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**Report on the Workshop on the South East Asian  
*agri benchmark* Rice Network**

**Working Paper 2013/5**

# **Report on the Workshop on the South-East Asian agri benchmark Rice Network** (March 18<sup>th</sup> to 22<sup>nd</sup> 2013)

## **1 Introduction**

As a main staple food, rice has long dominated agricultural economics in Southeast Asian countries (SEA). More than ever, rice production in mainland SEA including Cambodia, Laos, Myanmar, Thailand and Vietnam has developed substantially and is being shaped by a drive towards modernization and trade expansion. By pursuing agricultural development through export-led economies in the last century, Thailand and Vietnam have become the world's top rice exporters. More recently, policy makers in Myanmar, Cambodia and Laos have seen growing interest in developing strategies to promote rice production for export. In addition, governments of traditional importing countries like Indonesia and the Philippines are aiming to achieve self-sufficiency in rice production as a reaction against global cereal price spikes in the past few years.

At the same time there is an ongoing trend of declining per capita rice consumption in Asian countries. It is projected that this trend – together with a decline in population growth – will ultimately lead to a decline in total rice consumption in Asia (Timmer, 2013). Against this background a large rice surplus in coming years is a likely scenario. As of today, it is not clear whether global markets – especially in Africa – will be able to absorb those surpluses. In any case there will be competition which will, therefore, give rise to increased trade and competition among countries. This in turn inevitably implies opportunities and threats to farmers, particularly small-scale farmers, to adjust and fine tune their production and marketing patterns in order to cope with the dynamics of the regional economy.

On the other hand, some trends are already emerging in the rice sector. Land prices have gone up significantly and inputs costs have risen requiring further increases in productivity as well as greater efficiency of labor, water, fertilizer and energy use. Rural to urban migration has made labor in the agricultural sector scarce and expensive, driving mechanization as well as the development of new service sectors. Traditional smallholder farm management is being replaced with outsourcing of farming operations or the formation of small service enterprises.

In order to systematically analyze these challenges and to explore options to improve the economics of rice production, it has been envisaged to establish a regional network of rice production economists which will be part of the global agri benchmark Cash Crop network. This workshop was designed to serve as a starting point for a jointly defined regional agri benchmark network on the rice sector in SEA countries.

This report summarizes the results of the first regional agri benchmark workshop on how the rice based system in mainland SEA countries is currently developed with particular focus on structural changes in rice production. It goes on to

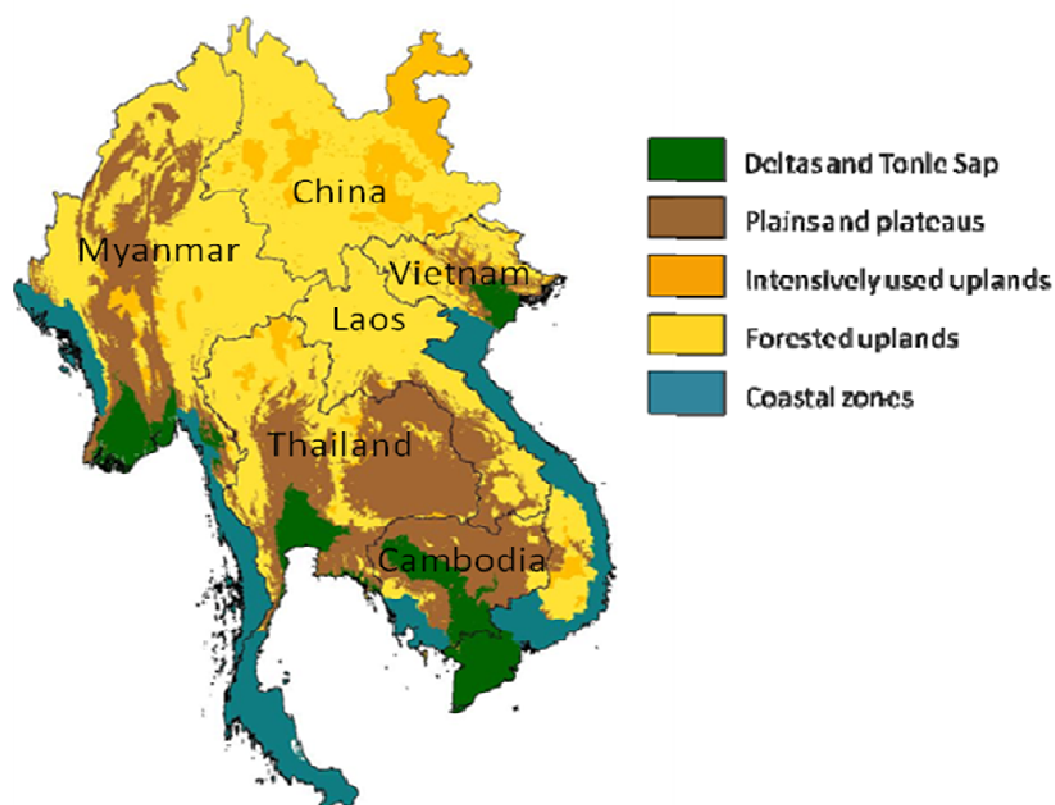
identify the main challenges and driving forces behind agricultural change in the region including investment and policy trends. Based on this analysis, a strategic plan for setting up a series of typical farms is recommended.

## 2 Rice based production systems and trends

### 2.1 Agro ecological zones in mainland South-East Asia

Mainland Southeast Asia can be divided into five agro ecological zones as shown in Fig. 1. Rice is grown throughout five zones with different cultivation techniques depending on climatic and geographical conditions. However, the main rice production regions are four mega-deltas and the Tonle Sap flood plain, which are formed by five long rivers, namely the Mekong, Ayeyawady, Salween, Chao Phraya and Red River. Although these deltas occupy less than 10% of the total land area (20 million hectares), they are home to over a third of the total population (86 million) and produce more than 50% of total rice, fruits, vegetables and aquaculture crops (Johnston et. al., 2010).

Figure 1: Schematic map of agro ecological zones of mainland Southeast Asia

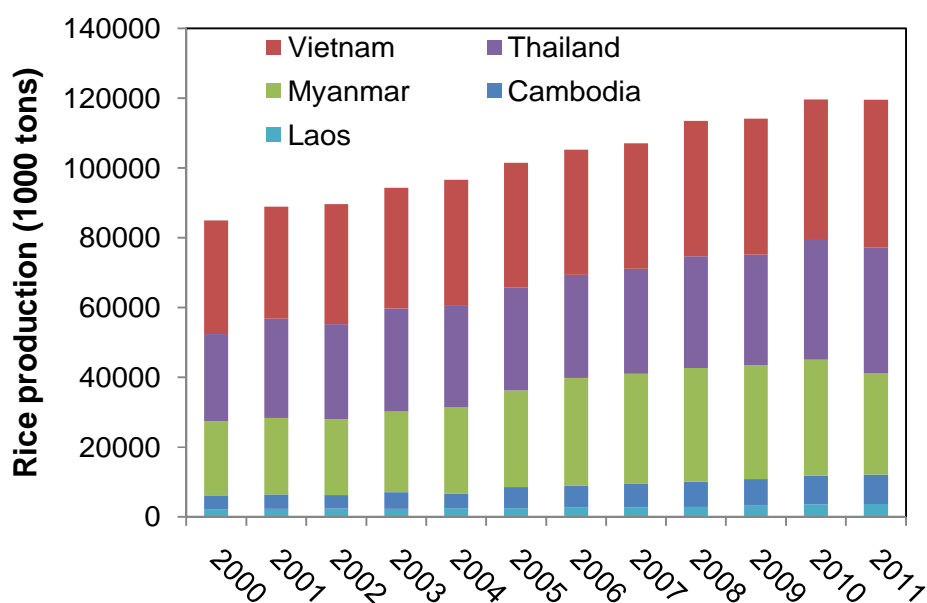


Source: Johnston et. al., 2010

## 2.2 Rice production and trends

Rice continues to dominate agricultural production in all SEA countries, grown both as food and as an export crop. Fig. 2 shows that the total rice production in the region has been steadily and substantially increasing nearly 3,7% annually over the last 12 years and has reached around 120 million tons of paddy (rice in the husk) in the year 2011. Although structural and political frameworks in the rice sector vary enormously between countries, overall strategies for increasing rice production are very similar: intensification, specialization, increased inputs and mechanization. This trend of production growth in the region will continue to be shaped by political intervention towards an export orientation as well as for food security and income generation. Thailand and Vietnam are well established rice-exporting countries with an increasing trend towards encouraging quality improvement of domestic rice, as well as modernization of production and processing. In Myanmar, Laos and Cambodia poverty reduction, employment generation in rural areas and enhancement of exportation are likely to be the main factors shaping national policies.

Figure 2: Rice production trend in mainland SEA countries

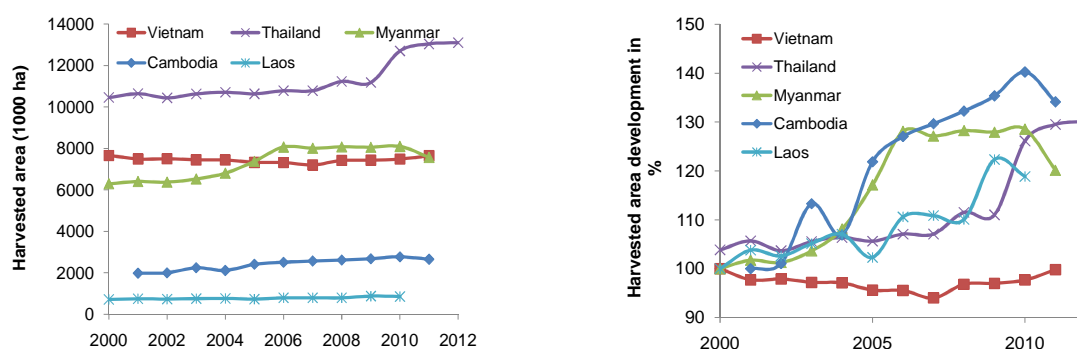


Source: Country presentations at the Workshop on SEA agri benchmark Rice Network, 2013; own calculation

The growth in production has been achieved by a combination of expansion in rice growing areas and improvement in yield. Overall, the increase in rice production has mainly been due to yield improvement, which contributed around a 2,1% annual growth rate in rice production during the first decade of the twenty-first century. The rice harvested area has increased at a lower growth rate of about 1,56% annually during the same period, from 27,1 million ha in 2000 to nearly 31,8 million ha by 2011 (Fig. 3). Of all mainland SEA countries, Cambodia and Myanmar have had the fastest increase in area expansion due to

their large reserve of land favorable for rice production and abundant water resources. In Thailand and Laos, the increase in area was modest. However, a sharp increase of rice area in Thailand since 2010 has resulted from a policy-driven pledging program which encouraged farmers to expand their rice area in response to higher price support and to offset last year's crop losses due to floods. In contrast, the harvested area in Vietnam tends to decrease as land and water resources are increasingly coming under competition with other crops, urbanization and industrialization. However its annual rice production has achieved sustained growth through yield increase (Fig. 4).

Figure 3: Evolution of harvested rice area in mainland SEA countries



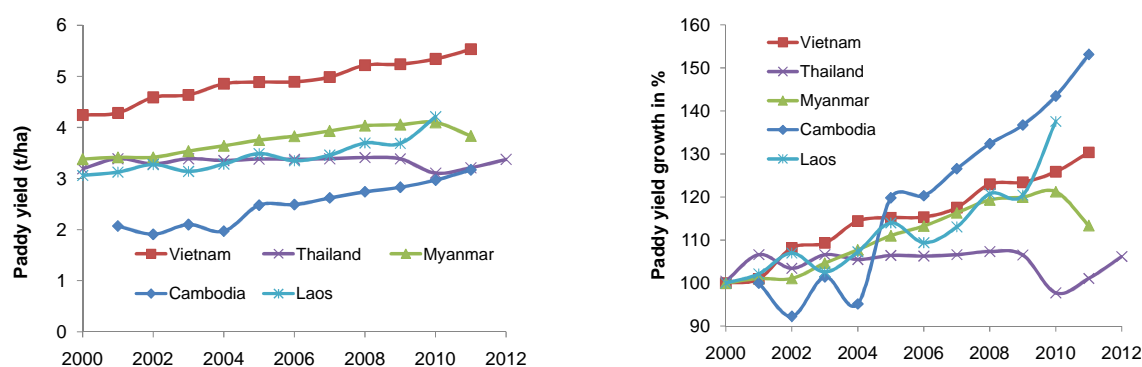
Source: Country presentations at the Workshop on SEA agri benchmark Rice Network, 2013; own calculation

As shown in Fig. 4, there is a large gap between paddy yields among mainland SEA countries. Vietnam has maintained the highest yield in the region, while the paddy yield in Cambodia is the lowest. The average paddy yield in Cambodia (2,5 t/ha) is about a half of that in Vietnam (5 t/ha). However, it is interesting to recognize that from 2006 onwards, Cambodian paddy yield growth is the highest in the region. This reveals that there is great potential in yield improvement for Cambodia rice production. Given the high responsiveness of fertilizer to the current very low yield level, farmers could considerably increase their yield and revenue from more market sales (Yu, 2009).

Similarly, Myanmar and Laos have gradually improved their paddy yields, albeit with a high year-to-year variability due to the affect of extreme climatic events such as drought and flooding. Although there are clear upward trends in paddy yield in four countries - Vietnam, Laos, Cambodia and Myanmar- the average yield in Thailand has remained more or less stagnant during the last years. This is mainly because the yields of traditional high-quality rice varieties from the single cropping pattern in rain fed lowlands which account for nearly 80% of the total rice area, are extremely low at about 2 tons, leaving much room for improvement. Major constraints for increasing rice productivity in the Northeast region which is the largest rice area in Thailand, are water shortage and inherent low soil fertility.

Generally, an increase in rice yield and a reduction of production cost are decisive factors in enhancing the economic competitiveness of rice production. Closing the yield gap is directly linked to a range of measures: more effective irrigation, uptake of improved varieties, and/or agronomically better use of fertilizers and improved farming practices. However, yield gains are not achieved by technology alone, but also require complementary changes in policies and institutions, which enhance farmers' skills, innovations in risk management, rural finance and a sound performance of advisory services. These would require substantial investments in research and extension as well as rural infrastructure.

Figure 4: Evolution of yield in mainland SEA countries



Source: Country presentations at the Workshop on SEA agri benchmark Rice Network, 2013; own calculation

### 3 What are driving forces for changes in rice production?

#### 3.1 Domestic policies

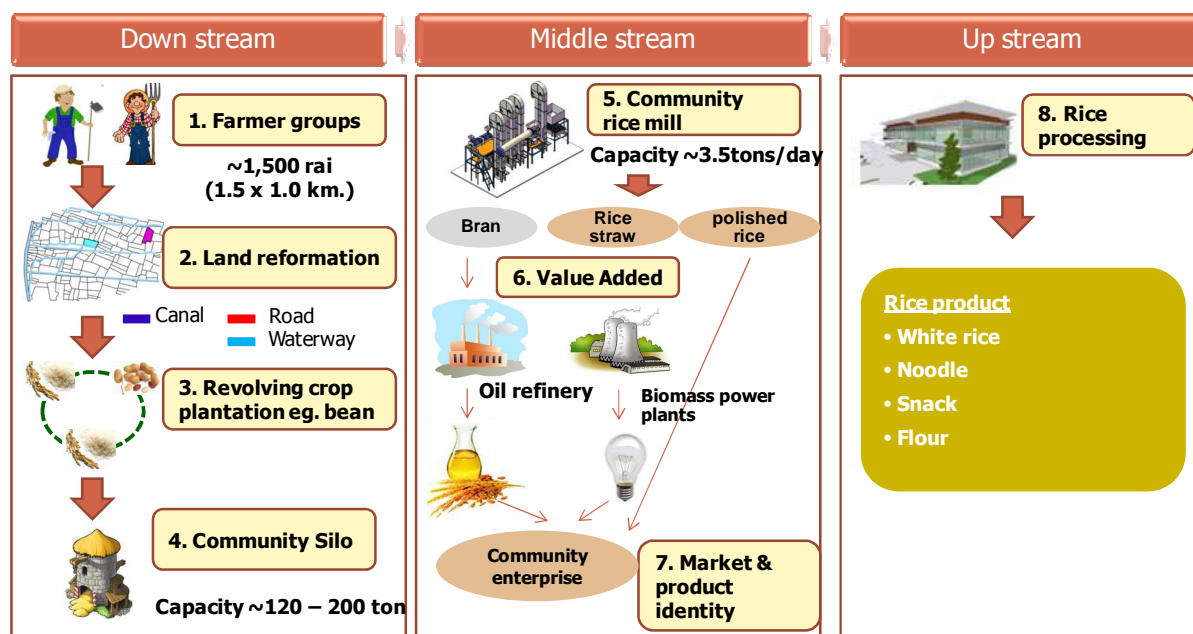
Export orientation will continue to shape agricultural policies for both Thailand and Vietnam, with an increasing trend towards domestic value addition and the modernization of agricultural production and processing. Due to the increasing competition from Myanmar, India and Cambodia in the low value rice sector, both countries have to figure out ways to move up or concentrate on higher quality, more value added rice.

The Vietnamese government supports a new model of large-scale cultivation, which has been practiced in the Mekong delta since 2011 in order to increase competitiveness of rice production and market efficiency. The model began during the winter-spring crop of 2011 in the An Giang province. Large millers joined together with large groups of farmers composed of 443 households and 1073 ha to produce high-value rice in a system based on trust and transparency. This is an important step towards realizing a vertical integration among farmers and processing plants in the rice value chain.

Similarly, the Federation of Thai Industry proposes the concept of "Better Farming Solutions for Better Agro-Industry", in which farmers cooperate in groups combining farms to 1500 rais (240 ha) as illustrated in Fig. 5

(Conference, 2012). The community targets to improve farming efficiency based on the concept of mechanization with modern farm machinery. Farmland must be rearranged by expanding from less than a 1 rai/plot which is the current situation to at least a 3 rais/plot, which would be suitable for utilization of machines. An “Agricultural Machinery Centre” would be set up as a hub for machine sharing among the community members.

Figure 5: Design of “Better Farming Solution for Better Agro-Industry” in Thailand (Conference, 2012)



In Cambodia, Myanmar and Laos, poverty reduction and employment generation are likely the main factors shaping national policies. Myanmar and Cambodia in particular, have broader strategies to become major rice exporters in the near future. Both countries are endowed with fertile lands and a favorable natural environment that can expand their production. In 2010, the Cambodian Government adopted a new “Rice Policy on Promotion of Paddy Production and Rice Export”. According to this policy paper, the Cambodian government aims to export a minimum 1.0 million tons of milled rice by 2015. At the same time, the Myanmar government took some steps to reform its rice sector with the establishment of the Myanmar Rice Industry Association (MRIA) in 2010 by merging producers, traders, millers and exporters. It aims to speed up the development of the sector by attracting private investment and raising the sector’s concerns to the government. In general, these countries have been keen to promote investment, mechanization and the adoption of high yielding varieties as well as to improve the availability of credit, inputs and storage facilities in order to accelerate the development of the rice sector.

There are a number of regional initiatives such as ASEAN, the Greater Mekong Subregion (GMS), Ayeyawady-Chao Phraya- Mekong Economic Cooperation Strategies (ACMECS), which encourage trade flow, domestic and foreign investment in tradable commodities and agribusiness. Under cooperation

frameworks, farmers in SEA countries can benefit from technology transfer, increasing cross-border trade and the enhancement of contract farming.

### 3.2 Diversification of the rice-based farming system

Declining profitability of rice farming due to high labour and input costs together with the risk of price volatility may push forward a gradual movement out of a monoculture system to a diversified market-oriented cropping pattern. In the deltas, several crops such as corn, peanuts, soybean, sweet potato, vegetables and fruits are grown in rotation with rice. In upland areas, farmers can convert paddy fields to cassava or perennial crops such as rubber, oil palm or sugarcane. The rice-pulses cropping system has long been practiced in Myanmar. In recent years, rice-corn cropping systems have emerged in Vietnam, Laos, Cambodia and Thailand. The key drivers for this transition in cropping patterns are new market opportunities for farmers due to the rapidly rising demand for corn as livestock feed; a decline in available irrigation water; pest outbreaks in intensive continuous rice systems; and a rapidly expanding agribusiness sector associated with corn seed markets, other production inputs, as well as the processing and marketing of corn products.

Table 1: Economics of the cropping system rice-rice-corn (2012) in Southeast region, Vietnam

Expense / Income items	Unit	1st rice	2nd rice	corn
<b>Acreage</b>	ha	3	3	3
<b>Yield</b>	t/ha	5	4,7	8,3
<b>Direct cost</b>	USD/ha	<b>399</b>	<b>382</b>	<b>694</b>
- Seed	USD/ha	86	86	137
- Fertilizer	USD/ha	241	217	507
- Plant protection	USD/ha	72	79	50
<b>Variable cost</b>	USD/ha	<b>469</b>	<b>469</b>	<b>840</b>
- Land preparation	USD/ha	96	96	48
- Irrigation	USD/ha			140
- diesel	USD/ha			64
- Harvest	USD/ha	134	134	119
- hired and family labor	USD/ha	239	239	469
<b>Fixed cost</b>	USD/ha	<b>132</b>	<b>132</b>	<b>139</b>
- Land (including opp. cost)	USD/ha	106	106	106
- Depreciation	USD/ha	16	16	16
- Interest	USD/ha	10	9	17
<b>Total cost</b>	USD/ha	<b>1000</b>	<b>983</b>	<b>1673</b>
Price	USD/t	239	239	311
<b>Gross revenue</b>	USD/ha	<b>1196</b>	<b>1124</b>	<b>2581</b>
<b>Farm's profit</b>	USD/ha	<b>196</b>	<b>142</b>	<b>908</b>

For example, Table 1 shows the economics of a typical farm performing a triple-cropping system: rice-rice-corn in the Southeast region of Vietnam in 2012. The cost of insecticides and herbicides for corn is equal with that of rice. However,



the expenditures for seeds and fertilizers for corn are higher than those of rice, because hybrid corn seeds are more expensive than inbred rice seeds and they require high fertilizer use to create more output. Fungicides are used much less in corn than in rice. In addition, corn was planted in the dry season and therefore had to be irrigated. Pumping water to the field was done mostly by electricity. Because electricity was not permanently available during the dry season, a diesel engine was used for pumping in replacement of the electrical pump on some days. Diesel costs in this case can also be considered as irrigation cost. The lack of corn harvesting machines makes labor cost for corn higher than that for rice. Although direct and variable costs for corn are about 1,8 times higher than that for rice, net profit from corn production is much better than that from rice production due to higher yields and higher corn prices compared with those of rice.

Many rice based cropping systems such as rice-rice, rice-rice-corn, corn-rice-corn, rice-rice-peanut, rice-rice-vegetable exist in the region. Although peanuts and vegetables are also grown after the second rice crop, corn seems to be the farmers' best option. The ultimate choice of a third crop in the system depends on the profits that farmers earn from growing it.

### 3.3 Mechanization

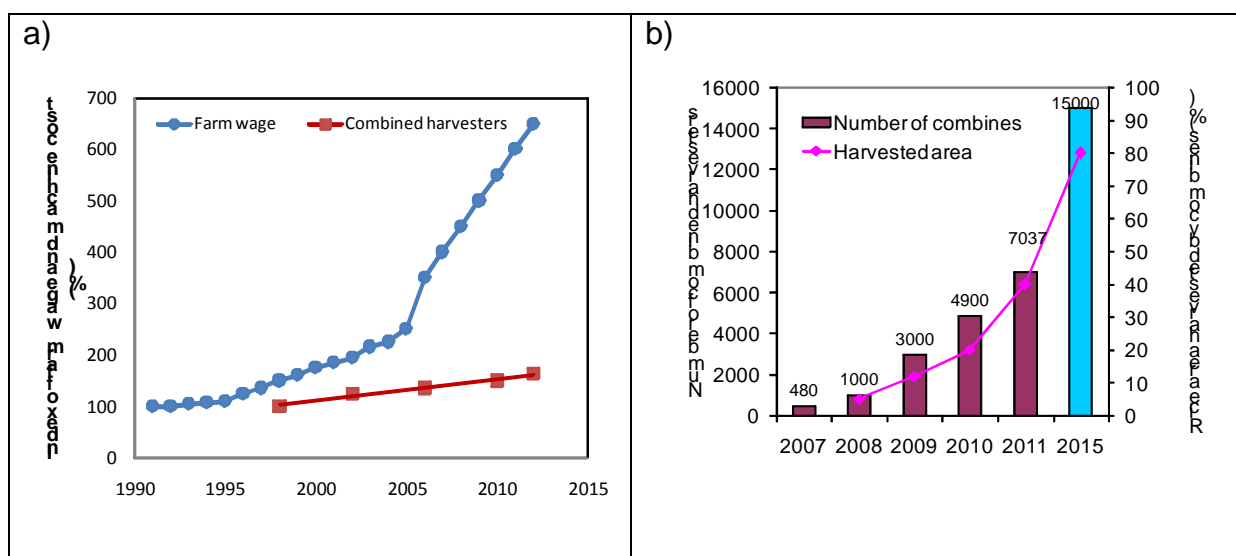
Rice farming has changed significantly with advances in machinery technology. Competition from urban and non-agricultural development has made labour in agriculture scarce and expensive, driving mechanization as well as the development of a new service sector. In particular, the most power-intensive stages of rice farming, such as land preparation and harvesting, have been increasingly outsourced to special service providers (Yang, 2013, Conference, 2012). Fig. 5 illustrates a successful example of using combined harvesters or simple combines in response to high labour costs, especially during the peak harvesting period in the Mekong Delta.

It is surprising to see that the daily farm wage rate<sup>1</sup> has sharply increased by 600% in Vietnam's Southeast region and Mekong delta in the last two decades (Fig. 5a), while the price of a local-made combine harvester has increased moderately by 160% since it was first introduced in 1998. It is noted that the average annual inflation rate in Vietnam during that period is about 8%; hence, the bulk increase in wage rates includes inflation. The introduction of harvesting machinery to reduce harvesting costs creates a new business opportunity for the private sector and causes a strong increase in the number of combines in the Mekong Delta (Fig. 5b). Generally, wealthier farm families, who also provide harvesting services (as contractors) for other small farmers, own combines. In recent years, many specialized enterprises have been established by small groups of skilled farmers who can buy medium or large size combines without government subsidy and provide harvesting services throughout the country.

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<sup>1</sup> Daily average wage for male workers

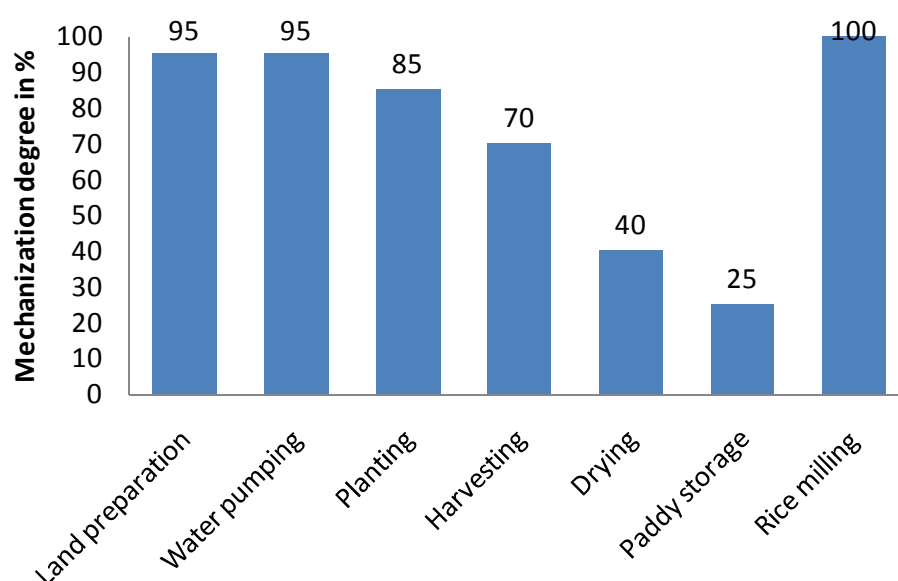
Figure 5: Development of harvesting machinery and agricultural wage rates in the Mekong delta



Source: Author's calculation

The adoption of mechanization for rice based farming systems among SEA countries is increasing, but is rather diverse (Conference, 2012; Soni, 2010). Fig. 6 shows mechanization rates in every step of the rice farming process in the Mekong Delta. Although mechanization services in terms of contractors are successfully adopted ranging from soil preparation, planting, maintaining and harvesting, efforts to promote improved post-harvest handling through mechanized drying and storage at farm level have generally been less successful. This is because the use of mechanical dryers often requires adaptation of technology into an existing post-harvest system. There is considerable scope for improvement of the private sector's milling efficiency, when mills take on a greater share of paddy drying activities.

Figure 6: Mechanization in rice production in Mekong Delta



Source: Own calculation

## 4 Main challenges in rice production

### 4.1 Small and fragmented farms

Rice farming in SEA countries is typically driven by small-scale farmers (Tab. 2). Small farm size inhibits mechanization, especially in highly densely populated areas like the Red River Delta (0.3 ha/household). Land accumulation has only progressed slowly in all SEA countries. In particular, land ownership is restricted by governments in Myanmar and Vietnam, which reduce opportunities for land consolidation/ accumulation and consequently hinder mechanization on large scale fields. The Vietnamese government enforces the designation of around 40% of agricultural land (3,8 mil. ha) strictly for paddy rice cultivation. The conversion of rice land to other uses, even to other annual crops, requires permissions from the provincial authorities.

Table 2: Typical farm size in South-East Asian countries

Countries	Farm size (ha/household)
Red river delta (Vietnam)	0,35
Mekong delta (Vietnam)	1,1
Thailand	3,2
Myanmar	2,5
Cambodia	1,8
Laos	1,7

Source: Workshop on SEA *agri benchmark* Rice Network, 2013

As the structural transformation advances, the agricultural share in national income falls and its importance for national economic growth diminishes. The non-agricultural sector becomes the primary engine of growth and the agricultural share of total employment falls more slowly than its share of national income. An inevitable result is that agricultural labour productivity and farm incomes per capita lag behind the non-agricultural sector. Therefore, diversification and more investment in production technologies combined with land consolidation to larger fields are key factors to improving the labour productivity of rice farmers in the long run. The rice farming system must be changed in order to realize economies of scale, necessary to make the investment in expensive machinery economically feasible.

Land accumulation and consolidation which are driven by many enterprises and individuals have been taking place in all countries, but restrictions on land use rights and land ownership still remain a concern. In Vietnam, agricultural land is technically owned by the state, and farmers receive land use rights for 20-year terms. In recent years, the government has gradually modified ownership rules so that the tenure of land allocated or rented to households and individuals should be extended from the current 20 to 50 or 70 years, and land quotas (maximum landholding per household) doubled from the current six-hectare limit. Policy makers, however, have a fear that an unfettered land market could have negative consequences for the poor, leading to rising landlessness and inequality. That is why there are several policies for land and landless farmers and very few policies encouraging tenant farming. Emphasis on improving infrastructure and market information would enable farmers to make their own decisions about market opportunities and consequent land use change, while landless or land-poor farmers would not become impoverished.

#### **4.2 Stagnant rice consumption vs. rice oversupply**

Over the longer term, world rice consumption is expected to decline as per capita consumption falls in many countries experiencing relatively rapid growth rates in per capita income. Consumers switch to higher value food such as vegetable oils and livestock products and fruits. Rice consumption is stagnant in Asia, where 80 per cent of world rice is now consumed. In general, the budget share spent on rice is falling rapidly. It is expected that in the midterm, rice surplus in Asia will increase due to stagnant rice demand and that at the same time there will be increases in rice production in almost all Asian countries. Therefore, rice-exporting countries, which include Thailand and Vietnam and emerging rice exporters like Myanmar and Cambodia, must learn how to cope with lower rice consumption and focus on raising the quality of rice, taking advantage of different marketing channels.

Outside Asia, rice consumption is still increasing between 3% to 4% per year in Africa, which in 30 years could possibly become the world's largest rice consumer. Rice consumption is also increasing a bit in Latin America. Until now, local African production has been low and unable to cope with increasing demand. Therefore, African countries still depend on rice imports to meet their

growing consumer demand. However, there are many projects going on to improve and increase African rice production. Whether or not the increasing Asian surpluses will find an adequate market in Africa will very much depend on the outcome of current initiatives to boost African rice production.

Due to the increasing rice surpluses in SEA countries, the potential for both short and medium term competition in the global market and consequently pressure on rice prices can be foreseen. Therefore, the agri benchmark initiative will conduct more research to understand whether rice production in the different mainly rice-producing regions will still be able to maintain its competitive advantage and what alternatives can enhance the competitiveness of the rice sector and ultimately increase rice farmers' profits. Three key issues have to be addressed:

High levels of labor productivity are a major source of comparative advantage in rice production for mainland Southeast Asian countries over rice importing countries. Therefore, it is necessary to quantify long-term changes in labor productivity in order to compare levels of labor productivity across the rice-producing countries in SEA.

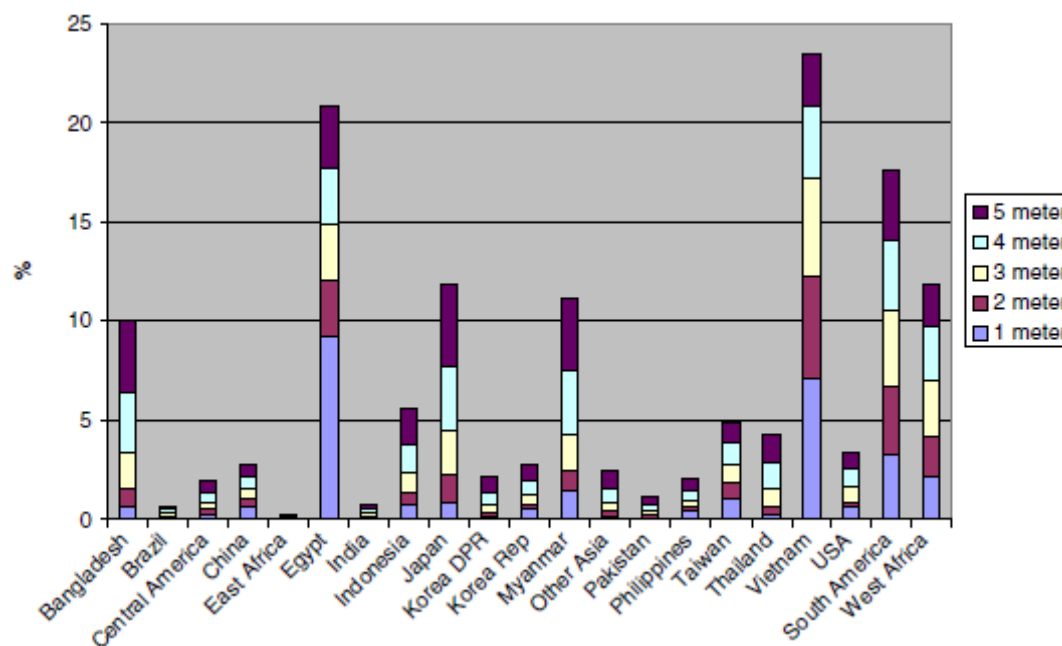
Technological changes play a crucial role in reducing production costs as well as upgrading rice quality. It is important, therefore, to investigate how rice production technology develops in different regions and its response to changes in agro-ecological, economic and social framework conditions.

Declining profitability of rice cultivation acts as a further incentive for seeking alternative ways of sustaining income for rice farmers. More research has to be undertaken to identify suitable crop diversifying strategies as well as agro-climatic and technological constraints to commercial large scale production.

### **4.3 Climate change and water shortage**

The main characteristics of global climate change are: an increase in temperature, variation in rainfall and its distribution, and a rising sea levels. To date, only the increases in temperature and sea level have been observed. An analysis of historical rainfall records indicates a high degree of variability, but no trend in either overall amount or seasonality of rainfall (Johnston et. al., 2010). Sea level is expected to continue rising in the years to come. That causes a significant threat to the deltas and coastal regions. Fig. 7 displays an estimate of the percentages of agricultural lands that would be inundated under various levels of sea level rise in some regions in the world (Desgupta et. al., 2009). Among mainland SEA countries, the Mekong delta and the Irrawaddy delta are the regions most affected by the rise in sea level.

Figure 7: Estimation of arable land affected by increasing sea water levels



Source: Dasgupta et. al., 2009

Land expansion and intensification of rice production, especially during critical months at the end of the dry season – April and May - have brought with them significant water demand, which may cause water shortages and more competition with other water users, as irrigation demand alone would surpass flow availability of the Mekong river (Pech et. al., 2008). Vietnam and Thailand use their arable land in the Mekong River Basin almost to its full extent for producing paddy rice and other crops for both domestic consumption and export. Cambodia, Myanmar and Laos will further increase their paddy production through the expansion of new land and irrigation areas.

The most effective adaption and resilient strategies to safeguard rice production in the regions in the context of climate change and climate variation would be:

- Perform the basic agricultural genetic research to figure out ways to make rice plants more resilient. For instance, a new rice variety (Super Scuba) has been successfully tested in Eastern India in flood conditions (Finkel, 2013). It survives under water for 2 weeks.
- Invest in putting the right kinds of infrastructure in place to improve farmers' resilience. All countries have recognized the importance of investment in water control – not just irrigation and drainage but also flood prevention and relief.
- Diversification of crop types toward those requiring less water.

#### 4.4 Access to Credit

Small-scale farmers in all countries except Thailand, suffer from high interest rates from informal credit lenders. For example, in Vietnam, informal input loans are widely accessible and farmers make use of them. Prices paid for inputs (seeds, fertilizers, herbicides, insecticides, etc.) by using a loan are 10 to 30 percents higher than the direct price. Furthermore, poor households have to pay a higher interest rate on informal loans than better-off farmers. Farmers, generally, have to sell their paddy rice soon after the harvest to avoid severe post-harvest losses due to the lack of drying facilities in the rainy season, obtain cash for their daily needs and to pay back loans.

State owned banks play an important role in the expansion of the formal farm credit market. They provide subsidized credit mostly on short term to farmers of rice and other crops with interest rates prescribed by the state banks. The bank normally requires collateral in the form of houses and land-use rights. This presents a challenge for poor rural households. That is why an informal credit market still exists in the form of private moneylenders, relatives and other individuals. Microfinance institutions provide loans to small borrowers but they are not capable of lending long-term loans for investment in machinery and other equipment that enhance labour productivity.

One option for farmers to overcome financial difficulties is contract farming. Through contracts, the buyers provide significant inputs such as credit, information, reliable markets, and services. There are, presently, relatively few examples of contract farming for rice in Asia. However, there are still some examples of quality rice production under contract. Millers and companies usually face an unreliable supply of rice, both in terms of the quantities and, particularly, qualities and varieties they would like to obtain. As a consequence of supply uncertainty, it is not always easy for companies to enter into forward contracts on domestic and export markets. Therefore, there are considerable potential advantages to contract farming as it can provide them with guaranteed quantities and qualities. The private sector should be playing a more active role in promoting such production.

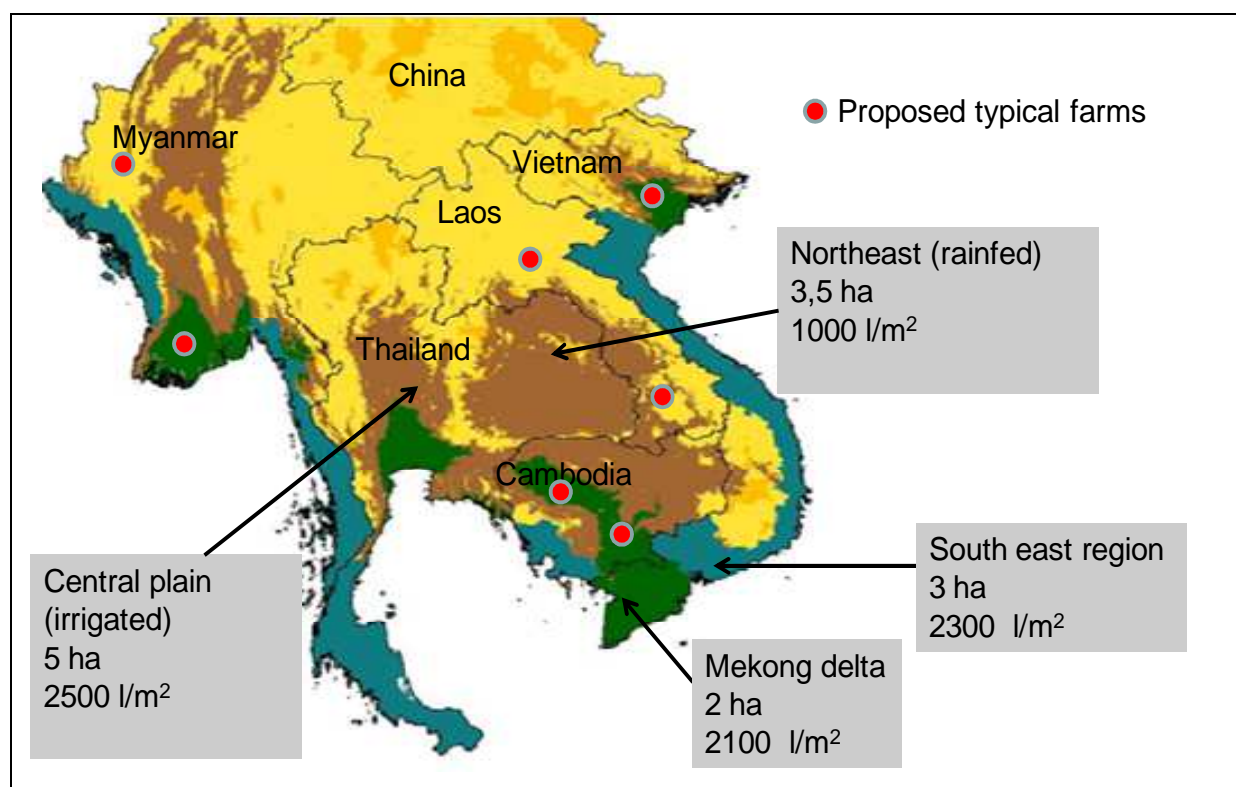
### 5 Discussion on establishment of typical farms in key rice regions

Based upon discussion during the workshop and analyses in this report, the following recommendations for establishing typical rice farms in SEA countries can be considered:

- (1) Due to varying agro-ecological and hydrological conditions in SEA countries, wide differences exist in the productivity of rice cultivation in different growing seasons. However, the largest rice production areas are concentrated in mega-deltas and low-lying floodplains of the Red, Mekong, Chao Phraya and Irrawaddy rivers- the "rice bowls" of the region. It is, therefore, advisable to establish a series of typical farms in these sites, as suggested in Fig. 7.

- (2) Because cropping patterns towards intensification/ diversification in rain fed and irrigated areas are increasing, additional typical farms in rice regions with rotation cropping systems have to be established.
- (3) The competition in terms of economic reasons between rice with other cash crops such as rubber, sugarcane is strong in upland areas, especially in Thailand, Laos and Cambodia. It is interesting to know how farmers maintain rice production for self-consumption and other cash crops for income generation. Establishment of typical farms for rice and other cash crops in these regions could be considered.

Figure 7: Existing and proposed typical farms in key rice regions





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