	**100.0%**				**2,048,171,950**	**100.0%**
Revenue											
Paddy											
	IR		-	-	-	0.0%		1,300	550,000	715,000,000	22.0%
	Phkar Khnhey				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%
	Neang Malis		12	216,667	7,583,333	3.0%				-	0.0%
	Mixed		-	-	-	0.0%		1,350	580,000	783,000,000	47.2%
Rice	IR		-	-	-	0.0%				-	0.0%
	Phkar Khnhey				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%
	Neang Malis	63%	2	383,333	2,300,000	1.0%				-	0.0%
	Mixed	62%	186	890,000	166,400,000	82.3%	64%	745	825,000	628,100,000	26.2%
By-Products	Broken Rice	4%	11	666,667	7,370,000	3.4%	4%	53	550,000	31,500,000	1.0%
	Bran	12%	34	560,000	19,165,000	10.3%	10%	158	600,000	94,950,000	3.1%
	Husk	23%	70	-	-	0.0%	22%	194	45,000	9,270,000	0.5%
Total Revenue					**202,818,333**	**100.0%**				**2,261,820,000**	**100.0%**
Average Purchasing Price (R/kg)			**508**					**538**			
Gross Margin			**86**	**85,737**	**28,861,362**			**39**	**39,063**	**213,648,050**	
					$7,215.34	**12.6%**				**$53,412.01**	**6.6%**

Source: Study Team Interviews

Table 106 Costs and Returns for Rice Milling – Average of Interviewed Millers in Battambang and Kampong Thom

Location		Battambang					Kampong Thom				
	Types of Products	**Recovery (%)**	**Quantity (Tonnes)**	**Unit Price (Riels)**	**Value**		**Recovery (%)**	**Quantity (Tonnes)**	**Unit Price (Riels)**	**Value**	
Expenses											
Paddy	IR				-	0.0%				-	0.0%
	Phkar Khnhey		1,500	560,000	563,333,333	28.9%		850	550,000	467,500,000	18.5%
	Somaly		1,000	583,333	583,333,333	24.1%		900	600,000	270,000,000	9.7%
	Neang Malis				-	0.0%				-	0.0%
	Mixed		4,250	510,000	1,475,000,000	41.8%		2,750	480,000	1,319,500,000	67.1%
Sub-total					**2,621,666,667**	**94.8%**				**2,057,000,000**	**95.4%**
Milling cost											
	Fuel cost		2,852	39,433	111,618,000	4.1%		1,920	32,500	61,200,000	3.3%
	Labor		2,852	404	1,046,320	0.0%		1,920	4,400	8,496,000	0.4%
	Sack & Bags		2,852	10,000	28,516,667	1.0%		1,920	9,300	18,252,000	0.8%
	Tax		2,852	152	393,127	0.0%		2,040	1,400	1,428,000	0.1%
	Other cost		-	-	-	0.0%		2,040	380	387,600	0.0%
Sub-total					**141,574,113**	**5.2%**				**89,763,600**	**4.6%**
Total Expenses					**2,763,240,780**	**100.0%**				**2,146,763,600**	**100.0%**
Revenue											
Paddy											
	IR				-	0.0%				-	0.0%
	Phkar Khnhey				-	0.0%				-	0.0%
	Somaly				-	0.0%				-	0.0%
	Neang Malis				-	0.0%				-	0.0%
	Mixed				-	0.0%				-	0.0%
Rice	IR				-	0.0%				-	0.0%
	Phkar Khnhey	61%	910	1,100,000	667,333,333	34.1%	0.5	360	1,025,000	387,000,000	15.6%
	Somaly	59.7%	597	1,200,000	716,000,000	29.5%	0.4	360	1,200,000	216,000,000	7.8%
	Neang Malis				-	0.0%				-	0.0%
	Mixed	60%	2,473	1,050,000	1,771,833,333	36.5%	50%	1,380	805,000	1,097,400,000	51.5%
By-Products	Broken Rice	10%	458	650,000	296,250,000	7.9%	13%	579	600,000	347,400,000	12.9%
	Bran	12%	590	566,667	342,000,000	8.4%	16%	690	550,000	379,500,000	14.7%
	Husk	19%	933	16,000	12,053,333	0.3%	21%	861	10,000	5,610,000	0.2%
Total Revenue					**3,805,470,000**	**100.0%**				**2,432,910,000**	**100.0%**
Average Purchasing Price (R/kg)			**548**					**501**			
Gross Margin			**213**	**213,483**	**1,042,229,220**			**71**	**70,677**	**286,146,400**	
					$260,557.31	**27.0%**				**$71,536.60**	**11.9%**

Source: Study Team Interviews

Table 107 Costs and Returns for Rice Milling – Average of Interviewed Millers

Location		Average				
	Types of Products	**Recovery (%)**	**Quantity (Tonnes)**	**Unit Price (Riels)**	**Value**	
Expenses						
Paddy	IR		867	346,667	132,800,000	4.5%
	Phkar Khnhey		1,175	555,000	262,500,000	12.4%
	Somaly		975	587,500	229,000,000	9.2%
	Neang Malis		15	433,333	2,800,000	1.4%
	Mixed		2,211	508,889	1,022,200,000	67.1%
Sub-total					**1,649,300,000**	**94.6%**
Milling cost						
	Fuel cost		1,564	33,130	52,804,300	4.1%
	Labor		1,564	1,898	2,539,556	0.2%
	Sack & Bags		1,564	9,095	14,889,175	1.0%
	Tax		1,538	448	497,642	0.0%
	Other cost		441	214	115,763	0.0%
Sub-total					**70,846,436**	**5.4%**
Total Expenses					**1,720,146,436**	**100.0%**
Revenue						
Paddy						
	IR		867	366,667	143,000,000	4.4%
	Phkar Khnhey				-	0.0%
	Somaly				-	0.0%
	Neang Malis		12	216,667	2,275,000	0.9%
	Mixed		540	232,000	156,600,000	9.4%
Rice	IR		-	-	-	0.0%
	Phkar Khnhey	0.555	635	1,062,500	277,600,000	13.4%
	Somaly	0.5475	538	1,200,000	258,000,000	10.4%
	Neang Malis	63%	2	383,333	690,000	0.3%
	Mixed	59%	1,084	892,222	926,570,000	51.2%
By-Products	Broken Rice	7%	267	625,000	166,866,000	6.2%
	Bran	12%	357	568,000	203,239,500	9.2%
	Husk	21%	512	16,500	6,592,000	0.2%
Total Revenue					**2,141,432,500**	**100.0%**
Average Purchasing Price (R/kg)			**525**			
Gross Margin			**112**	**111,714**	**421,286,065**	
					$105,321.52	**15.6%**

Source: Study Team Interviews

Table 108 Location of Sales by Millers - Value Chain Respondents

	Location	Kampong Speu			Svay Rieng		Battambang			Kampong Thom	
	Miller	1	2	3	1	2	1	2	3	1	2
% of Paddy Sales	Local Market		100%								
	Vietnam				100%	100%					
% of Rice Sales	Army									28%	
	Kampong Cham						25%				
	Local Market	100%	100%	100%	100%				20%	50%	
	Phnom Penh						50%	100%	80%		80%
	Police					15%				22%	
	Siem Reap						25%				
	Thailand										20%
	Vietnam					85%					
% of by-product Sales	Kampong Som		33%								
	Local Market	100%	66%	100%	100%	100%	100%	100%	84%	100%	100%
	Phnom Penh								16%		

Sales by Volume
Source: Study Team Field Work

Table 109 Moisture Meter Tests of Paddy Moisture – Selected Mills and Traders

Location	Sample1	Sample2	Sample3	Average
Battambang Province	13.4%	14.0%	13.7%	13.7%
	13.0%	13.2%	12.8%	13.0%
	12.5%	12.3%	12.5%	12.4%
	13.1%	12.9%	12.7%	12.9%
	12.0%	12.1%	12.0%	12.0%
	12.4%	12.7%	12.7%	12.6%
	11.5%	11.5%	11.6%	11.5%
	11.7%	11.6%	11.7%	11.7%
	12.7%	12.7%	12.7%	12.7%
	12.5%	12.4%	12.5%	12.5%
	11.7%	11.7%	11.8%	11.7%
Kampong Speu	18.3%	18.3%	17.8%	18.1%
	15.1%	14.6%	14.9%	14.9%
	14.3%	14.2%	14.5%	14.3%
	13.7%	13.2%	13.7%	13.5%
	13.4%	13.3%	13.2%	13.3%
	12.6%	12.9%	12.7%	12.7%
	13.6%	13.6%	13.8%	13.7%
	14.4%	14.2%	14.1%	14.2%
	14.7%	14.5%	14.3%	14.5%
	13.9%	13.5%	13.7%	13.7%
	14.3%	13.8%	13.9%	14.0%
Kampong Thom	13.7%	13.8%	13.1%	13.5%
	13.7%	13.8%	13.6%	13.7%
	14.4%	14.4%	14.6%	14.5%
	12.2%	12.2%	12.2%	12.2%
	12.4%	12.1%	12.4%	12.3%
	12.9%	12.6%	13.0%	12.8%

Table 110 Perceptions by Millers about Moisture Content of Paddy and Objective Measurement

Location	Paddy Variety	Source	Moisture %	
			Key Informant Perception	Moisture Meter Average (3 samples)
Kirireaksney Village	Neang Malis	Farmer Dried	14%	18.1
Kirireaksney Village	Mixed	Farmer Dried	15%	14.8
Krang Chhney	Mixed	Farmer Dried	17%	14.3
Samroung Torn District	Mixed	Farmer Dried	20%	14.5

Table 111 Trade Flows of Rice and Paddy

Area	From	To	Type	Kinds / Major variety
	Thailand	Phnom Penh	Rice	Thai Jasmine broken
Northwest Region	Battambang	Phnom Penh	Rice	Somely, Phaka Kagney, Neang Menh, Neang Khon
	Banteay Meanchey	Phnom Penh	Rice	Somely, Phaka Kagney, Neang Menh, Neang Khon
	Battambang	Seam Reap, Pursat, Kampong Chhnang	Rice and Paddy	Somely
	Banteay Meanchey	Thailand	Paddy	Somely, Domely
	Battambang	Thailand	Paddy	Somely
	Seam Reap	Kampong Cham	Rice and Paddy	Mixed
Central	Kampong Thum	Kampong Cham	Rice and Paddy	Mixed
Southeast Region	Takeo	Kampong Speu	Rice and Paddy	IR
	Kampong Speu	Phnom Penh	Rice and Paddy	IR, Mixed, Other Local Varieties
	Prey Veng	Kampong Cham	Rice and Paddy	Mixed
	Kampong Cham	Kratie	Rice and Paddy	IR, Mixed
	Takeo	Phnom Penh	Rice	IR, Phaka Kagney, Srov Krahome, Mixed
	Prey Veng	Phnom Penh	Rice	IR, Phaka Kagney, Srov Krahome, Mixed
	Takeo	Vietnam	Paddy	IR
	Prey Veng Phnom Penh	Vietnam Vietnam	Paddy Rice	IR Phaka Kagney

Source: (JICA 2001)

Table 112 Comparison of Retailers in Cambodia

	Retailer/ Market stall type	Retailer/Wholesaler Independent shop type	Wholesaler/Independent shop type
Phnom Penh			
Sell	20 – 200 kg/day	0.2 – 2 tonnes/day	40 – 200 tonnes/month
Stock	1 – 3 tonnes	10 – 30 tonnes	30 – 400 tonnes
Buy	500 kg – 5 tonnes	4 – 40 tonnes/time	40 tonne/time/miller
Siem Reap			
Sell	100 – 300 kg/day	8 – 15 tonnes/month	
Stock	0.2 – 3 tonnes	20 – 50 tonnes	
Buy	0.3 – 2 tonnes/time	2 – 5 tonnes/time/mill	
Kompong Cham			
Sell	50 – 150 kg/day	15 – 60 tonnes/month	
Stock	0.2 – 2 tonnes	10 – 30 tonnes	
Buy	0.3 – 2 tonnes/time	10 – 20 tonnes/time	

Source: (JICA 2001)

Table 113 Preferences for Different Varieties of Rice in Cambodia

Variety	Comments
Medium-High priced rice: Somaly, Phaka Kagney, Neang Khon, Neang Menh	1. These varieties are most commonly sold in the urban areas such as Phnom Penh and Sihanoukville where residents have the highest income level in the country. 2. In Phnom Penh, some wholesalers and retailers have No.1 and No.2, grades of Somaly and Phaka Kagney. The price difference between the grades is normally 100-200 Riel/kg. 3. The rice sellers evaluate the differences in grade depending on appearance (clearness) which comes from different degrees of milling, broken rice ration, or production area (i.e. taste). Although it appears that some common scale/sense of quality evaluation exist among the traders, no numerical indicator is used for grading.
Thai Broken rice	4. Sold at most rice shops in Phnom Penh. Consumers value this rice "It is soft and it maintain softness even when rice get cool". 5. In contrast, Cambodian rice "becomes hard when it is cool". Many local restaurants use Thai broken rice for blending with local rice to add fragrance and softness.
Medium-low priced rice: Local variety, Mixed rice, and IR	6. IR rice produced in the southern part of the country such as Takeo and Prey Veng is considered to taste not as good as other rice varieties. It is the cheapest rice in Cambodia. 7. IR rice is marketed mostly for factory lunch consumption and for low-income earners living in the outskirt of the Phnom Penh. IR rice is sold only at a few markets in the city center. 8. Phaka Kagney produced in Takeo is 100-150 Riel/kg cheaper than the same rice produced in Battambang, due to "hard taste".

Source: (JICA 2001)

Table 114 Preference Criteria for Purchasing Rice

Criteria	Average score	Order
Variety	1.596	1
Fragrance	2.324	2
Price	3.396	3
Whiteness	3.917	4
Production place	4.917	5
Shop recommendation	5.729	6
Broken rice	6.042	7

Source: (JICA 2001)

Table 115 Consumer and Restaurant Preferences for Rice - 2001

Variety	Consumers		Restaurants	
Phaka Kagney	73	48%	10	26%
Neang Minh	29	19%	6	15%
Somaly	19	12%	3	8%
Thai rice	10	7%	1	3%
Mix of Thai Jasmine + Local variety	-	-	8	21%
Srov Krahom	4	3%	-	-
Wet season mix rice	3	2%	2	5%
IR + State rice + Dry season rice	4	3%	0	0%
Other local variety	3	2%	8	21%
Neang Khon	-	-	0	0%
Neang Minh / Phaka Kagney / Somaly	8	5%	-	-
Don't know	-	-	1	3%
Respondents	153	100%	39	100%

Source: (JICA 2001)

Table 116 Marketing Costs and Margins for Rice, 1998

	Farmer	Miller	Wholesaler	Retailer	Total
Transport Cost	30	43.20			
Cleaning			11.78	5.77	
Handling		12.50	2.36	2.89	
Packaging		6.60	2.95	1.92	
Milling		4.50			
Tax and Levy		1.86		5.09	
Rent			8.84	5.77	
Invested Capital		14			
Input Cost		470	559.55	605.85	
Total Costs	**30**	**552.66**	**585.47**	**627.29**	
Price Received	470	559.55	605.85	663.55	
Value of By-Product		53.25			
Profit	**440**	**60.14**	**20.38**	**36.26**	
Marketing Margins	70.83%	13.50%	6.98%	8.70%	29.17%
Markup	0%	30.38%	28.90%	41.18%	

Riel per kg of Paddy Rice
Phaka Khgney Variety of Paddy, Battambang Millers, Transported to Phnom Penh
Conversion Factors: Paddy to Rice 0.589; Miller to Wholesaler Wastage 0.98
Derived From: (Agricultural Marketing Office 1998, Table 1 and pp. 10-11)

Table 117 Marketing Costs and Margins for Rice, 2002

	Inputs	Farmer	Collector	Miller	Transporter	Wholesaler	Retailer	Total
Transport Cost			15		26.5	10.00		
Operating Cost				34.22		6.03		
Input Cost		355.02	453.24	469.74	526.72	561.72	605.06	
Total Costs		**355**	**468**	**503.96**	**553.22**	**577.75**	**605.06**	
Price Received	355.02	453.24	469.74	526.72	561.72	605.06	625.06	
Value of By-Product				65.52				
Total Revenue	355.02	453.24	469.74	592.24	561.72	605.06	625.06	
	355	**98**	**1.5**	**88.3**	**8.5**	**27.3**	**20.0**	243.81
Profit		**21.7%**	**0.3%**	**14.9%**	**1.5%**	**4.5%**	**3.2%**	
Percent of Total Profit		**40%**	**0.62%**	**36%**	**3%**	**11%**	**8%**	100%
Marketing Margins	56.80%	15.71%	2.64%	9.12%	5.60%	6.93%	3.20%	27.49%
Markup over Farm Gate		0%	4%	31%	24%	33%	38%	

2 tonnes/ha yield, transport from Battambang to Phnom Penh
Riel per kg of Paddy Rice. Milling Recovery 0.64
Source: Derived from data colleted by (ACI 2002)

Table 118 Summary Table for Rice Marketing Margins – 1998 - 2002

Source	Inputs	Farmer	Collector	Miller	Transporter	Wholesaler	Retailer
ACI***	57%	16%	3%	9%	6%	7%	3%
	73%		12%		13%		
AMO* - Phaka Khgney		71%		13%		7%	9%
JICA** - Phaka Khgney	44%	30%		4%		16%	5%
JICA** - Neang Minh	51%	21%		6%		17%	5%

Sources:
*(Agricultural Marketing Office 1998, Table 1 and pp. 10-11)
** (JICA 2001)
*** (ACI 2002)

Table 119 Marketing Costs and Margins for Rice, 2006

	Inputs	Farmer	Collector	Miller	Transporter	Wholesaler	Retailer	Total
Transport Cost			20		60	10.00		
Operating Cost			5	49.64		6.03		
Input Cost		255.97	500.00	530.00	675.84	750.00	832.00	
Total Costs		**256**	**525**	**579.64**	**735.84**	**766.03**	**832.00**	
Price Received	255.97	500.00	530.00	675.84	750.00	832.00	896.00	
Value of By-Product		16.13		117.57				
Total Revenue	255.97	516.13	530.00	793.41	750.00	832.00	896.00	
Profit	**256**	**260**	**5.0**	**213.8**	**14.2**	**66.0**	**64.0**	623.06
		50.4%	**0.94%**	**26.9%**	**1.9%**	**7.9%**	**7.1%**	
Percent of Total Profit		**42%**	**0.80%**	**34%**	**2%**	**11%**	**10%**	100%
Marketing Margins	28.57%	29.04%	3.35%	16.28%	8.28%	9.15%	7.14%	42.40%
Markup over Farm Gate Price		3%	6.0%	59%	50%	66%	79%	

3 tonnes/ha yield, transport from Battambang to Phnom Penh
Riel per kg of Paddy Rice. Milling Recovery 0.64
Source: Derived from data colleted by the Consultant Team March-April 2006

Table 120 Major Constraints in the Cambodian Rice Sector

Limited Capacity of Domestic Absorption of Incremental Production	Cambodia has been in rice-surplus situation over the past 5 years. Considering the present high level of cereal consumption, there is not much scope of greater domestic absorption of increment production. At present, absorption of the rice surplus is highly dependent on neighboring countries, although its export is carried out informally.
Poor Marketing Infrastructure	In Cambodia the basic infrastructure required for improved economic activity is underdevelopment. The very poor condition of roads, such as NR5, NR6 and farm-to-market roads, is a serious obstacle to more efficient trade. Even with rehabilitation efforts, about half the length of national roads needs major improvement. Most provincial and tertiary roads are broken and damaged, with many being impassible during the rainy season. In urban areas, the run-down condition of most markets in terms of cleanliness, drainage and truck access is another major obstacle to efficient trading activity. Lack of nation-wide telecommunication system also hinders efficient trade activity. Although several mobile-phone networks have been developed, communication is still limited to urban areas and costly. Larger traders such as rice millers and wholesalers are equipped with ICON for local communication. But small-scale traders and farmers, even government offices in remote areas, lack effective means of communicating with urban areas.
Poor Financial Service System	Even the basic banking services being required for most business operations are currently unavailable in the provinces. Settlement of accounts between rice millers in the provinces and rice sellers in Phnom Penh are mostly done face to face. In some cases, informal remittance services of gold shops are used to settle accounts between provinces. Banks do no offer long term lending, and the maximum lending period is only 1 year. Although many NGOs provide minimum financial services in the countryside, no loan conditions meet the requirements of rice millers for renovation of their facilities or for procuring paddy.
Illegal fee collection	With police and army heading the list, government officials collect illegal fees from the private sector. These illegal fees increase marketing costs in addition to the difficulties in transportation due to poor road conditions. Illegal fees are routinely collected at the following places/phases of rice marketing; - Road fee collections at provincial towns, Phnom Penh city, Sihanouk Ville port and etc. - Fee collections at border areas. - Custom clearance and other exporting procedures
Restricted opportunities for farmers to see better buyers	Farmers often have limited outlets for their paddy and are often bound to sell to middleman because of poor condition of farm-to-markets road, and may include an element of credit provision by the middleman. Opportunities for farmers to see better buyers are restricted. Such opportunities are further hindered by the small quantities produced by most farmers.
Weak bargaining power of farmers	Despite the definite price order existing among rice/paddy varieties, the price difference of high and low quality varieties in rice mill buying prices, especially in Battambang, is relatively small compared to the price difference in urban markets. Price is always decided by negotiation, but the information resources available to farmers are limited. In most cases, a farmer gets price information from neighbors or buyer. Also, no numerical indicator is applied in paddy quality evaluation except a few rice millers in Battambang, and the farmer's capability to evaluate paddy quality is limited.
Weak marketing capability of rice millers	Northwest production areas such as Battambang and Banteay Meanchey have an established reputation for high quality (good taste) rice. It dominates the domestic high quality rice markets in Phnom Penh city and in some provincial towns. There are several other local varieties of high quality (good taste) in some other provinces around Phnom Penh. But the weak marketing capability of rice millers in these provinces hinders their expansion and outlets in Phnom Penh markets. This in turn limits the market for farmers.
Weak incentive for physical quality improvement	Based on income levels and buying power of consumers, the markets in urban and provincial towns have different needs. At lower buying power area such as Kampong Speu town, consumer needs are for cheap price. Therefore the physical quality is kept inferior level (high contents of small broken rice) deliberately to maintain a lower price for the consumer. On the other hands, in Phnom Penh, where consumers have the highest income levels in the country, consumer's first criteria for choosing rice is its variety and few complaints are raised about physical quality.
Constraints in Market Information Service	Difficulty in disseminating provincial information: Due to time limits of the MIS radio program, it is unable to disseminate all provincial information, and there exists a mismatch between what the farmers/traders want to know and the program content. Negotiations for 'free' broadcast with a private radio station in the provinces was attempted but so far none of them have successful. Duplication of data-gathering activity: Beside the AMO/AMFF, several governmental institutes, including MOC, also collect the marketing information of agricultural commodities. But there is no cooperation in data collection/exchange at present time. Scarce records for import and export: There are several export/import records available from the Custom Department/MOEF, Foreign Trade Department/MOC, Camcontrol and Port Authority. All these records are based on different sources of information and have no consistency with each other. In addition to their unreliability, the lack of border trade data is the biggest hindrance to estimate the national food balance and to formulate policies and intervention measures.
Weak Institutional Capacity	The institutional capacity for supporting the private sector is weak. Beside the constraints in MIS activity mentioned above, the lack of capable and experienced staff remains the biggest constraint of AMO/MAFF in providing marketing support to farmers and traders. Worse situation is encountered in MOC.
Unfair dealing in State rice procurement	Reportedly there are unfair dealings in the government's rice procurement for the army and police supply, and collusion in the WFP rice tender. These large quantities of rice procurement may influence the market prices. The government should have a mechanism such as Fair Trade Commission to supervise such large transactions to maintain fairness and transparency.
Rice Import by WFP	Although it may be cheaper to import rice from neighboring countries when the need arises, it would be desirable for donors, including WFP, to purchase local rice surplus for internal transfers to deficit areas. Apart from cost savings, this would help support prices in surplus areas in Cambodia.

Source: (JICA 2001)

Table 121 Major Constraints in the Farming Sector

Constraint	Nature of constraint(s)
1. Seed Constraints	Maintenance of breeder stock requires significant public investment that can be undermined by commercial pressures for breeding centers to be financially viable
2. Land Tenure Constraints	Limited tenure rights (less than 10 percent of farmers hold land titles) discourages investment in agricultural land.
3. Fertilizer and Pesticide Constraints	Access to fertilizer and pesticides among small-scale farmers is extremely limited due to income and credit constraints, resulting in sub-optimal use of fertilizer. Knowledge of appropriate input usage technology also limited.
4. Irrigation Constraints	Lack of irrigation in many areas reduces the productivity of rice. Where irrigation is present, operation of water user groups replete with politicization and free rider effects.
5. Profitability Constraints	In many areas rice production is a marginally profitable activity due to technical factors such as climate and soil fertility/salinity
6. Credit Constraints	There is a lack of access to credit and other financial services in rural areas. Even when credit is available commercial lending requirements dictate that loans are not tailored to agricultural activities or the seasonal nature of agricultural production. Credit application procedures are complex and not tailored to small loans sizes for inputs. Farmers find it difficult to access loans for emergency cash purposes and have to resort to high interest loans from moneylenders.

Source: (ACI 2002)

Table 122 Major Constraints in the Milling Sector

Constraint	Nature of constraint(s)
1. Lack of Working Capital	There is a lack of working capital among millers for purchases of paddy at harvest time, due to cash purchases of paddy and sales of milled rice on credit. As a result, rice mills are often idled for periods of time, limiting the amount of paddy that can be domestically milled. Limited capital also precludes improvement in milling technology and expansion in milling capacity.
1. Low Paddy Quality	Millers are constrained by poor paddy quality, in the form of mixed varieties of seeds from farmers and/or traders and inadequate post-harvest handling (particularly drying). This results in high levels of broken rice and limits entry in world markets.
2. Low Levels of Milling Technology	The majority of mills use old equipment from Viet Nam and China that is inadequate for sophisticated sorting of varieties and results in higher levels of broken rice than more modern machines.
3. Lack of Market Access	Rice millers have limited access to foreign markets, due to the inability to produce consistent amounts of standardized varieties of milled rice. Market access is also compromised by limited information about foreign market conditions and competitive factors.

Source: (ACI 2002)

Table 123 Major Constraints in the Retail Sector

Constraint	Nature of constraint(s)
1. Poor Marketing and Distribution Systems	The distribution of rice is hampered by an inadequate infrastructure and distribution network, which hampers the ability of retailers to obtain rice, particularly in remote provinces.
2. Low Margins in Retail Sector	Retailers receive low margins on rice sales, due to significant competition among rice retailers and limited competition among distributors.

Source: (ACI 2002)

Table 124 Major Constraints in the Export Sector

Constraint	Nature of constraint(s)
1. High Transactions Costs/Lack of Transparency	Exports are constrained by numerous transactions costs in transportation and port charges. Nearly 50 percent of transportation fees are unofficial costs. Port charges and procedures lack transparency and add sizable costs to exports. These unofficial and other costs significantly impede the competitiveness of rice in world markets.
2. Limited Volumes of Standardized Qualities of Milled Rice	Exports are limited by the inability of exporters to obtain consistent amounts of a standardized quality of milled rice.
3. Poor Infrastructure	Exporters are constrained by poor road and rail infrastructure that limits the ability to procure paddy from remote areas and efficiently transport rice exports to world markets.

Source: (ACI 2002)

Table 125 Priority Constraints as indicated by the stakeholders

	Priority 1 Constraint	Priority 2 Constraint	Priority 3 Constraint	Priority 4 Constraint
Farmers	Irrigation and Water Management	Technology	Marketing	
Traders	Marketing	Quality	Capital	Technology
Millers	Marketing	Capital	Competition	
Processors	Quality	Technology	Marketing	Capital
Other Stakeholders (Provincial Departments, NGO,MFI)	Technology	Irrigation and Water Management	Coordination	Marketing

Source: Diagnostic Study Fieldwork

Table 126 Comparison of Gross Margins Per Hectare by Farm Size and Agroecological Zone for Vegetables

Crop	Farm Size	North-East (Ratnakiri)	North-East (Kratie)	Coastal (Sihanoukville)	Coastal (Kampot)	Tonle Sap (Battambang)	Tonle Sap (Pursat)	Mekong (K.cham, K. speu)
Sesame	Small	704	896					
	Medium		375					
	Large		275.75					
White Yam	Small		272					
	Medium		139					
	Large							
Cucumber	Small			559		415.5	466	
	Medium					330	1100	
	Large						134	
Long bean	Small			1196			962	
	Medium						223	
	Large							
Lettuce	Small			1797		915.8125	960	
	Medium						1694	
	Large							
Peanut	Small	103	165			37	73	
	Medium	315	338			249	353	
	Large							
Watermelon	Small			919	1773	1144.875	660	
	Medium			77			511	
	Large							
Cabbage	Small					2150.188	387	
	Medium						314	
	Large							

Crops vary by location. Some crops are dominant in certain areas while others do not have significant presence.
Farm data not available for all three farm size categories for all crops.
Farm Size: Small = <3.0 ha; Medium = 3-10 ha; Large = >10ha
Source: (ACI 2005)

Table 127 Partial Budget for White Yam (Kratie Province, Northeast Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	10	155000	1550000	t	9.245	120000	1109400				
By product (fodder)	t			0	t			0				
Revenue	riels			1550000	riels			1109400				
Seeds/Seedlings	kg	15	1250	18750	kg	25	3212.5	80312.5				
Fertilizer	kg			0	kg			0				
Pump hire/irrigation or fuel	liter			0	hr			0				
Farm chemicals	liter			0	liter			0				
Other inputs	kg			0								
Tractor/bullock hire	ha	1	220000	220000	ha	1	140000	140000				
Total material costs	riels			238750	riels			220312.5				
Land preparation	md	0		0	md	4	5000	20000				
Planting	md	10	5000	50000	md	24	5000	120000				
Weeding	md	15	5000	75000	md	20	5000	100000				
Irrigation/water management	md			0	md			0				
Other application	md			0	md			0				
Harvest	md	15	5000	75000	md	17	5000	85000				
Threshing/winnowing												
Transport	md	5	5000	25000	md	2	5000	10000				
Total labor cost				225000				335000				
Total costs	riels/ha			463750	riels/ha			555312.5				
Total revenue-total cost	riels/ha			1086250	riels/ha			554087.5				
Total revenue-total cost	**$/ha**			**272**	**$/ha**			**139**				

Source: (ACI 2005)

Table 128 Partial Budget for Cucumber (Sihanoukville Province, Coastal Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	12	250000	3000000								
By product (fodder)	t			0								
Revenue	riels			3000000								
Seeds/Seedlings	kg	1.5	15000	22500								
Fertilizer	kg			0								
Other inputs	kg	1500	20	30000								
Pump hire/irrigation	hr	60	5000	300000								
Farm chemicals	liter	2	20000	40000								
Tractor/bullock hire	ha			0								
Total material costs	riels			392500								
Land preparation	md	6	8000	48000								
Planting	md	25	4000	100000								
Weeding	md	15	4000	60000								
Irrigation/water management	md	2	4000	8000								
Other application	md	15	4000	60000								
Harvest	md	20	4000	80000								
Threshing/winnowing												
Transport	md	4	4000	16000								
Total labor cost				372000								
Total costs	riels/ha			764500								
Total revenue-total cost	riels/ha			2235500								
Total revenue-total cost	**$/ha**			**559**								

Source: (ACI 2005)

Table 129 Partial Budget for Cucumber (Pursat Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	12	200000	2400000	t	10.15	500000	5075000	t	5	200000	1000000
By product (fodder)	t			0	t			0	t			0
Revenue	riels			2400000	riels			5075000	riels			1000000
Seeds/Seedlings	kg	2.5	60000	150000	kg	1.5	50000	75000	kg	2	40000	80000
Fertilizer	kg			0	kg	100	1300	130000	kg			0
Pump hire/irrigation	hr			0	hr	36	5500	198000	hr			0
Farm chemicals	liter			0	liter			0	liter			0
Tractor/bullock hire	ha	1	140000	140000	ha	1	85000	85000	ha	1	130000	130000
Total material costs	riels			290000	riels			488000	riels			210000
Land preparation	md			0	md			0	md			0
Planting	md	5	5750	28750	md	12	4000	48000	md	13	5000	65000
Weeding	md	4	5750	23000	md	2	4000	8000	md	4	5000	20000
Irrigation/water management	md	29	5750	166750	md	10	4000	40000	md	30	5000	150000
Other application	md	0		0	md	2	3000	6000	md	0		0
Harvest	md	5	5750	28750	md	18	4000	72000	md	3	5000	15000
Threshing/winnowing												
Transport	md	0	5750	0	md	3	4000	12000	md	1	5000	5000
Total labor cost				247250				186000				255000
Total costs	riels/ha			537250	riels/ha			674000	riels/ha			465000
Total revenue-total cost	riels/ha			1862750	riels/ha			4401000	riels/ha			535000
Total revenue-total cost	**$/ha**			**466**	**$/ha**			**1100**	**$/ha**			**134**

Source: (ACI 2005)

Table 130 Partial Budget for Cucumber (Battambang Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	11	250000	2750000	t	7.666	300000	2299800				
By product (fodder)	t			0	t			0				
Revenue	riels			2750000	riels			2299800				
Seeds/Seedlings	kg	2	44000	88000	kg	4.5	31750	142875				
Fertilizer	kg	150	1350	202500	kg	100	1400	140000				
Pump hire/irrigation	hr	45	7000	315000	hr	70	5500	385000				
Farm chemicals	liter	1	25000	25000	liter			0				
Tractor/bullock hire	ha	1	100000	100000	ha	1	80000	80000				
Total material costs	riels			730500	riels			747875				
				0								
Land preparation	md			0	md			0				
Planting	md	15	4500	67500	md	20	4000	80000				
Weeding	md	3	5000	15000	md	2	4000	8000				
Irrigation/water management	md	8	5000	40000	md	5	4000	20000				
Other application	md	4	5000	20000	md	2	4000	8000				
Harvest	md	35	5000	175000	md	21	4000	84000				
Threshing/winnowing												
Transport	md	8	5000	40000	md	8	4000	32000				
Total labor cost				357500				232000				
Total costs	riels/ha			1088000	riels/ha			979875				
Total revenue-total cost	riels/ha			1662000	riels/ha			1319925				
Total revenue-total cost	**$/ha**			**416**	**$/ha**			**330**				

Source: (ACI 2005)

Table 131 Partial Budget for Long Bean (Sihanoukville Province, Coastal Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	8	700000	5600000								
By product (fodder)	t			0								
Revenue	riels			5600000								
Seeds/Seedlings	kg	15	3500	52500								
Fertilizer	kg	50	1200	60000								
Pump hire/irrigation or fuel	liter	60	2000	120000								
Farm chemicals	liter	2.5	25000	62500								
Other inputs	kg	1000	20	20000								
Tractor/bullock hire	ha			0								
Total material costs	riels			315000								
Land preparation	md	8	8000	64000								
Planting	md	20	4000	80000								
Weeding	md	20	4000	80000								
Irrigation/water management	md	24	4000	96000								
Other application	md	15	4000	60000								
Harvest	md	25	4000	100000								
Threshing/winnowing												
Transport	md	5	4000	20000								
Total labor cost				500000								
Total costs	riels/ha			815000								
Total revenue-total cost	riels/ha			4785000								
Total revenue-total cost	**$/ha**			**1196**								

Source: (ACI 2005)

Table 132 Partial Budget for Long Bean (Pursat Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	8.5	500000	4250000	t	2.6333	583333	1536091				
By product (fodder)	t			0	t			0				
Revenue	riels			4250000	riels			1536091				
Seeds/Seedlings	kg	4	1500	6000	kg	3.33	3457	11511.81				
Fertilizer	kg	0		0	kg	85	1375	116875				
Pump hire/irrigation	hr	0		0	hr	37	5750	212750				
Farm chemicals	liter	0		0	liter	1	24000	24000				
Tractor/bullock hire	ha	0		0	ha	1	100000	100000				
Total material costs	riels			6000	riels			465136.8				
				0								
Land preparation	md	10	5750	57500	md	0		0				
Planting	md	17	5750	97750	md	13	4333	56329				
Weeding	md	5	5750	28750	md	1	4500	4500				
Irrigation/water management	md	32	5750	184000	md	12	4333	51996				
Other application	md	0		0	md	2	4000	8000				
Harvest	md	5	5750	28750	md	9.33	4333	40426.89				
Threshing/winnowing												
Transport	md	0		0	md	3.67	4333	15902.11				
Total labor cost				396750				177154				
Total costs	riels/ha			402750	riels/ha			642290.8				
Total revenue-total cost	riels/ha			3847250	riels/ha			893800				
Total revenue-total cost	**$/ha**			**962**	**$/ha**			**223**				

Source: (ACI 2005)

Table 133 Partial Budget for Lettuce (Sihanoukville Province, Coastal Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	15.3	500000	7650000								
By product (fodder)	t			0								
Revenue	riels			7650000								
Seeds/Seedlings	kg	30	7500	225000								
Fertilizer	kg	50	1200	60000								
Pump hire/irrigation	hr			0								
Farm chemicals	liter			0								
Tractor/bullock hire	ha			0								
Total material costs	riels			285000								
				0								
Land preparation	md	10	7000	70000								
Planting	md	3	5000	15000								
Weeding	md	5	5000	25000								
Irrigation/water management	md	3	6000	18000								
Other application	md	2	5000	10000								
Harvest	md	3	5000	15000								
Threshing/winnowing												
Transport	md	5	5000	25000								
Total labor cost				178000								
Total costs	riels/ha			463000								
Total revenue-total cost	riels/ha			7187000								
Total revenue-total cost	**$/ha**			**1797**								

Source: (ACI 2005)

Table 134 Partial Budget for Lettuce (Pursat Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	15.3	300000	4590000	t	15	500000	7500000				
By product (fodder)	t			0	t			0				
Revenue	riels			4590000	riels			7500000				
Seeds/Seedlings	kg	15	23000	345000	kg	30	7000	210000				
Fertilizer	kg			0	kg			0				
Pump hire/irrigation	hr			0	hr			0				
Farm chemicals	liter			0	liter			0				
Tractor/bullock hire	ha	1	130000	130000	ha	1	140000	140000				
Total material costs	riels			475000	riels			350000				
Land preparation	md			0	md			0				
Planting	md	15	5000	75000	md	16	5750	92000				
Weeding	md	4	5000	20000	md	5	5750	28750				
Irrigation/water management	md	32	5000	160000	md	38	5750	218500				
Other application	md			0	md			0				
Harvest	md	3	5000	15000	md	5	5750	28750				
Threshing/winnowing												
Transport	md	1	5000	5000	md	1	5750	5750				
Total labor cost				275000				373750				
Total costs	riels/ha			750000	riels/ha			723750				
Total revenue-total cost	riels/ha			3840000	riels/ha			6776250				
Total revenue-total cost	**$/ha**			**960**	**$/ha**			**1694**				

Source: (ACI 2005)

Table 135 Partial Budget for Lettuce (Battambang Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	8	550000	4400000								
By product (fodder)	t			0								
Revenue	riels			4400000								
Seeds/Seedlings	kg	20	20000	400000								
Fertilizer	kg			0								
Pump hire/irrigation	hr			0								
Farm chemicals	liter			0								
Tractor/bullock hire	ha	1	63750	63750								
Total material costs	riels			463750								
				0								
Land preparation	md			0								
Planting	md	12	5250	63000								
Weeding	md			0								
Irrigation/water management	md	28	5250	147000								
Other application	md			0								
Harvest	md	12	5250	63000								
Threshing/winnowing												
Transport	md	0		0								
Total labor cost				273000								
Total costs	riels/ha			736750								
Total revenue-total cost	riels/ha			3663250								
Total revenue-total cost	**$/ha**			**916**								

Source: (ACI 2005)

Table 136 Partial Budget for Peanut (Ratanakiti Province, Northeast Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	0.8	1000000	800000	t	1.3	1300000	1690000				
By product (fodder)	t			0	t			0				
Revenue	riels			800000	riels			1690000				
Seeds/Seedlings	kg	40	2500	100000	kg	50	1800	90000				
Fertilizer	kg			0	kg			0				
Pump hire/irrigation	hr			0	hr			0				
Farm chemicals	liter			0	liter			0				
Tractor/bullock hire	ha	1	114000	114000	ha	1	105000	105000				
Total material costs	riels			214000	riels			195000				
				0								
Land preparation	md	1	5000	5000	md	5	5000	25000				
Planting	md	20	5000	100000	md	20	5000	100000				
Weeding	md	2	5000	10000	md	3	5000	15000				
Irrigation/water management	md			0	md			0				
Other application	md			0	md			0				
Harvest	md	10	5000	50000	md	15	5000	75000				
Threshing/winnowing												
Transport	md	2	5000	10000	md	4	5000	20000				
Total labor cost				175000				235000				
Total costs	riels/ha			389000	riels/ha			430000				
Total revenue-total cost	riels/ha			411000	riels/ha			1260000				
Total revenue-total cost	**$/ha**			**103**	**$/ha**			**315**				

Source: (ACI 2005)

Table 137 Partial Budget for Peanut (Kratie Province, Northeast Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	1	1000000	1000000	t	2.25	850000	1912500				
By product (fodder)	t			0	t			0				
Revenue	riels			1000000	riels			1912500				
Seeds/Seedlings	kg	50	2000	100000	kg	30	1400	42000				
Fertilizer	kg	0		0	kg			0				
Pump hire/irrigation	hr	0		0	hr			0				
Farm chemicals	liter	0		0	liter			0				
Tractor/bullock hire	ha	0		0	ha	1	220000	220000				
Total material costs	riels			100000	riels			262000				
				0								
Land preparation	md	3	5600	16800	md	0		0				
Planting	md	25	5600	140000	md	20	5000	100000				
Weeding	md	2	5600	11200	md	25	5000	125000				
Irrigation/water management	md			0	md			0				
Other application	md			0	md			0				
Harvest	md	11	5600	61600	md	10	5000	50000				
Threshing/winnowing												
Transport	md	2	5600	11200	md	5	5000	25000				
Total labor cost				240800				300000				
Total costs	riels/ha			340800	riels/ha			562000				
Total revenue-total cost	riels/ha			659200	riels/ha			1350500				
Total revenue-total cost	**$/ha**			**165**	**$/ha**			**338**				

Source: (ACI 2005)

Table 138 Partial Budget for Peanut (Pursat Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	1.5	450000	675000	t	4	450000	1800000				
By product (fodder)	t			0	t			0				
Revenue	riels			675000	riels			1800000				
Seeds/Seedlings	kg	22	2200	48400	kg	26	3500	91000				
Fertilizer	kg			0	kg			0				
Pump hire/irrigation	hr			0	hr			0				
Farm chemicals	liter			0	liter			0				
Tractor/bullock hire	ha	1	130000	130000	ha	1	140000	140000				
Total material costs	riels			178400	riels			231000				
				0								
Land preparation	md			0	md			0				
Planting	md	11	5000	55000	md	12	5750	69000				
Weeding	md	8	5000	40000	md	9	5750	51750				
Irrigation/water management	md			0	md			0				
Other application	md			0	md			0				
Harvest	md	20	5000	100000	md	5	5750	28750				
Threshing/winnowing												
Transport	md	2	5000	10000	md	1	5750	5750				
Total labor cost				205000				155250				
Total costs	riels/ha			383400	riels/ha			386250				
Total revenue-total cost	riels/ha			291600	riels/ha			1413750				
Total revenue-total cost	**$/ha**			**73**	**$/ha**			**353**				

Source: (ACI 2005)

Table 139 Partial Budget for Peanut (Battambang Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	0.6	500000	300000	t	1.3	1300000	1690000				
By product (fodder)	t			0	t			0				
Revenue	riels			300000	riels			1690000				
Seeds/Seedlings	kg	20	2400	48000	kg	30	2300	69000				
Fertilizer	kg	0		0	kg	140	1350	189000				
Pump hire/irrigation	hr			0	hr	38	7000	266000				
Farm chemicals	liter			0	liter	1.5	24500	36750				
Tractor/bullock hire	ha	1	63750	63750	ha	1	70000	70000				
Total material costs	riels			111750	riels			630750				
				0								
Land preparation	md			0	md			0				
Planting	md	1	5750	5750	md	2.5	4000	10000				
Weeding	md	5	5750	28750	md	3	4000	12000				
Irrigation/water management	md	0		0	md	6	4000	24000				
Other application	md			0	md	2	4000	8000				
Harvest	md			0	md			0				
Threshing/winnowing		27	5750			26	4000					
Transport	md	1	5750	5750	md	2	4000	8000				
Total labor cost				40250				62000				
Total costs	riels/ha			152000	riels/ha			692750				
Total revenue-total cost	riels/ha			148000	riels/ha			997250				
Total revenue-total cost	**$/ha**			**37**	**$/ha**			**249**				

Source: (ACI 2005)

Table 140 Partial Budget for Watermelon (Kampot Province, Coastal Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	15	500000	7500000								
By product (fodder)	t			0								
Revenue	riels			7500000								
Seeds/Seedlings	can	4	20000	80000								
Fertilizer	bag	1	62000	62000								
Pump hire/irrigation	hr			0								
Farm chemicals	liter	0.5	15000	7500								
Tractor/bullock hire	ha	1	100000	100000								
Total material costs	riels			249500								
Land preparation	md			0								
Planting	md	10	4000	40000								
Weeding	md	5	4000	20000								
Irrigation/water management	md			0								
Other application	md	5	4000	20000								
Harvest	md	10	4000	40000								
Threshing/winnowing												
Transport	md	10	4000	40000								
Total labor cost				160000								
Total costs	riels/ha			409500								
Total revenue-total cost	riels/ha			7090500								
Total revenue-total cost	**$/ha**			**1773**								

Source: (ACI 2005)

Table 141 Partial Budget for Watermelon (Sihanoukvillet Province, Coastal Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	10	450000	4500000	t	6	200000	1200000				
By product (fodder)	t			0	t			0				
Revenue	riels			4500000	riels			1200000				
Seeds/Seedlings	can	4	20000	80000	kg	4	45000	180000				
Fertilizer	kg	100	1200	120000	kg	300	1200	360000				
Orvanic manure	cart	24	1800	43200	cart	10	3000	30000				
Pump hire/irrigation	hr			0	hr			0				
Farm chemicals	liter	2	28000	56000	liter	6	8700	52200				
Tractor/bullock hire	ha	1	150000	150000	ha	1	130000	130000				
Total material costs	riels			449200	riels			752200				
				0								
Land preparation	md	5	15000	75000	md	0		0				
Planting	md	15	6000	90000	md	10	3000	30000				
Weeding	md	5	6000	30000	md	0		0				
Irrigation/water management	md			0	md			0				
Other application	md	5	6000	30000	md	10	6000	60000				
Harvest	md	15	6000	90000	md	5	6000	30000				
Threshing/winnowing												
Transport	md	10	6000	60000	md	3	6000	18000				
Total labor cost				375000				138000				
Total costs	riels/ha			824200	riels/ha			890200				
Total revenue-total cost	riels/ha			3675800	riels/ha			309800				
Total revenue-total cost	**$/ha**			**919**	**$/ha**			**77**				

Source: (ACI 2005)

Table 142 Partial Budget for Watermelon (Pursat Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	10	300000	3000000	t	8	300000	2400000				
By product (fodder)	t			0	t			0				
Revenue	riels			3000000	riels			2400000				
Seeds/Seedlings	kg	1.5	24000	36000	kg	1.2	35000	42000				
Fertilizer	kg	0		0	kg			0				
Pump hire/irrigation	hr			0	hr			0				
Farm chemicals	liter	0		0	liter			0				
Tractor/bullock hire	ha	1	150000	150000	ha	1	130000	130000				
Total material costs	riels			186000	riels			172000				
Land preparation	md			0	md			0				
Planting	md	7	5750	40250	md	15	5000	75000				
Weeding	md	14	5750	80500	md	15	5000	75000				
Irrigation/water management	md			0	md			0				
Other application	md			0	md			0				
Harvest	md	5	5750	28750	md	4	5000	20000				
Threshing/winnowing												
Transport	md	4	5750	23000	md	3	5000	15000				
Total labor cost				172500				185000				
Total costs	riels/ha			358500	riels/ha			357000				
Total revenue-total cost	riels/ha			2641500	riels/ha			2043000				
Total revenue-total cost	**$/ha**			**660**	**$/ha**			**511**				

Source: (ACI 2005)

Table 143 Partial Budget for Watermelon (Battambang Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	12	417000	5004000								
By product (fodder)	t			0								
Revenue	riels			5004000								
Seeds/Seedlings	kg	2.5	50000	125000								
Fertilizer	kg			0								
Pump hire/irrigation	hr			0								
Farm chemicals	liter	0		0								
Tractor/bullock hire	ha	1	63750	63750								
Total material costs	riels			188750								
				0								
Land preparation	md			0								
Planting	md	13	5750	74750								
Weeding	md	11	5750	63250								
Irrigation/water management	md			0								
Other application	md	5	5750	28750								
Harvest	md	8	5750	46000								
Threshing/winnowing												
Transport	md	4	5750	23000								
Total labor cost				235750								
Total costs	riels/ha			424500								
Total revenue-total cost	riels/ha			4579500								
Total revenue-total cost	**$/ha**			**1145**								

Source: (ACI 2005)

Table 144 Partial Budget for Cabbage (Pursat Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	4	500000	2000000	t	3	600000	1800000				
By product (fodder)	t			0	t			0				
Revenue	riels			2000000	riels			1800000				
Seeds/Seedlings	kg	1	16000	16000	kg	2	15000	30000				
Fertilizer	kg	0		0	kg	150	1500	225000				
Pump hire/irrigation	hr	0		0	hr	15	5000	75000				
Farm chemicals	liter			0	liter			0				
Tractor/bullock hire	ha	1	130000	130000	ha	1	85000	85000				
Total material costs	riels			146000	riels			415000				
Land preparation	md			0	md			0				
Planting	md	16	5000	80000	md	7	4000	28000				
Weeding	md	2	5000	10000	md	3	4000	12000				
Irrigation/water management	md	38	5000	190000	md	2	4000	8000				
Other application	md	0		0	md	1	4000	4000				
Harvest	md	3	5000	15000	md	15	4000	60000				
Threshing/winnowing												
Transport	md	2	5000	10000	md	4	4000	16000				
Total labor cost				305000				128000				
Total costs	riels/ha			451000	riels/ha			543000				
Total revenue-total cost	riels/ha			1549000	riels/ha			1257000				
Total revenue-total cost	**$/ha**			**387**	**$/ha**			**314**				

Source: (ACI 2005)

Table 145 Partial Budget for Cabbage (Battambang Province, Tonle Sap Zone)

Revenue/Costs	Small				Medium				Large			
	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount	Unit	Qty	Rate	Amount
Main product	t	11.125	850000	9456250								
By product (fodder)	t			0								
Revenue	riels			9456250								
Seeds/Seedlings	kg	1	62000	62000								
Fertilizer	kg	150	1350	202500								
Pump hire/irrigation	hr	50	5500	275000								
Farm chemicals	liter	1	28000	28000								
Tractor/bullock hire	ha	1	80000	80000								
Total material costs	riels			647500								
				0								
Land preparation	md			0								
Planting	md	10	4000	40000								
Weeding	md	1	4000	4000								
Irrigation/water management	md	6	4000	24000								
Other application	md	3	4000	12000								
Harvest	md	15	4000	60000								
Threshing/winnowing												
Transport	md	17	4000	68000								
Total labor cost				208000								
Total costs	riels/ha			855500								
Total revenue-total cost	riels/ha			8600750								
Total revenue-total cost	**$/ha**			**2150**								

Source: (ACI 2005)

Table 146 Costs and Returns for Vegetable Production in Cambodia – Kampong Speu Province

Type of Vegetable		Cauliflower				Watermelon			
Revenue/Costs	**Unit**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**		**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**	
Main Product	tonnes	3.571	2,700,000	9,641,700		10	200,000	2,000,000	
By product	tonnes								
Total revenue				**9,641,700**				**2,000,000**	
Material cost									
Seeds/seedlings	kg	0.357	6,500,000	2,320,500	26.4%			80,000	7.2%
Fuel	litre			0	0.0%				0.0%
Fertilizer	kg			0	0.0%			340,000	30.4%
Pump hire/irrigation	hr			0	0.0%			40,000	3.6%
Farm chemicals	litre			0	0.0%			108,000	9.7%
Tractor/bullock hire	ha			0	0.0%			330,000	29.5%
Farm machinery hire	Riels			0	0.0%				0.0%
Other material costs	Riels			0	0.0%				0.0%
Total material costs				**2,320,500**	**26.4%**			**898,000**	**80.3%**
Labor costs									
Nursery plot establishment	pd	11	5,000	55,000	0.6%				0.0%
Land preparation	pd	357	5,000	1,785,000	20.3%	included in tractor			0.0%
Transplanting	pd	89	5,000	445,000	5.1%	15	5,000	75,000	6.7%
Broadcasting	pd			0	0.0%				0.0%
Weeding	pd	178	5,000	890,000	10.1%	15	5,000	75,000	6.7%
Irrigation	pd	225	5,000	1,125,000	12.8%	4	4,000	40,000	3.6%
Fertilizer	pd	178	5,000	890,000	10.1%				0.0%
Pesticide/herbicide	pd	214	5,000	1,070,000	12.2%	6	5,000	30,000	2.7%
Harvesting	pd	44.6	5,000	223,000	2.5%	by traders			0.0%
Post Harvest	pd			0	0.0%				0.0%
Other cost	pd			0	0.0%				0.0%
Total labor cost				**6,483,000**	**73.6%**			**220,000**	**19.7%**
Total costs	Riels/ha			**8,803,500**	**100.0%**			**1,118,000**	**100.0%**
Gross Margin	Riels/ha			**838,200**				**882,000**	
	$/ha			**210**				**221**	
Gross Margin % (incl Labor)				**9%**				**44%**	
Gross Margin % (excl Labor)				**76%**				**55%**	

Costs and Returns per hectare
Source: Study Team Value Chain Questionnaire

Table 147 Costs and Returns for Vegetable Production in Cambodia – Selected Provinces

Location Type of Vegetable		Svay Rieng Convolvulus				Kampong Thom Watermelon				Kampong Thom Cabbage			
Revenue/Costs	**Unit**	**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**		**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**		**Quantity**	**Rate (Riel/unit)**	**Amount (Riel)**	
Main Product	tonnes	24	500,000	12,000,000				4,200,000				7,500,000	
By product	tonnes			0								50,000	
Total revenue				**12,000,000**				**4,200,000**				**7,550,000**	
Material cost													
Seeds/seedlings	kg	50	6,500	325,000	11.8%	5	20,000	100,000	5.9%			140,000	7.7%
Fuel	litre			0	0.0%			-	0.0%			360,000	19.7%
Fertilizer	kg	70	900	63,000	2.3%			608,000	35.6%			400,000	21.9%
Pump hire/irrigation	hr			0	0.0%			380,000	22.3%			-	0.0%
Farm chemicals	litre			0	0.0%			100,000	5.9%			250,000	13.7%
Tractor/bullock hire	ha			0	0.0%			-	0.0%			-	0.0%
Farm machinery hire	Riels			0	0.0%			0	0.0%			40,000	2.2%
Other material costs	Riels			0	0.0%	digging open well		157,500	9.2%			-	0.0%
Total material costs				**388,000**	**14.0%**			**1,345,500**	**78.9%**			**1,190,000**	**65.0%**
Labor costs													
Nursery plot establishment	pd	50	5,000	250,000	9.0%				0.0%				0.0%
Land preparation	pd	50	5,000	250,000	9.0%			80,000	4.7%			140,000	7.7%
Transplanting	pd	50	5,000	250,000	9.0%	16	5,000	80,000	4.7%			200,000	10.9%
Broadcasting	pd			0	0.0%			-	0.0%			-	0.0%
Weeding	pd			0	0.0%	8	10,000	80,000	4.7%			300,000	16.4%
Irrigation	pd	150	5,000	750,000	27.1%			-	0.0%			-	0.0%
Fertilizer	pd	25	5,000	125,000	4.5%			-	0.0%			-	0.0%
Pesticide/herbicide	pd			0	0.0%			120,000	7.0%			-	0.0%
Harvesting	pd	150	5,000	750,000	27.1%	by traders		-	0.0%	by traders		-	0.0%
Post Harvest	pd			0	0.0%			-	0.0%			-	0.0%
Other cost	pd			0	0.0%			-	0.0%			-	0.0%
Total labor cost				**2,375,000**	**86.0%**			**360,000**	**21.1%**			**640,000**	**35.0%**
Total costs	Riels/ha			**2,763,000**	**100.0%**			**1,705,500**	**100.0%**			**1,830,000**	**100.0%**
Gross Margin	Riels/ha			**9,237,000**				**2,494,500**				**5,720,000**	
	$/ha			**2,309.25**				**624**				**1,430**	
Gross Margin % (incl Labor)				**77%**				**59%**				**76%**	
Gross Margin % (excl Labor)				**97%**				**68%**				**84%**	

Costs and Returns per hectare
Source: Study Team Value Chain Questionnaire

Table 148 Input Dealers Business Characteristics

Product Category	No of Input dealers active	Average daily Sales	Average daily Income Riel	Average Profit/kg Riel
Seed	2	NA[51]	20,000	NA
Fertilizer	5	1521 kg	65,000	43 Riel/kg
Pesticide	5	68 l	23,000	340 Riel/kg

Source: (Ypma 2005)

Table 149 Farmer Availability and Preference ranking

Crop	Availability	Preference	Preference ranking
Small gourd	14	11	4
Morning glory	12	15	2
Taro	10	2	17
Cucumber	8	17	1
Chopstic spinach	8	13	3
Wax gourd	7	3	8
Long bean	6	2	13
Mint	5	10	5
Spring onion	4	8	6
Pumpkin	4		
Pty	3	3	8
Papaya	3		
Punley	2	5	7
Ginger	2	3	8
Chunlung	2	3	8
Lamiet	2	2	13
Bitter gourd	2	1	20
Eggplant	2	1	20
Trakiet	2	1	20
Lemon grass	2		
Plov Kangkeb	2		
Taro plant	2		
Radish	1	3	8
Green bean	1	2	13
Bottle gourd	1	1	20
Chili	1		
Mustard greens	1		
Bamboo shoot	1		
Trasork Srov	1		
Sandek Bondos	0	2	13

Source: (Ypma 2005)

Table 150 Advantages & Disadvantages of Farmers' Preferred Crops

Advantage criterion	Frequency	Disadvantage Criterion	Frequency
Easy to grow	21	Disease/insects	15
High margin	14	Seeds	4
Easy to sell	6	seasonal	3
Big yield	3	labour intensive	2
Continuous income	2	Lack of irrigation	2
No insect damage	2	Difficult to grow	1
Shelf Life	2	low price	1
Short growing period	1	Use pesticides	1

Source: (Ypma 2005)

[51] Due to differences in volume of packaging per type of seed enumerators were not able to provide an estimate of sales volume

Table 151 Ratio of Local vs. Imported Vegetables

Actor Class	Local : Import Ratio
Importer	1:1
Wholesaler	1:1
Retailer	2:1
Processor	4:1

Source: (Ypma 2005)

Table 152 Origin of Vegetables Traded in Svay Rieng

Locally Produced		Imported
Cucumber Wax gourd Morning glory Taro Spring onion	Pty Eggplant Pumpkin Water lili Plov Kangkeb	Cucumber Chinese kale Ginger Bitter gourd Cabbage
Kanh Chaet Kandieng Banana flower Bamboo shoot Bitter gourd	Mchul Phnom Rum Chang Dong Vek Trakiet Water melon	Boko celery Mustard greens Lemon Onion Cauliflower
Yard long bean Chopstick spinach Mustard greens Small gourd Chunlung	Sbai Roeung Papaya Trasak Srov Ponley Mor Meanh	Radish Lettuce Pineapple French potato Plae Sue
Lemon grass Lemon Mint Radish Sandek bondos	Lamiet Garlic Bottle gourd	Water melon Tomato

Source: (Ypma 2005)

Table 153 Geographic Sourcing of Vegetables in Svay Rieng Province

Actor	Market	Dry Season								Wet Season							
		KCH	PV	PP	OP	LC	SVR	NL	VN	KCH	PV	PP	OP	LC	SVR	NL	VN
Total Importers		**0**	**0**	**0**	**0**	**1**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**3**
	Veal Yun	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Chipou	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1
	Kroulko	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Brasotr	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
Wholesalers		**0**	**0**	**0**	**0**	**4**	**2**	**2**	**9**	**0**	**0**	**0**	**0**	**4**	**2**	**2**	**9**
	Veal Yun	0	0	0	0	0	0	1	5	0	0	0	0	0	0	1	5
	Chipou	0	0	0	0	4	1	0	4	0	0	0	0	4	1	0	4
	Kroulko	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0
	Brasotr	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Retailers		**0**	**0**	**3**	**0**	**24**	**4**	**3**	**22**	**0**	**0**	**3**	**0**	**27**	**5**	**3**	**20**
	Veal Yun	0	0	0	0	19	2	0	17	0	0	0	0	21	3	0	17
	Chipou	0	0	0	0	2	1	0	3	0	0	0	0	4	1	0	1
	Kroulko	0	0	3	0	0	0	3	0	0	0	3	0	0	0	3	0
	Brasotr	0	0	0	0	3	1	0	2	0	0	0	0	2	1	0	2
Processors		**1**	**1**	**2**	**1**	**12**	**0**	**1**	**2**	**1**	**1**	**3**	**0**	**12**	**0**	**3**	**2**
	Veal Yun	1	1	2	1	11	0	1	2	1	1	3	0	11	0	3	2
	Chipou	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kroulko	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Brasotr	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
Total		**1**	**1**	**5**	**1**	**41**	**6**	**6**	**36**	**1**	**1**	**6**	**0**	**44**	**7**	**8**	**34**

KCH = Kampong Cham; PV = Prey Veng; PP = Phnom Penh; OP = Other Provinces; LC =Local (Within market district); SVR = Svay Rieng; NL =Neak Loeung; VN = Vietnam
Traders are defined as individuals and or businesses because more than 50% of their income comes from purchasing and onward selling of vegetables, whether they are processed or not
Source: (Ypma 2005)

Table 154 Wholesaler Availability and Preference for Vegetables

Vegetables	Origin		Wholesalers		Wholesaler Preference	
	Import	Local	No.	%	Score	Ranking
Carrot	X		10	91	6	4
Tomato	X		10	91	9	3
Cabbage	X		9	82	17	1
Radish	X		9	82		
Cucumber	X	X	8	73	6	4
Chili	??	??	8	73		
Wax gourd		X	7	64	10	2
Onion	X		7	64	4	6
Eggplant		X	7	64		
Long bean	x		6	55		
Chopstick spinach		X	6	55		
Pumpkin		X	6	55	4	6
Chinese kale	X		6	55		
Bitter gourd	X		5	45		
Morning glory		X	5	45	3	8

Not listed amongst the usually available vegetables at Wholesalers but included in the preferred vegetables
Kahn Chaet ranked no 9 with a score of 2
Small Gourd ranked no 10 with a score of 1
Source: (Ypma 2005)

Table 155 Retailer Availability and Preference for Vegetables

Vegetables	Origin		Retailers		Retailer Preference	
	Import	Local	No	%	Score	Ranking
Cucumber	x	x	32	76	65	1
Wax gourd		x	25	60	24	2
Mint	??	??	22	52	15	4
Bitter gourd	X		19	45	12	6
Chili	??	??	15	36		
Morning glory		X	15	36	15	4
Small gourd		X	15	36	8	9
Onion	X		13	31	4	14
Long bean		X	13	31	6	13
Lemon	X		13	31	7	11
Carrot	X		12	29		
Tomato	X		12	29	12	6
Cabbage	X		12	29	8	9
Spring onion		X	12	29		
Lettuce	X		12	29	7	11

Not listed amongst the usually available vegetables at retailers but included in the preferred vegetables
Kahn Chaet ranked no 3 with a score of 18
Plov Kangl ranked no 8 with a score of 10
Pumpkin ranked no 14 with a score of 4
Source: (Ypma 2005)

Table 156 Processor Availability and Preference for Vegetables

Vegetables	Origin		Processors		Processors preference	
	Imported	Local	No.	%	Score	rank
Mustard greens	X	X	10	56	25	1
Cucumber	X	X	9	50	14	2
Radish	X	X	8	44	14	2
Sandek Bondos		X	3	17	9	4
Mor Meanh		X	3	17	4	6
Taro plant		X	2	11	6	5
Bamboo shoot		X	2	11	3	7
Chili	??	??	1	6	2	9
Spring onion		X	1	6	1	10
Chabb Chay	??	??	1	6	3	7
Garlic		X	1	6	1	10
Trasork Srov		X	1	6	1	10

Source: (Ypma 2005)

Table 157 Importer Availability and Preference for Vegetables

Vegetables	Origin		Importers		Importers Preferences	
	Imported	Local	No	%	Score	ranking
Cucumber	x	x	3	100	3	2
Wax gourd		x	3	100	3	2
Carrot	x		3	100		
Chili	??	??	2	67		
Bitter gourd	X		2	67	5	1
Cabbage	X		2	67		
Pumpkin		X	2	67	2	5
Tomato	X		1	33		
Onion	X		1	33		
Long bean		X	1	33		
Small gourd		X	1	33		
Eggplant		X	1	33		
Lemon	X		1	33		
Taro		X	1	33		
Boko celery	X		1	33		
Ginger	X		1	33	3	2

Source: (Ypma 2005)

Table 158 Vegetable Sales across Seasons in Svay Rieng

Actor Type	Total Veg. Sold/ Season		Total Local Veg. sold/ Season		Total Imported Veg. Sold/ Season		WS as % of DS	% of Veg. of local origin/season	
	DS	WS	DS	WS	DS	WS		DS	WS
Wholesalers	494.000	185.000	34.000	11.000	460.000	174.000	37%	7%	6%
Retailers	1.141.000	695.000	462.000	297.000	679.000	398.000	61%	41%	43%
Processors	79.000	78.000	62.000	61.000	17.000	17.000	98%	78%	78%
Importers	122.000	69.000	7.000	2.000	114.000	67.000	51%	6%	3%

Source: (Ypma 2005)

Table 159 Preferred Vegetables as Percentage of Total Sales in Svay Rieng

Actor Type	Total Veg. Sold/ Season		Total preferred crop sold/ season		Total preferred Veg. Sold as % of total		WS as % of	% of Veg. of local origin/season	
	DS	WS	DS	WS	DS	WS	DS	DS	WS
Wholesalers	494.000	185.000	305,500	82,600	62%	45%	37%	7%	6%
Retailers	1.141.000	695.000	434,600	338,200	38%	49%	61%	41%	43%
Processors	79.000	78.000	73,100	72,400	-------	-------	98%	78%	78%
Importers	122.000	69.000	65,000	34,800	53%	50%	51%	6%	3%

Source: (Ypma 2005)

Table 160 Daily Sales Volumes of Vegetables in Svay Rieng

Actor Type	Daily sales volumes		
	minimum sales/day in Kg	Average daily sales DS in Kg	Average daily sales WS in Kg
Wholesalers	50	300	120
Retailers	30	180	120
Processors	20	30	30
Importers	160	270	160

Source: (Ypma 2005)

Table 161 Margins and Income Estimates for Vegetables in Svay Rieng

	Average Margins (Riel/kg)		Average Monthly income (Riel)		Average Monthly income (US$)	
Actor Type	DS	WS	DS	WS	DS	WS
Wholesalers	180	150	1188000	396000	297	99
Retailers	250	200	990000	528000	247.5	132
Processors	530	560	349800	369600	87.45	92.4
Importers	140	140	831600	492800	207.9	123.2

Source: (Ypma 2005)

Table 162 Access to Credit for Vegetables in Svay Rieng

Type of Actors	No of respondents answering the question	Respondents providing / Receiving credit		Percentage of actors responding to the question	
		Receiving	Providing	Receiving	Providing
Farmers	15	2	0	13%	0%
Wholesalers	8	1	3	13%	38%
Retailers	39	8	12	21%	31%
Importers	3	1	1	33%	33%
Processors	14	3	0	21%	0%

Source: (Ypma 2005)

Table 163 Consumer Vegetable Preferences

Vegetables ranked by consumers			Vegetables ranked by restaurants		
Ranking	Individuals	Score individuals	Ranking	Restaurants vegetable preference	Score restaurants
1	Morning glory	14	1	Cucumber	5
2	Cucumber	11	2	Morning glory	4
3	Chopstick spinach	5	3	Onion	3
4	Cabbage	4	4	Carrot	3
5	Wax gourd	4	5	Chinese kale	3
6	Tomato	3	6	Long bean	3
7	Kanh Chaet	3	7	Lettuce	3
8	Chinese kale	2	8	Sweet pepper	2
9	Boko celery	2	9	Tomato	2
10	Eggplant	2	10	Eggplant	2

Source: (Ypma 2005)

Table 164 Estimated Annual Income of Fishery Dependent Households

Income Level	Number of Households ('000)		Total Gross Income (US$ million)	Income per Household (US$)
<1000	151	72%	71	470
1001-2000	34	16%	44	1294
2001-5000	18	9%	60	3333
>5000	6	3%	40	6667
Total	209	100%	215	1029

Source: (Hap, Chuenpagdee et al. 2006)

Table 165 Percentage of Households Involved in Fishing

Involvement in Fishing		Closed Season	Open Season	All Year	Occassional or Not At All
Kampong Chhnang	Fishing	2	7	89	2
	Fishing/Farming	7	13	71	9
	Farming	49	0	18	33
Siem Reap	Fishing	0	2	98	0
	Fishing/Farming	4	22	60	13
	Farming	44	9	31	16
Both	Fishing	1	4	93	1
	Fishing/Farming	6	18	66	11
	Farming	47	4	24	24

Source: (Hap, Chuenpagdee et al. 2006)

Table 166 Average Annual Catch per Household

Utilization of Catches (kg)	Kampong Chhnang			Seam Reap		
	Fishing	Fishing/Farming	Farming	Fishing	Fishing/Farming	Farming
Home Consumption	136	172	150	723	240	128
Sold Fresh	7402	1166	347	11369	4597	121
Fish Processing	67	30	16	1884	113	4
Fish Feed	592	889	44	1449	73	1
Annual Catch	8197	2257	557	15425	5023	254
Home Consumption	2%	8%	27%	5%	5%	50%
Sold Fresh	90%	52%	62%	74%	92%	48%
Fish Processing	1%	1%	3%	12%	2%	2%
Fish Feed	7%	39%	8%	9%	1%	0%
Annual Catch	100%	100%	100%	100%	100%	100%

Source: (Hap, Chuenpagdee et al. 2006)

Table 167 Costs of Marketing Fish from the Tonle Sap Lake to Phnom Penh

Marketing Level	Cost Item	Average Marketing Costs		
		R/kg	$/tonne	% of Total
Traders	Operating and Capital Costs	531	134.43	50.2%
	Transportation	253	64.05	23.9%
	Ice	221	55.95	20.9%
	Labor	41	10.38	3.9%
	Equipment and Materials	16	4.05	1.5%
	Spoilage and Weight Loss	218	55.19	20.6%
	Commission Fee to Distributor	186	47.09	17.6%
	Distribution Center Owner Charge	88	22.28	8.3%
	Road / Checkpoint Fees	35	8.86	3.3%
	Total Costs	1058	267.85	100.0%
Retailers	Operating and Capital Costs	149	37.72	95.5%
	Fees (Pheasi and Sanitation)	7	1.77	4.5%
	Total Costs	156	39.49	100.0%
Total Marketing Costs		1214	307.34	

Exchange Rate December 2002 = R3950/US$
Source: (Yim and McKenney 2003)

Table 168 Marketing Margins for Fish Trading - Kompong Luong to Phnom Penh

Marketing Level	Fish Species					
	Chhlang		Chhkok		Chhdor	
	Price (R/kg)	% of Final Retail Price	Price (R/kg)	% of Final Retail Price	Price (R/kg)	% of Final Retail Price
Fisher to Trader	1000	24%	1500	34%	1700	35%
Trader to Retailer via Distributor	2200	52%	2450	56%	2586	53%
Retailer to Consumer	4239	100%	4396	100%	4867	100%
Marketing Margin	3239	76%	2896	66%	3167	65%

Marketing margins in Orussey and Thmei markets, December 2002
Source: (Yim and McKenney 2003)

Table 169 Costs for Exporting Fish

Cost Item	Trade Cost		Percent of Total Costs
	Riel/kg	$/tonne	
Operating Costs	354	89.62	60%
Transportation	102	25.82	17%
Working Capital	85	21.52	15%
Ice	85	21.52	15%
Materials/other	38	9.62	6%
Labor	25	6.33	4%
Loan Loss	19	4.81	3%
Spoilage/Weight Loss	201	50.89	34%
Capital Costs	31	7.85	5%
Total Trade Costs	586	148.35	100%

Source: (Yim and McKenney 2003)

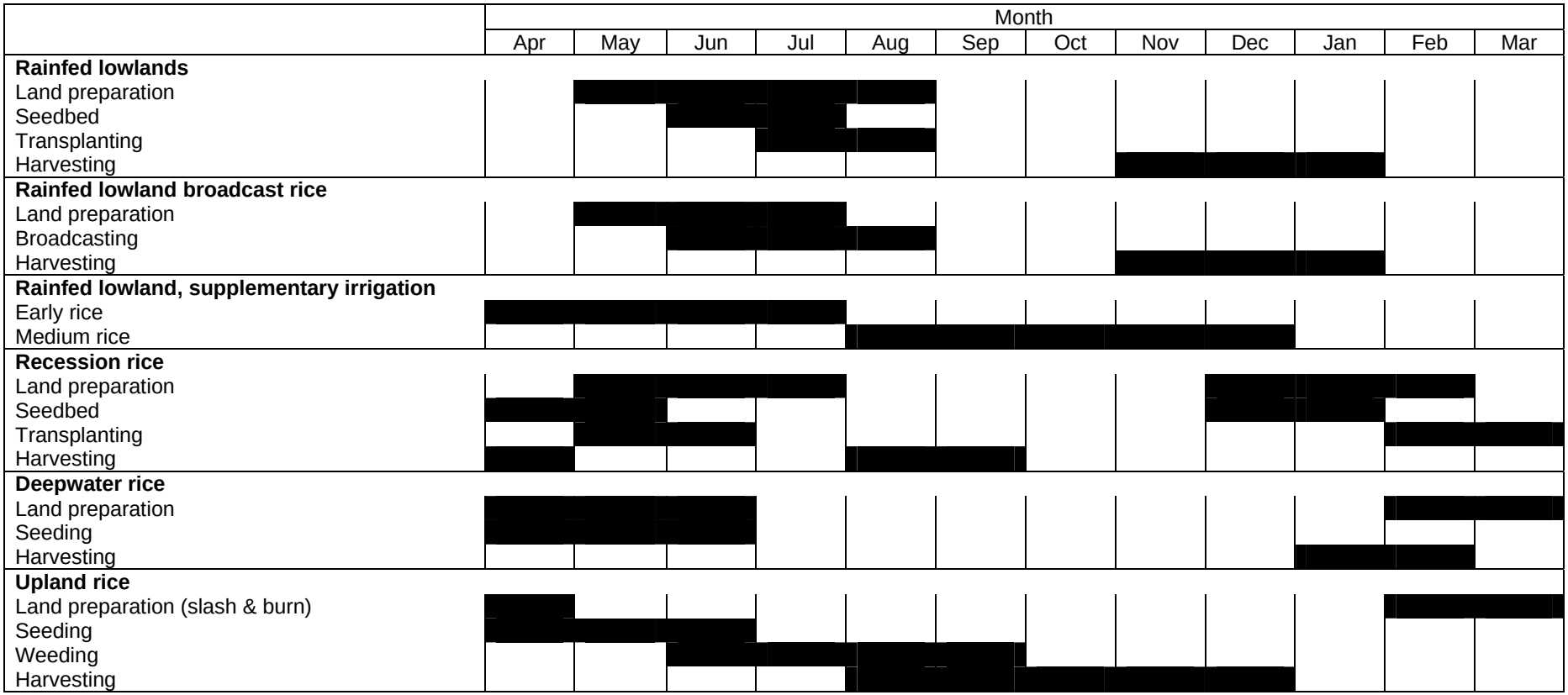
Table 170 Margins and Costs for Fish Exports

Margin and Cost	Export Route 1		Export Route 2		Export Route 3		Export Route 4		Export Route 5		Average			
	Riel/kg	$/tonne	Riel/kg	$/tonne	Riel/kg	$/tonne	Riel/kg	$/tonne	Riel/kg	$/tonne	Riel/kg	$/tonne	Range - Low	Range -High
Buying Price (Landing Site)	4,724	1,196	4,903	1,241	4,154	1,052		-	3,699	936	4,370	1,106	936	1,241
Selling Price (Thai Market)	5,746	1,455	5,923	1,499	5,223	1,322		-	4,830	1,223	5,431	1,375	1,223	1,499
Gross Margin	1,022	259	1,020	258	1,069	271	-	-	1,131	286	1,061	268	258	286
Trade Costs	528	134	583	148	517	131	595	151	717	182	586	148	131	182
Fees	318	81	330	84	355	90	305	77	301	76	326	83	76	90
Profit Margin	176	45	107	27	197	50		-	113	29	148	38	27	50
Fees as % of Total Cost		38%		36%		41%		34%		30%		36%	30%	41%
Fees as % of Profit		64%		76%		64%				73%		69%	64%	76%

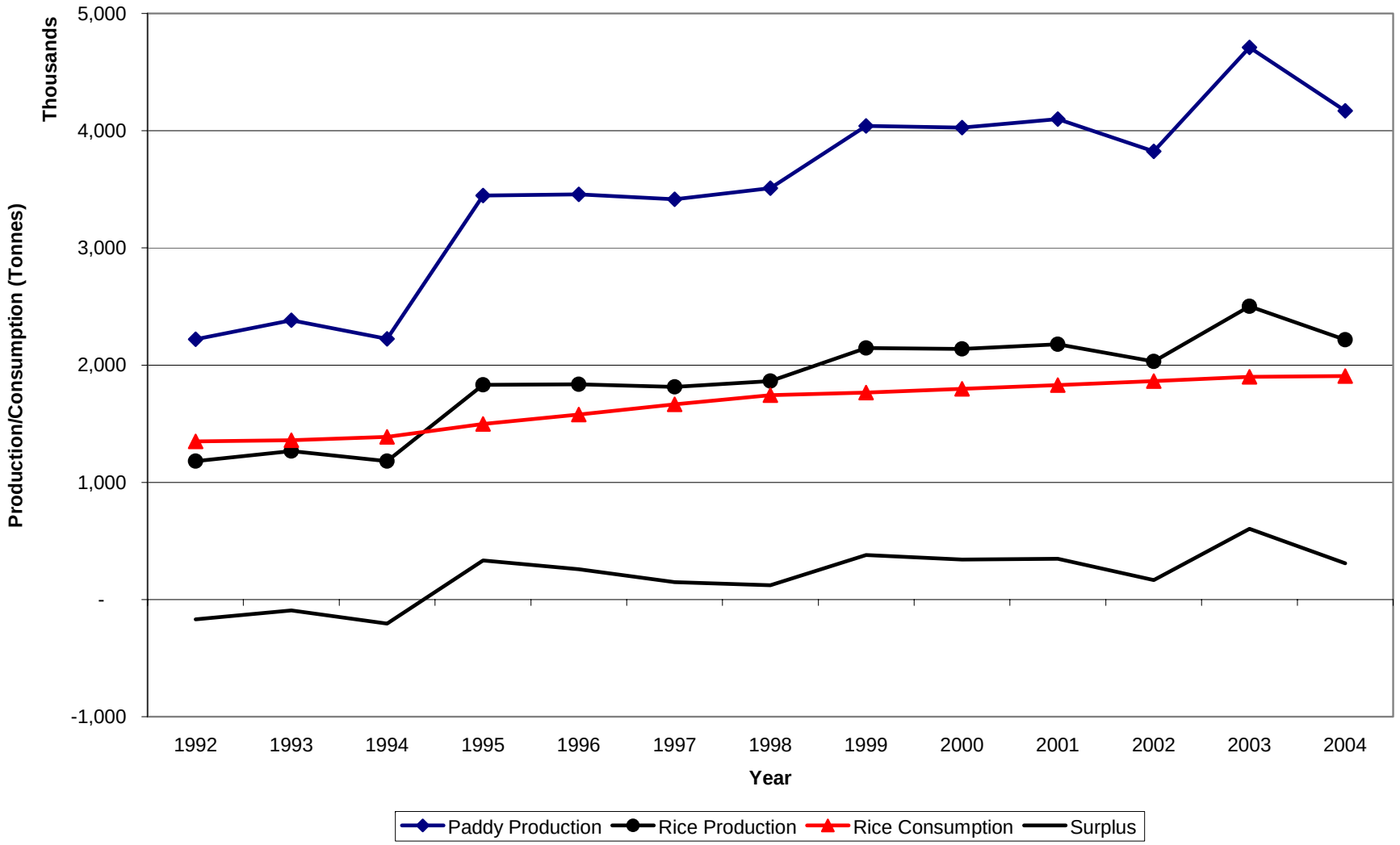
Export Route 1: Provincial Town in Kampong Chhnang to Thai market
Export Route 2: Chhnok Tru in Kampong Chhnang to Thail market
Export Route 3: Kompong Luong in Pursat to Thai market
Export Route 4: Battambang to Thai market
Export Route 5: Chong Khneas in Seam Reap to Thai market
Source: (Yim and McKenney 2003)

J.6 Figures

Figure 23 Rice Cropping Patterns

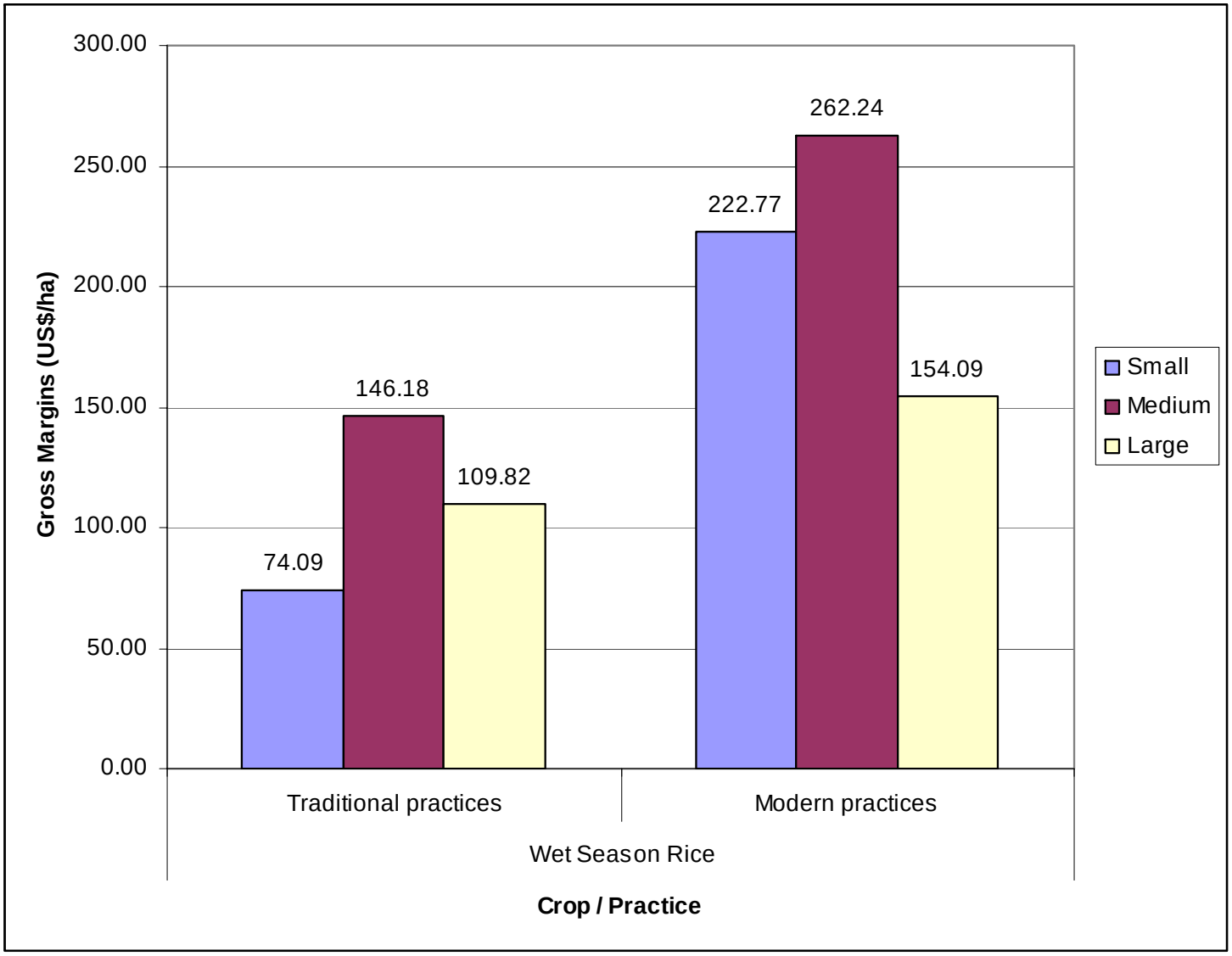


Source: (JICA 2001)



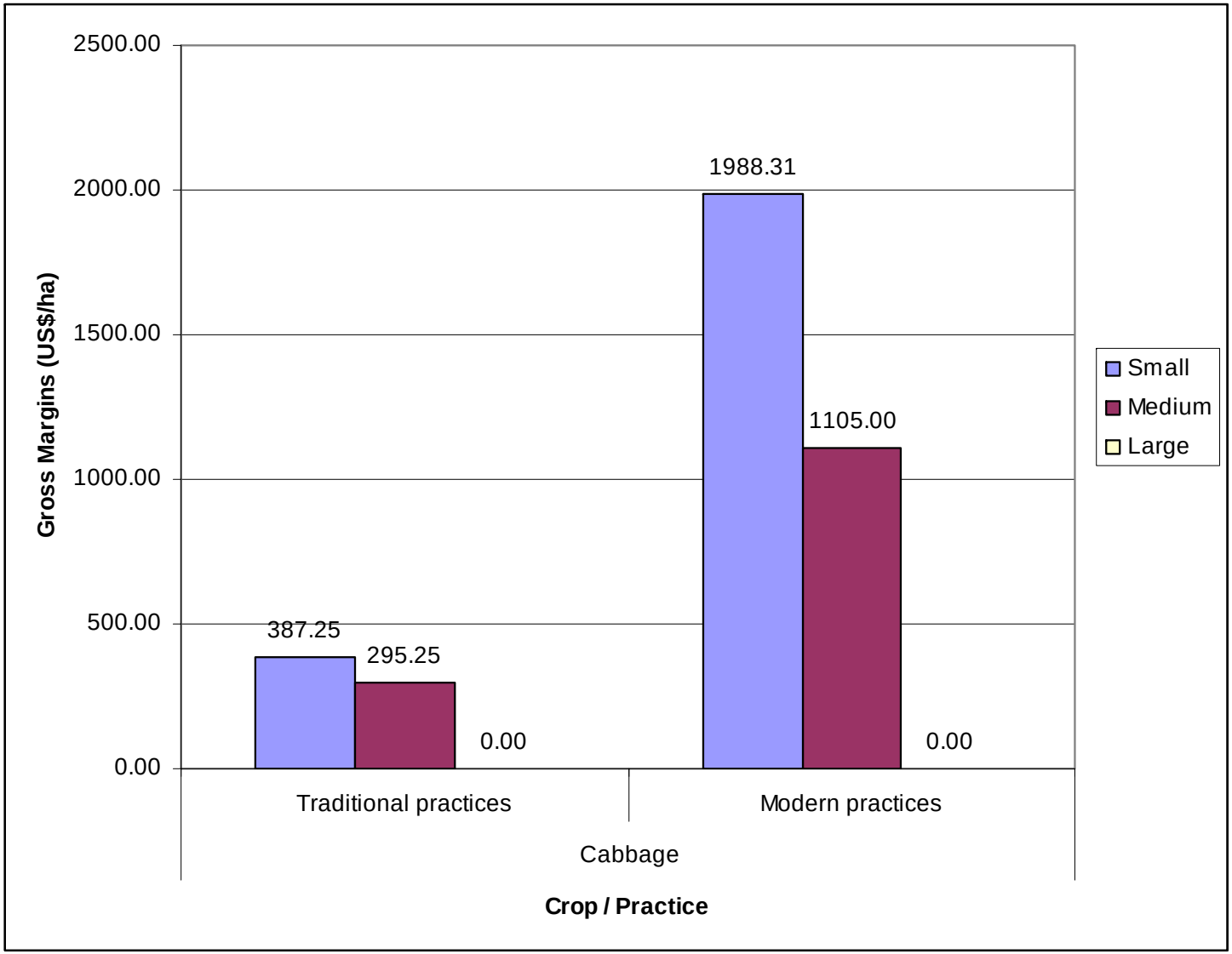
Source: (MAFF 2001; MAFF 2001; MAFF 2002; MAFF 2004; MOP and NIS 2004; MAFF 2005)

Figure 24 Production of Paddy and Rice, Food Requirements and Food Balance



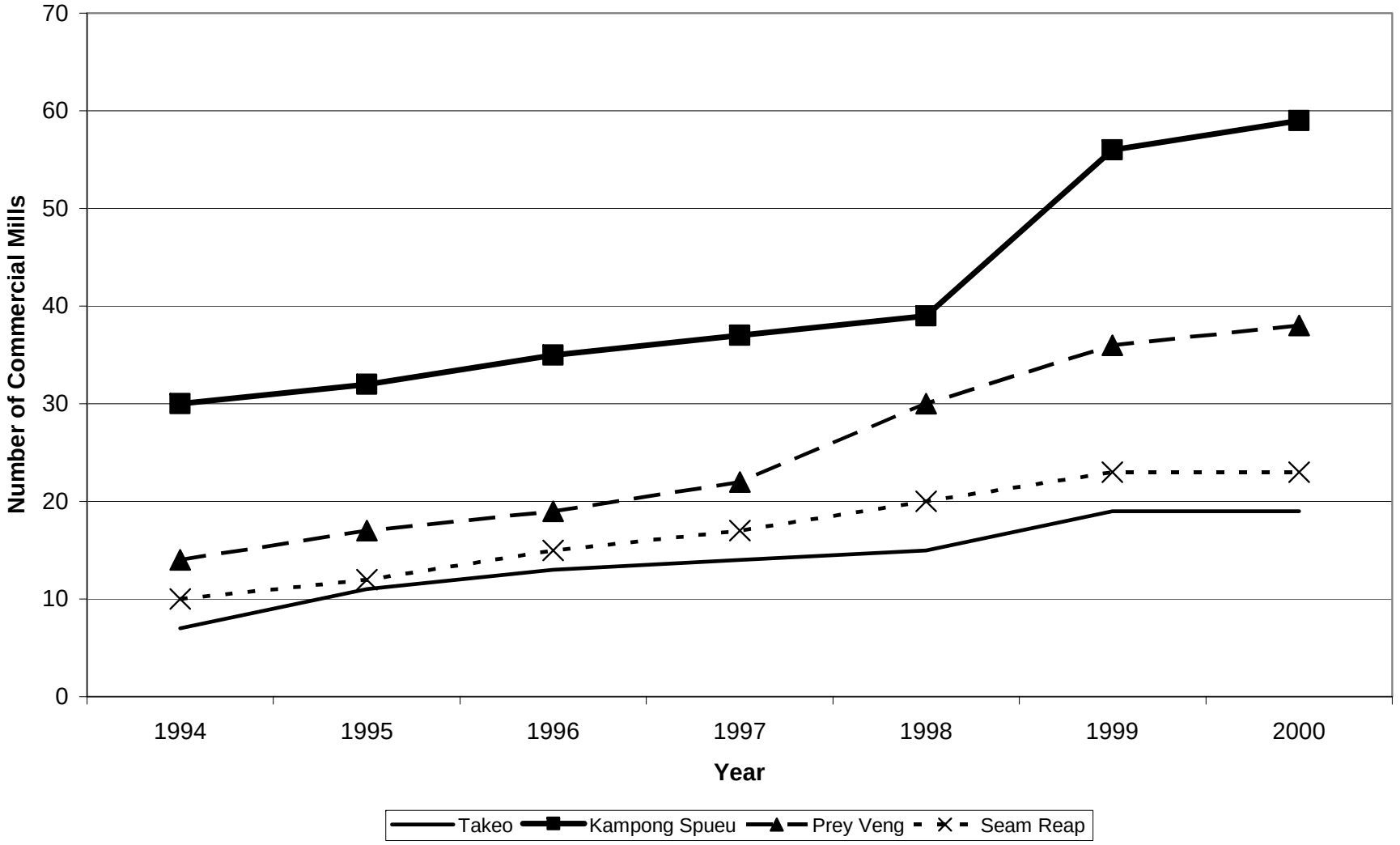
Source: (ACI 2005)

Figure 25 Performance of Traditional vs. Modern Technology Adoption Farms in Cambodia - Wet Season Rice



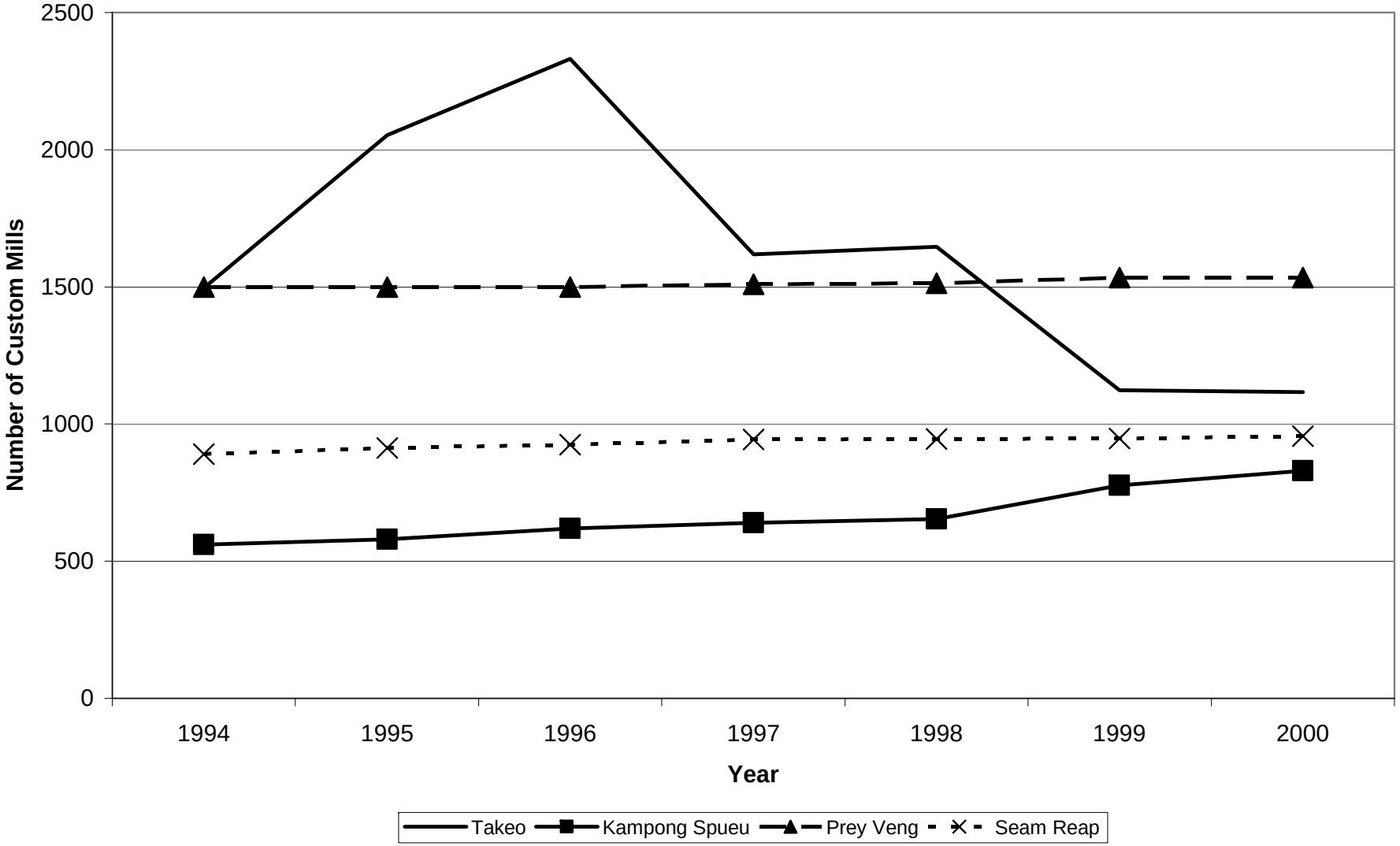
Source: (ACI 2005)

Figure 26 Performance of Traditional vs. Modern Technology Adoption Farms in Cambodia – Cabbage



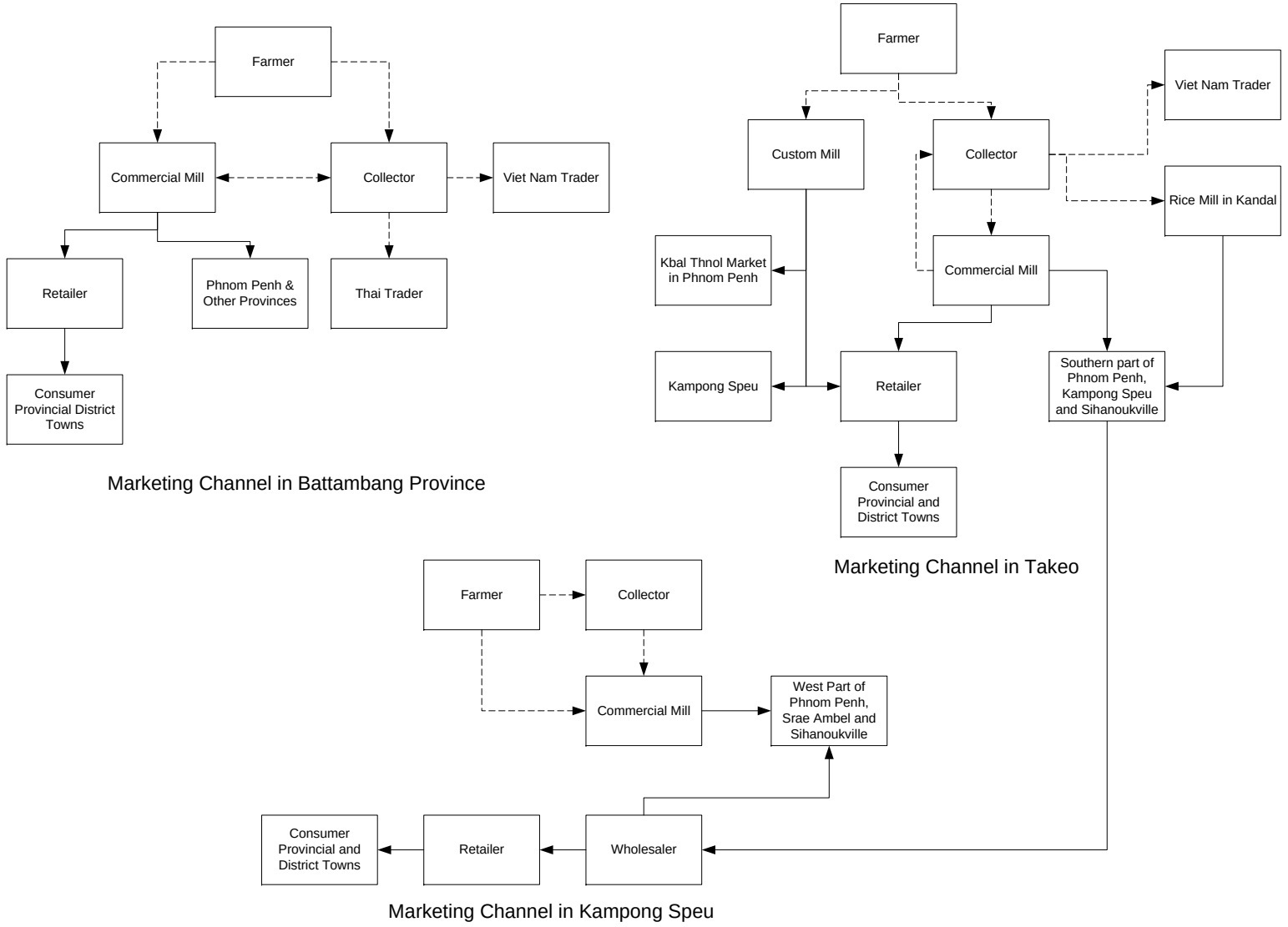
Source: (JICA 2001)

Figure 27 Number of Registered Commercial Mills in Cambodia 1994-2000



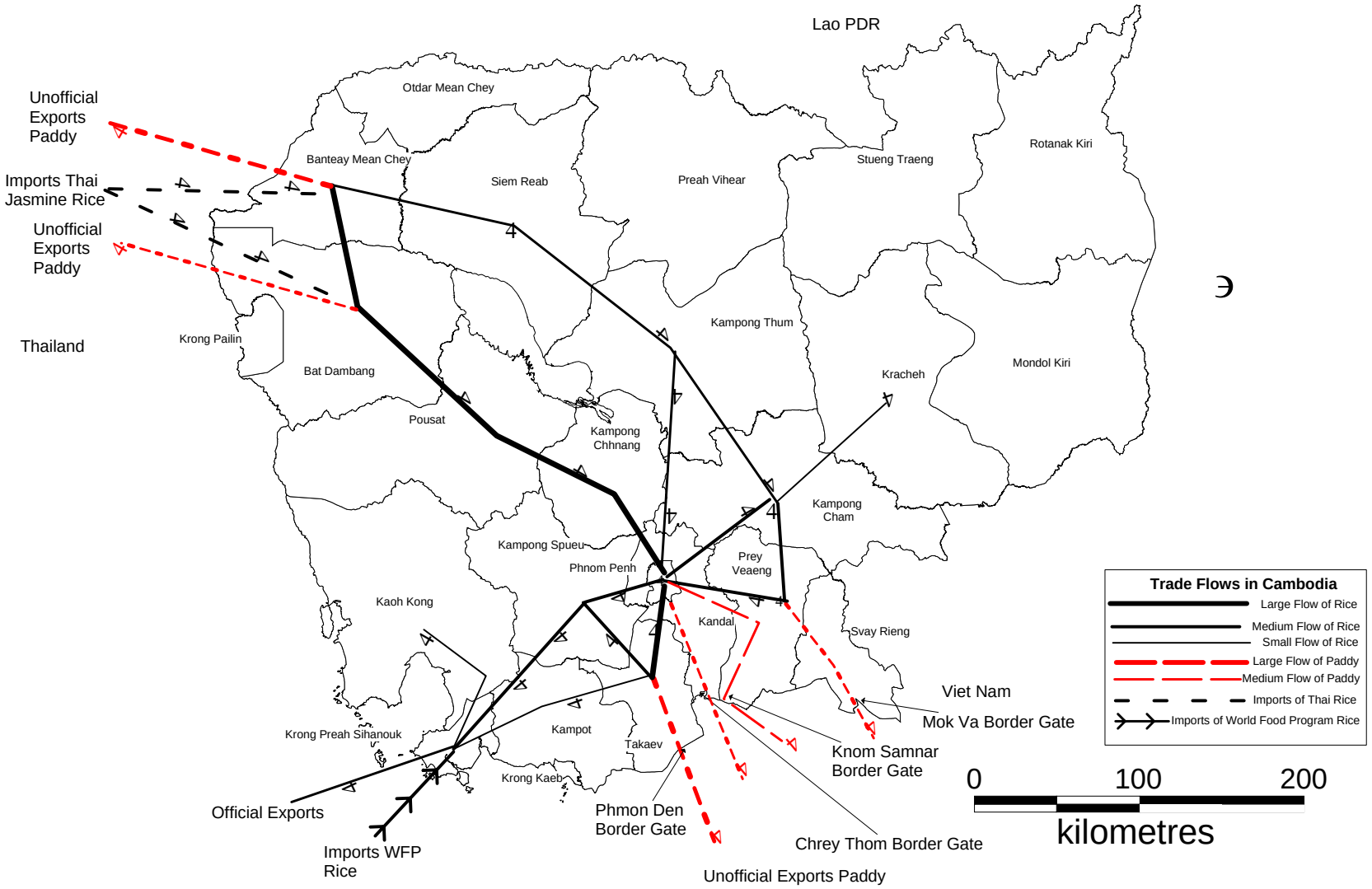
Source: (JICA 2001)

Figure 28 Number of Registered Custom Mills in Cambodia 1994-2000



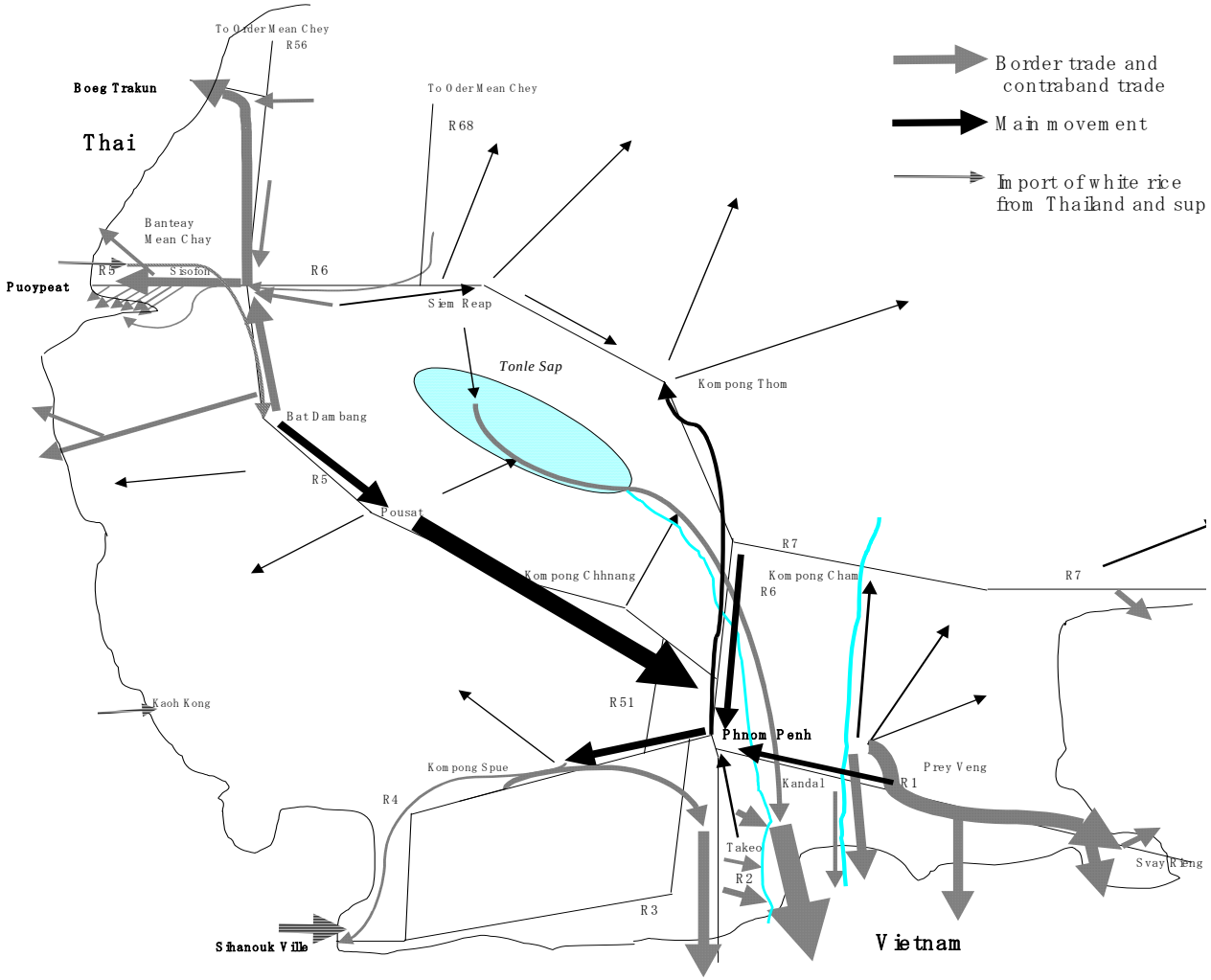
Source: (JICA 2001, pg. E11)

Figure 29 Marketing Channels in Battambang, Takeo and Kampong Speu Provinces



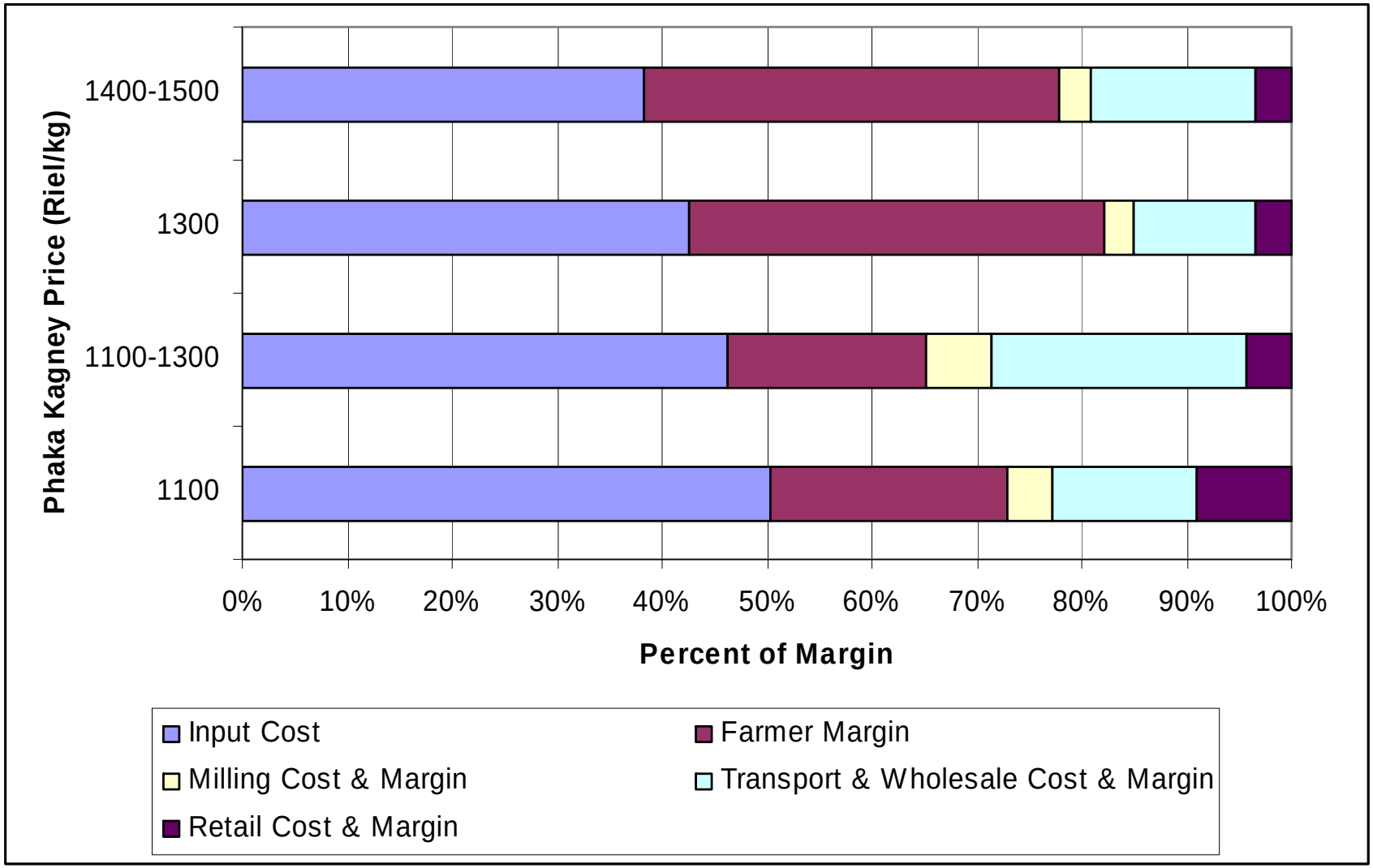
Source: (ACI 2002)

Figure 30 Trade Flows of Rice and Paddy in Cambodia



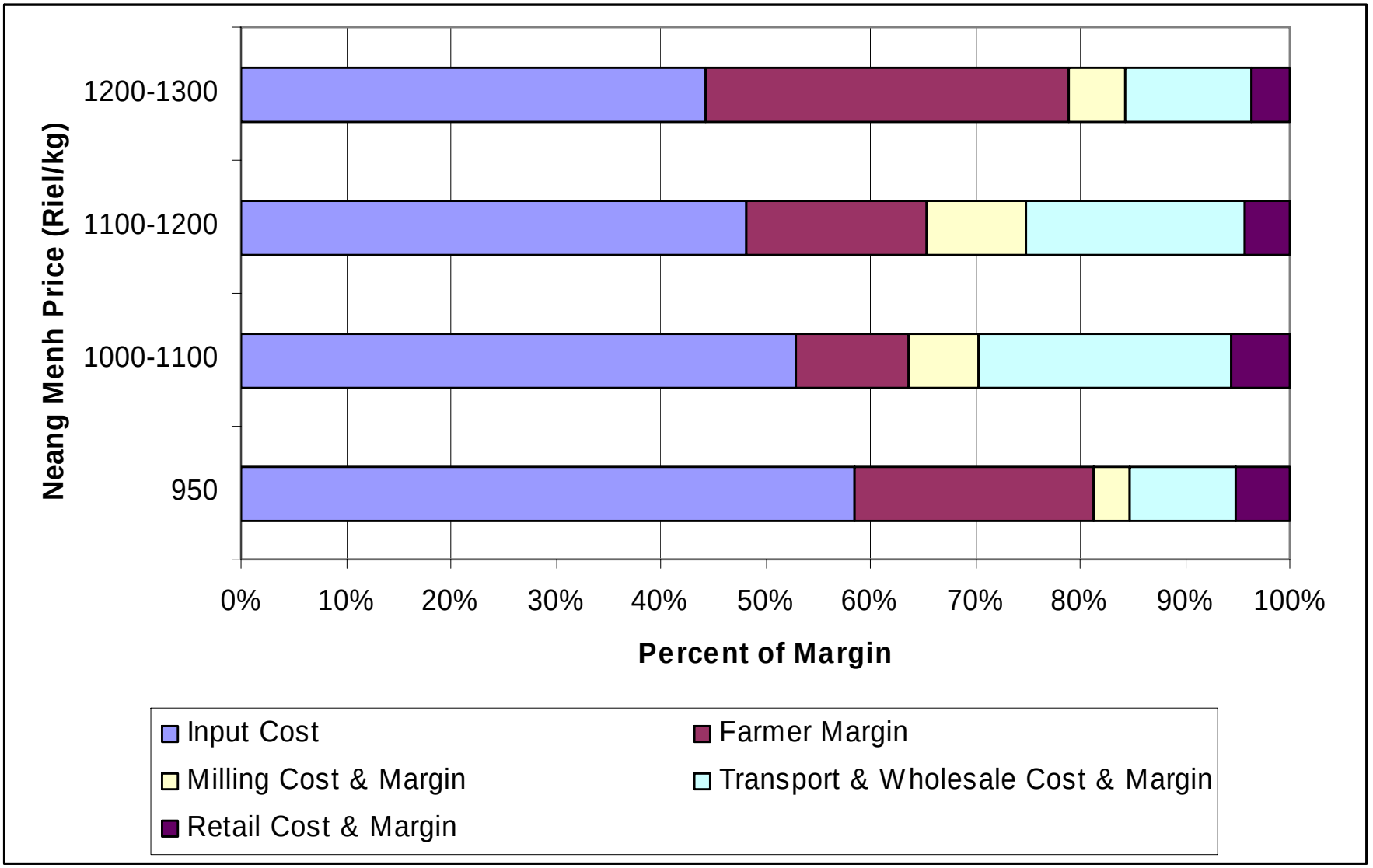
Source: (JICA 2001)

Figure 31 Trade Flows of Rice and Paddy in Cambodia (1998-1999)



Source: (JICA 2001), (ACI 2002) Estimates of Cost of Production, R355/kg

Figure 32 Costs and Margins for Rice Marketing Chain 1998-99, Phaka Khgney Variety



Source: (JICA 2001), (ACI 2002) Estimates of Cost of Production, R355/tkg

Figure 33 Costs and Margins for Rice Marketing Chain 1998-99, Neang Menh Variety

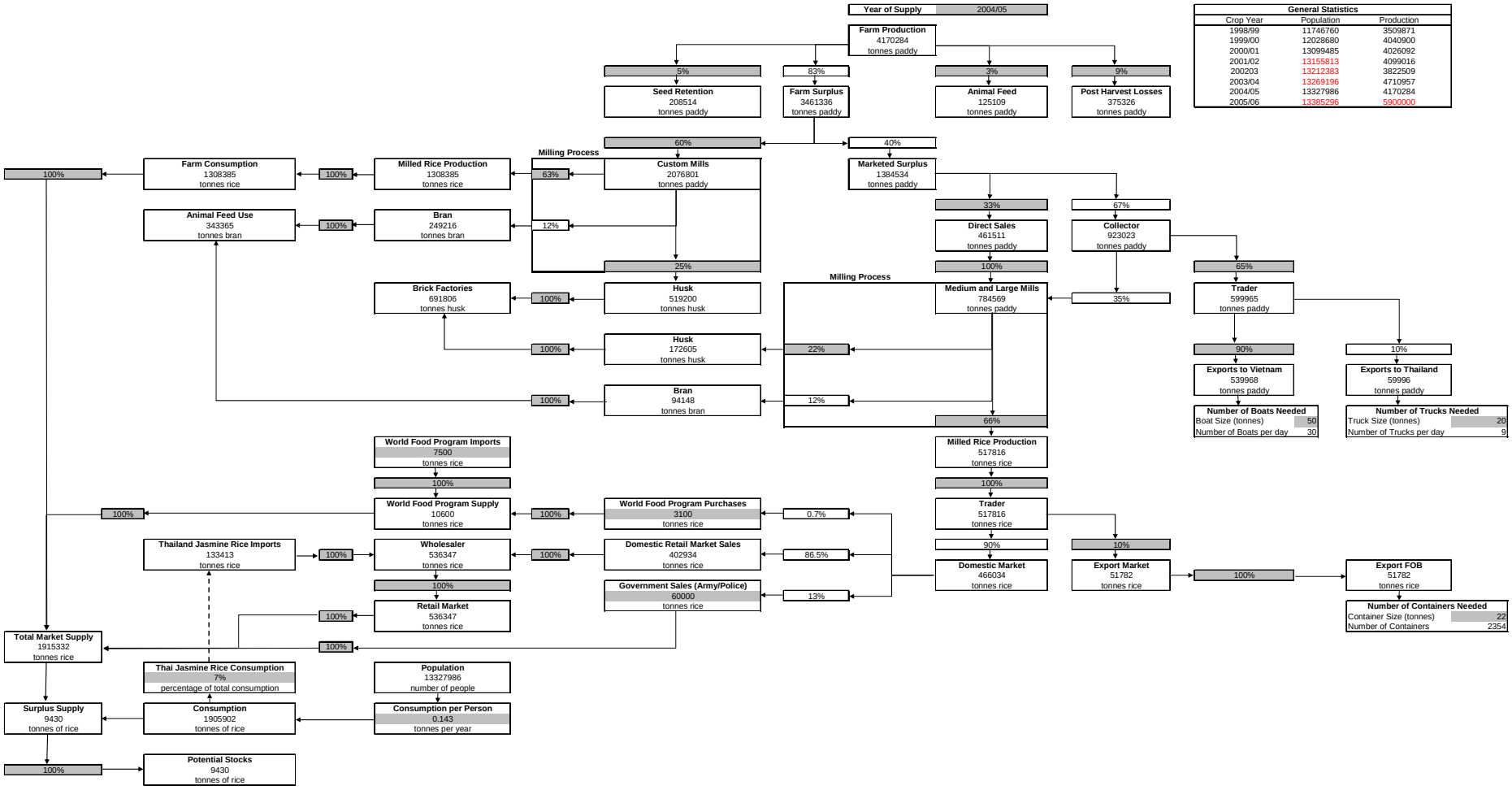
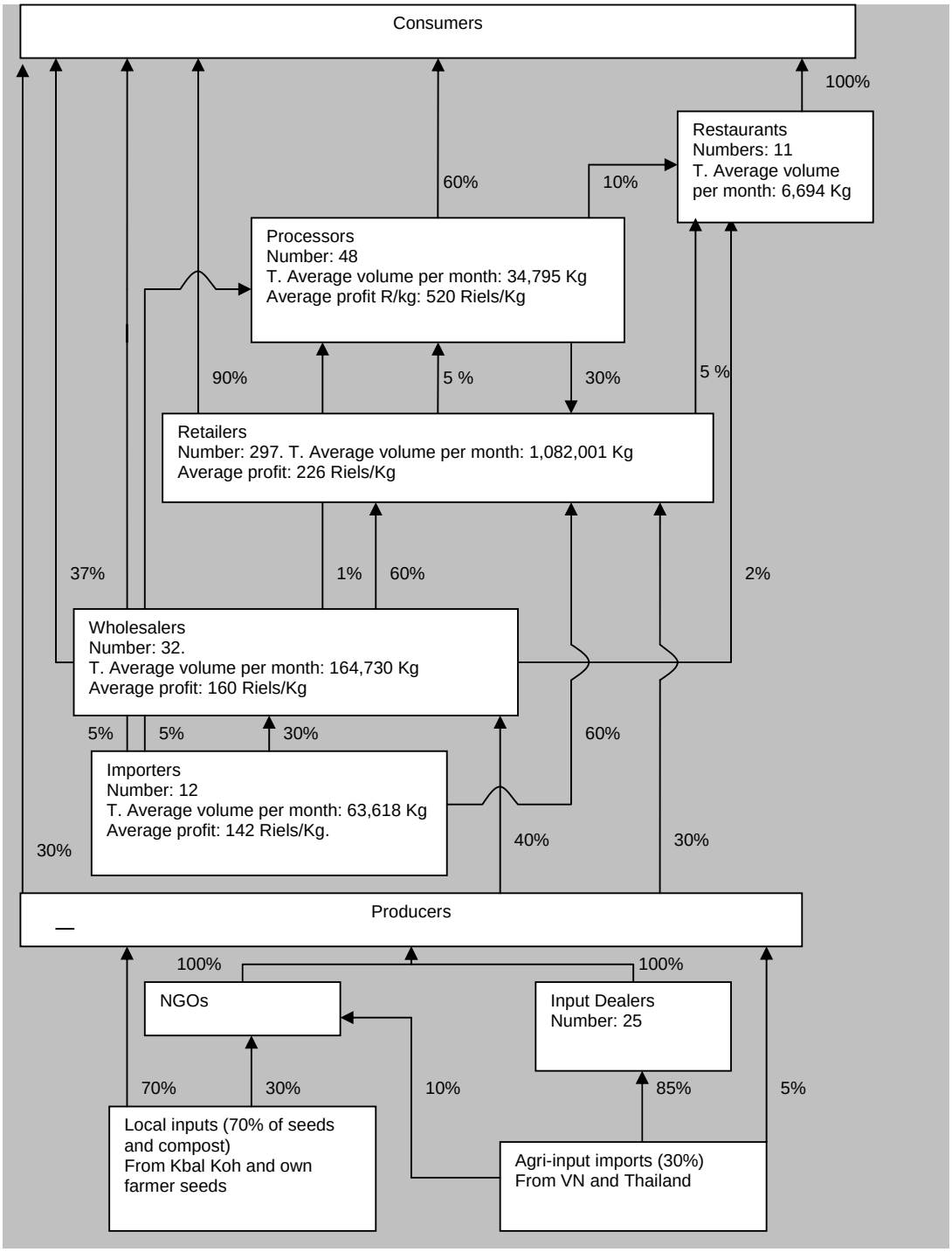


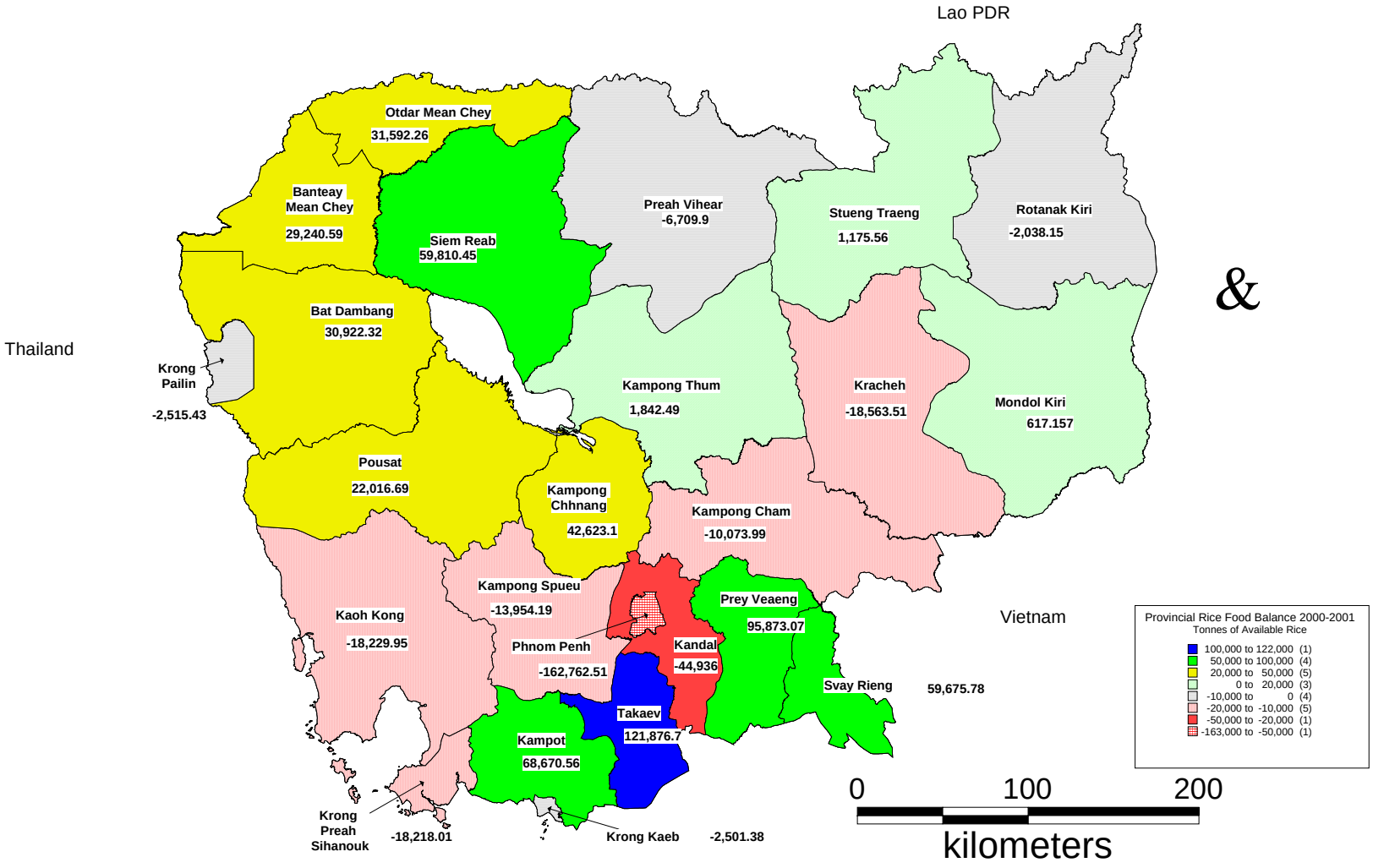
Figure 34 Rice Marketing Chain for Cambodia – 2004-05 Crop Year



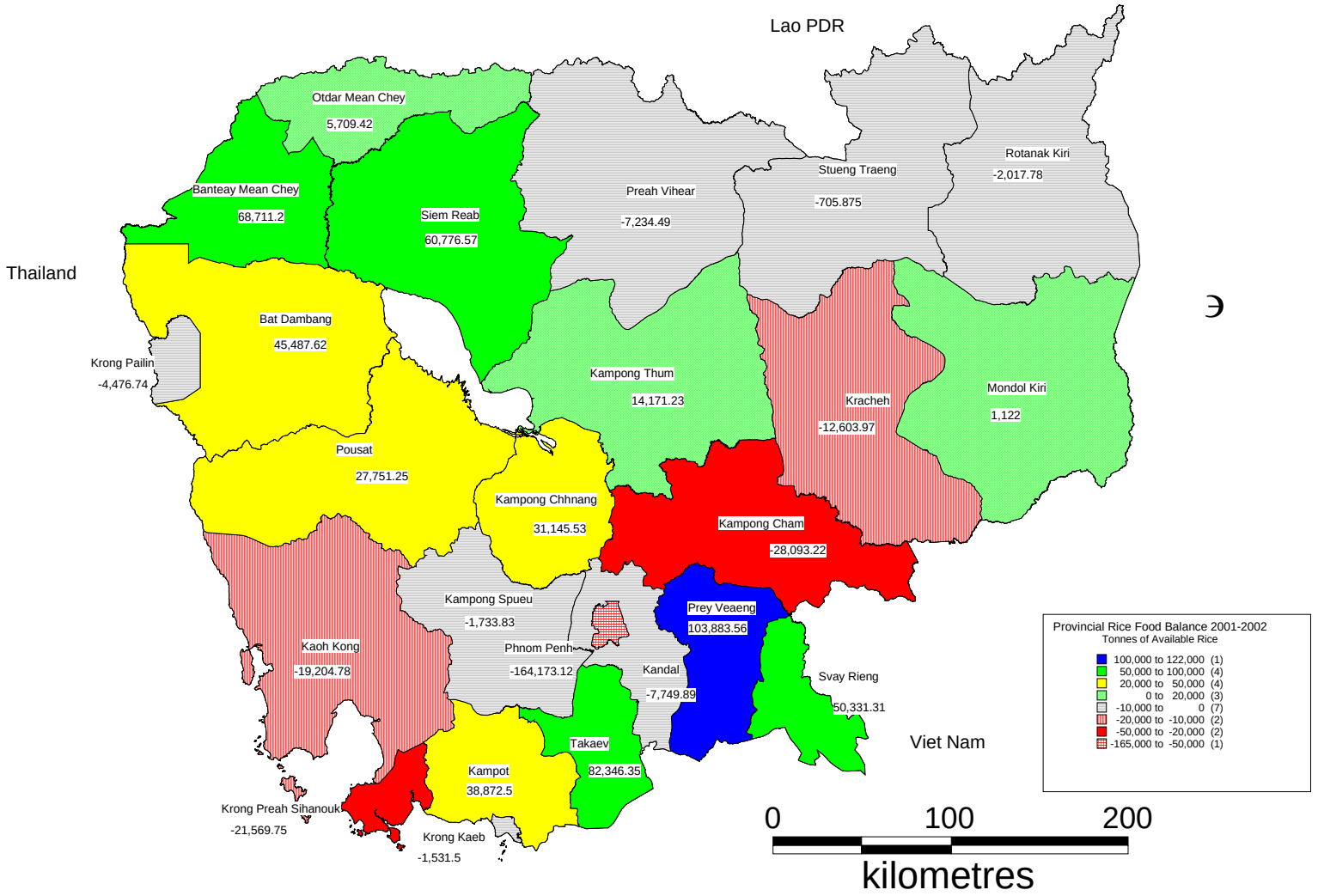
Source: (Ypma 2005)

Figure 35 Relative Trading Relationships between Actors in the Wet Season

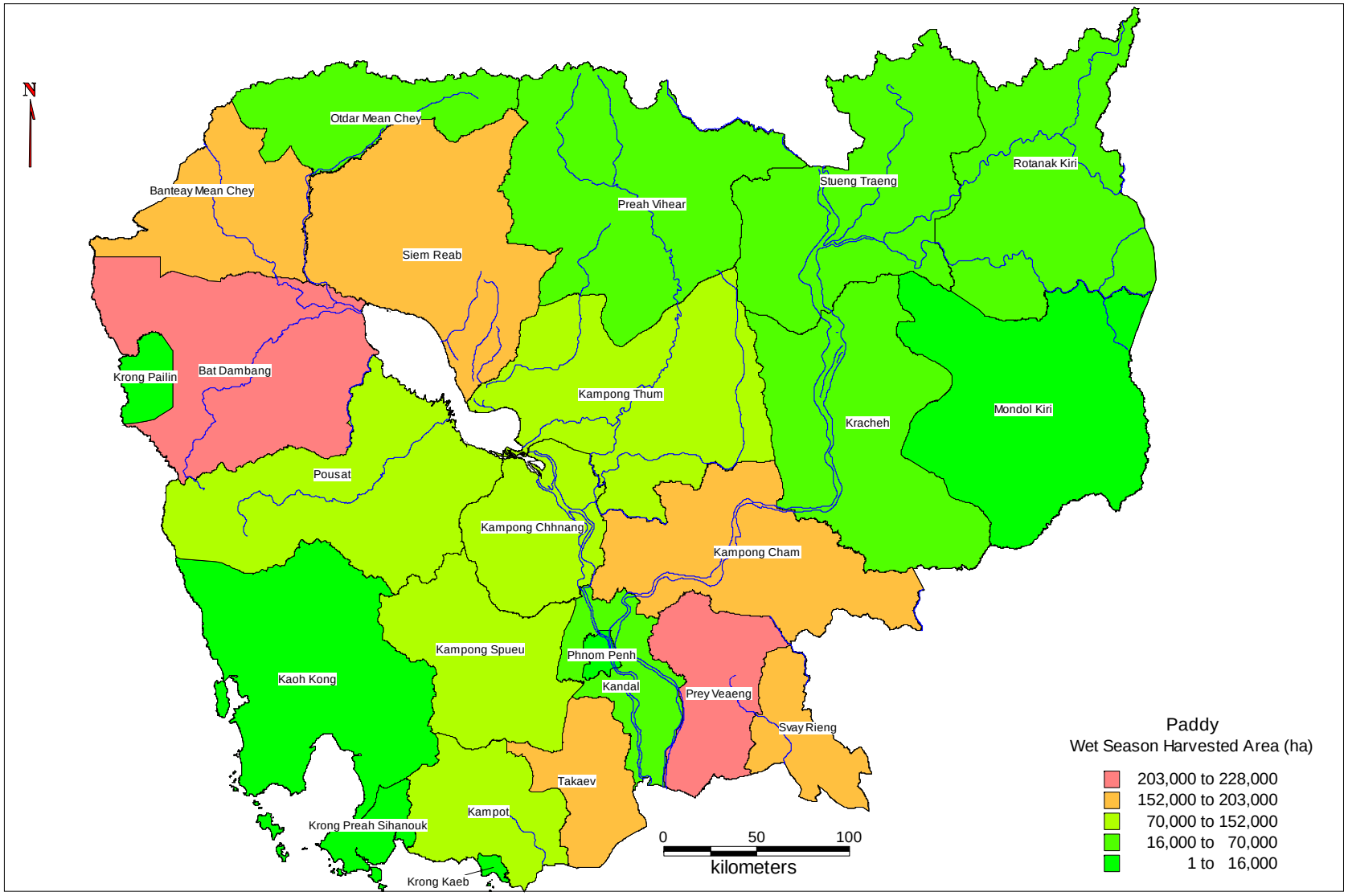
J.7 Maps



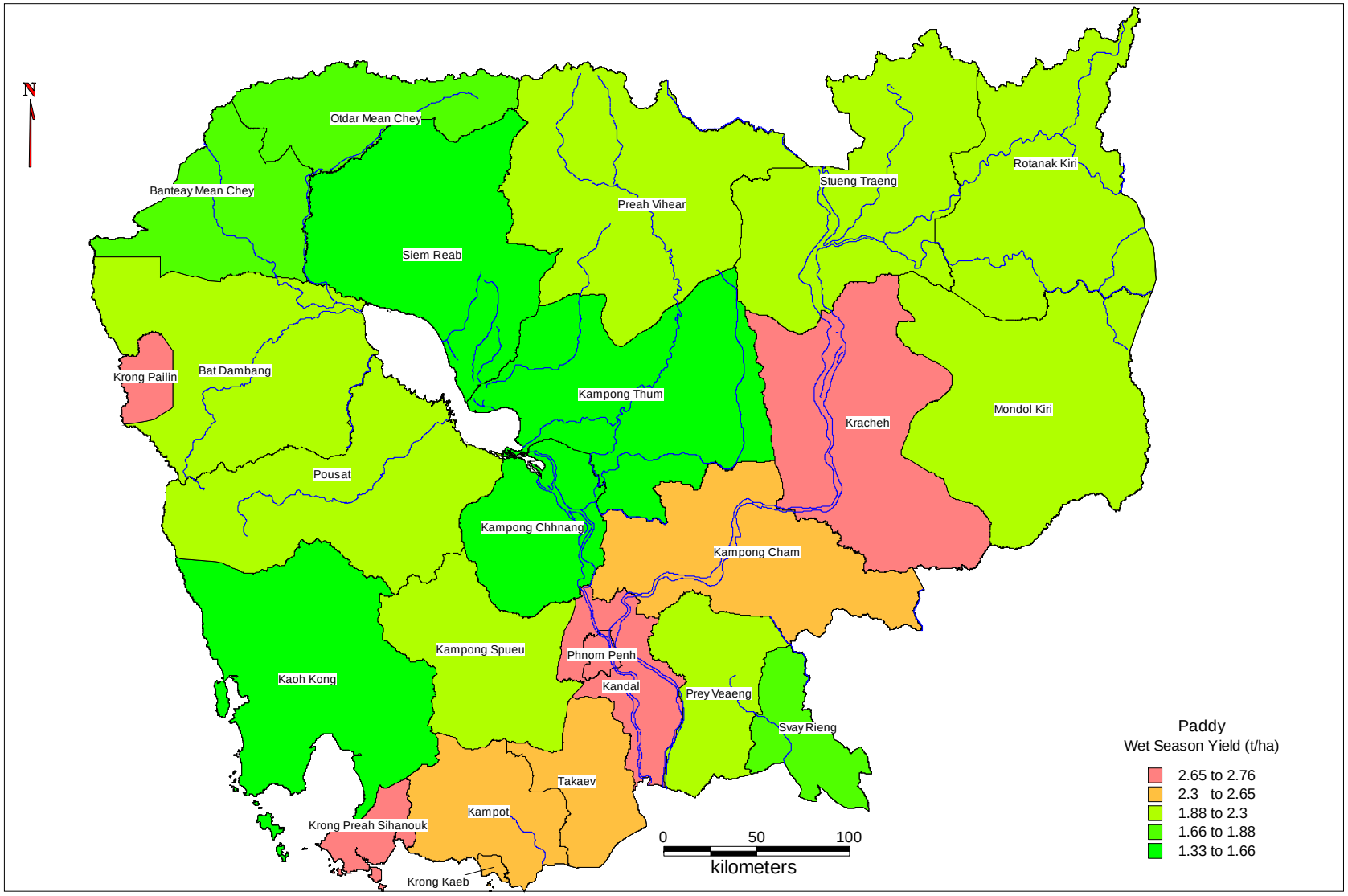
Map 1 Food Balance in Cambodia – 2000-2001



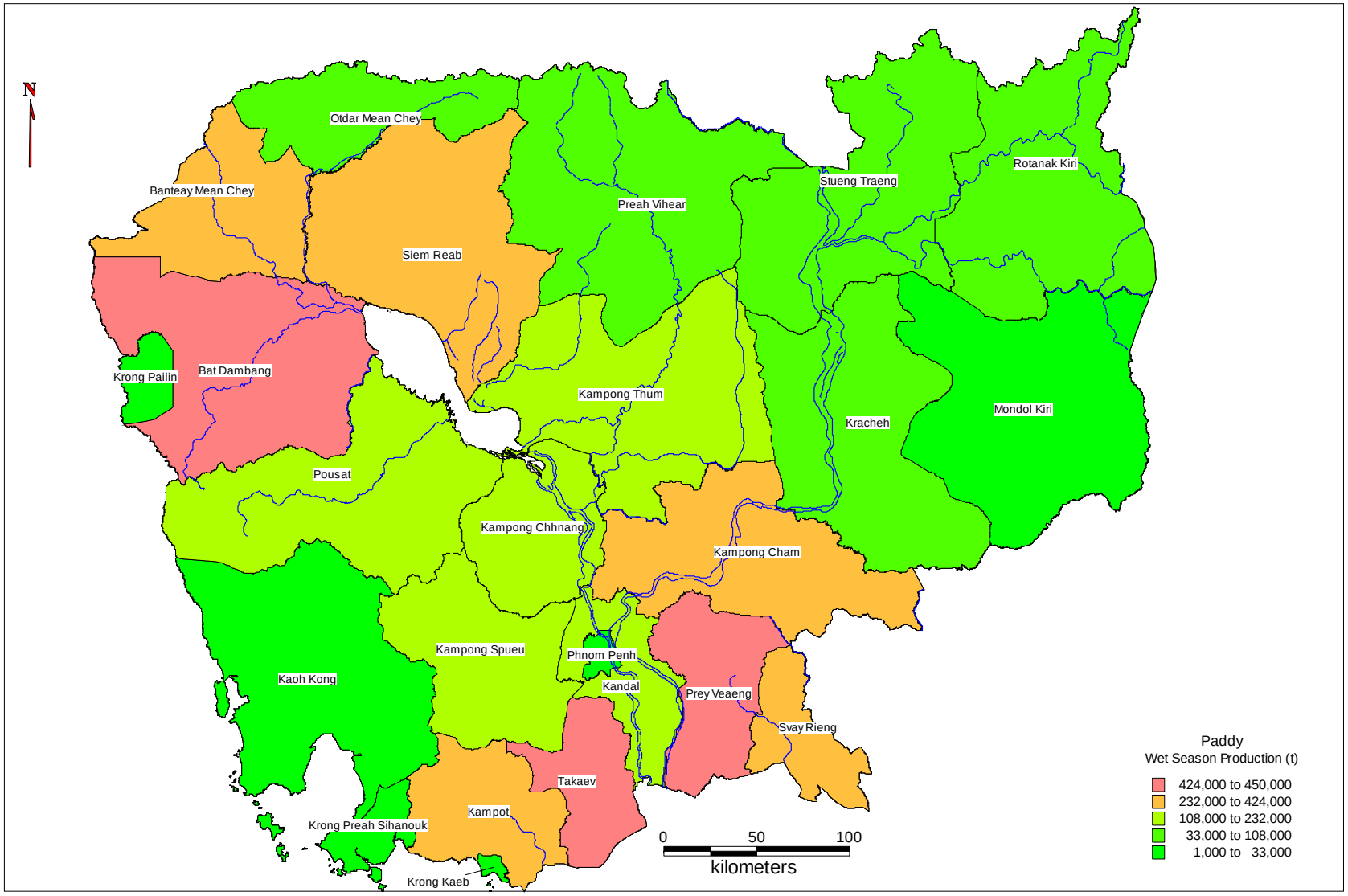
Map 2 Food Balance in Cambodia – 2001-2002



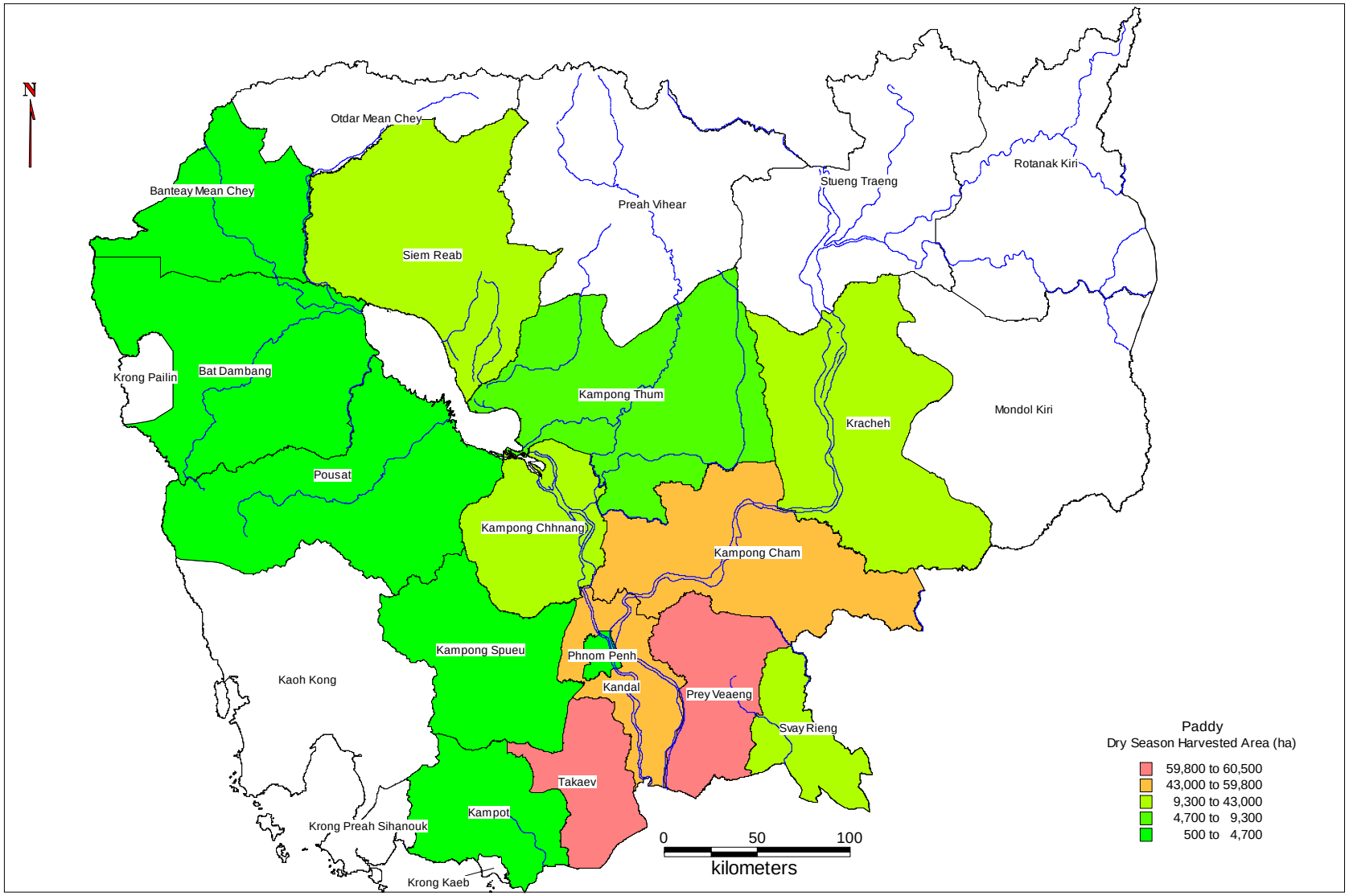
Map 3 Provincial Distribution of Crop Production 2003/04 – Paddy – Wet Season Harvested Area



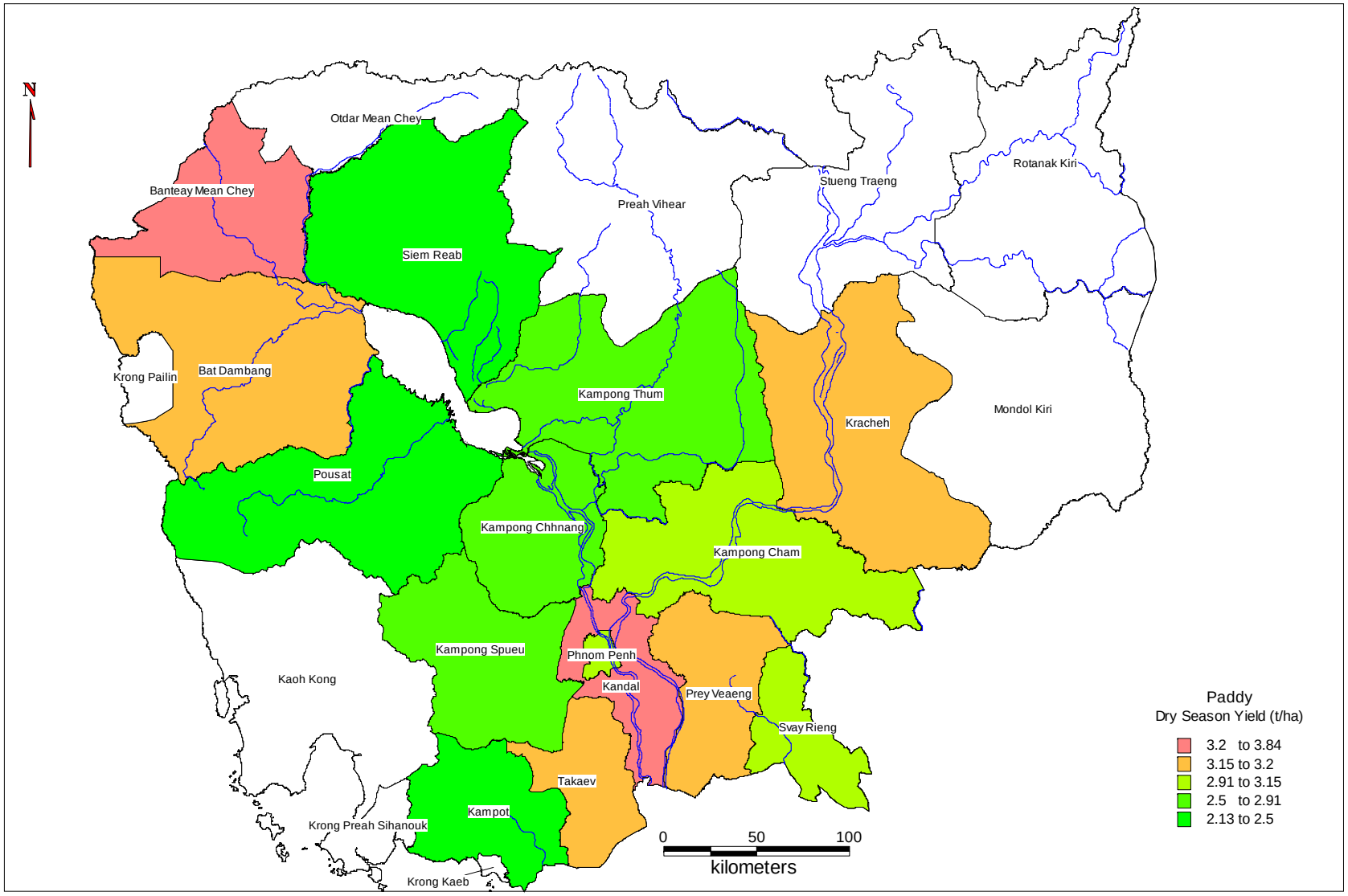
Map 4 Provincial Distribution of Crop Production 2003/04 – Paddy – Wet Season Yield



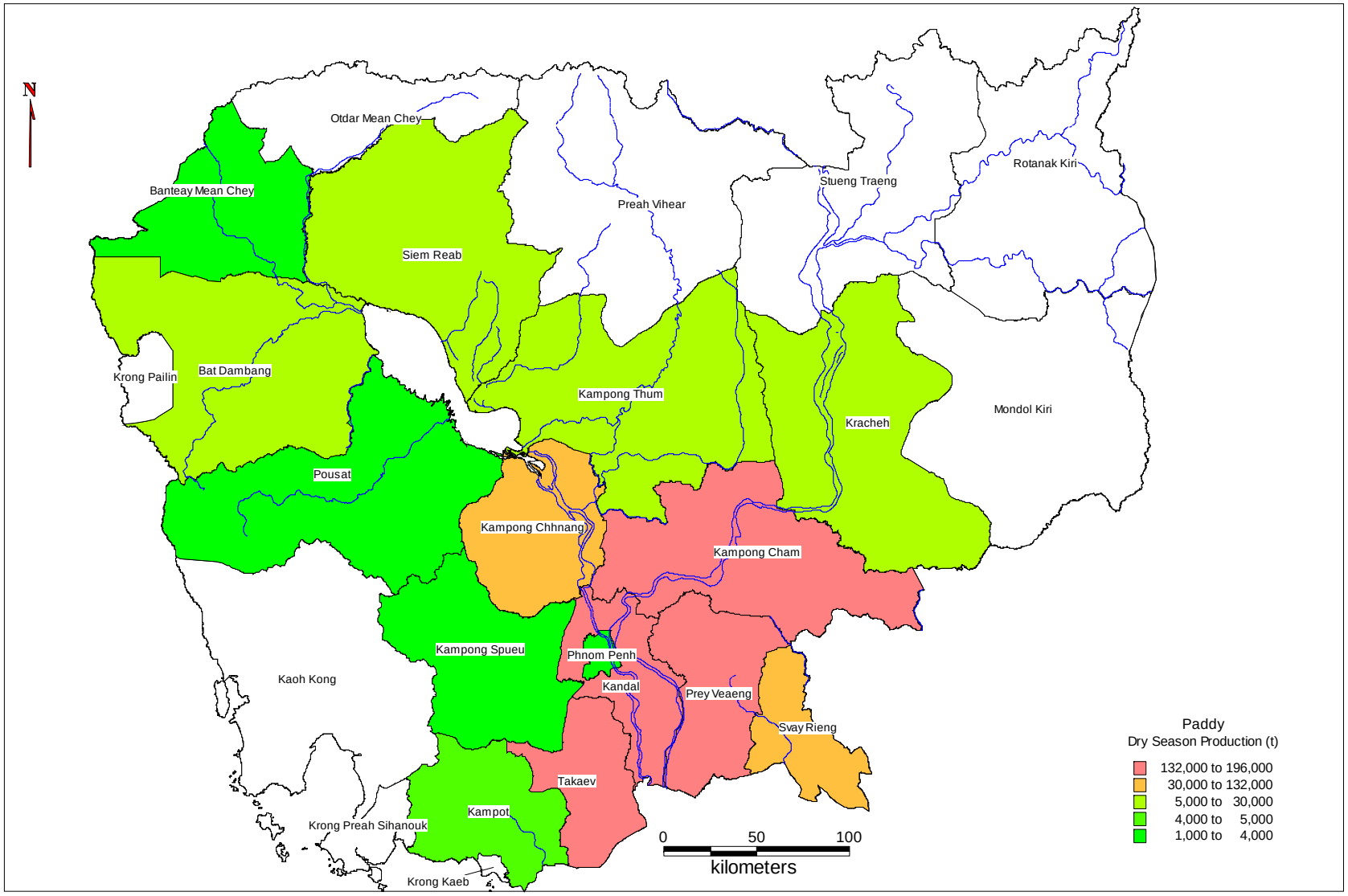
Map 5 Provincial Distribution of Crop Production 2003/04 – Paddy – Wet Season Production



Map 6 Provincial Distribution of Crop Production 2003/04 – Paddy – Dry Season Harvested Area



Map 7 Provincial Distribution of Crop Production 2003/04 – Paddy – Dry Season Yield



Map 8 Provincial Distribution of Crop Production 2003/04 – Paddy – Dry Season Production