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Changing Realities – Perspectives on Balinese Rice Cultivation

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Introduction

Rice yields harvested in Bali are the highest in the Indonesian Archipelago with more than 5.6 tons per hectare (BPS, 2007). This is well above the national average of 4.6 tons per hectare (BPS, 2007). The fertile volcanic soils and abundant water are only two of the factors that enable high and stable yields. An key role is played by the subak, a commonly recognized socio-religious agricultural association (Sutawan, 2000). Subak support farmers in all matters relating to the cultivation and irrigation of rice. They are considered to be one of the most effective hydraulic organizations in the world (Ostrom, 1992).

Bali's beautifully laid out rice terraces not only produce high yields. They are also a main attraction for the many tourists that visit Bali every year. But, as an ever-increasing stream of tourists arrives each year in Bali the economy rapidly develops and new off-farm employment opportunities arise. Moreover, many of the rice terraces and irrigation canals disappear under new buildings or roads. Rising land prices, better off-farm working conditions such as regular working hours and better wages as well as the stigma of the "dirty, uneducated farmer" lure particularly the younger generation of Balinese away from agriculture.

Of course, the transformation of the rural economy is not only noticeable in Bali. Several studies draw attention to the various elements inducing agrarian change in many Asian countries, such as an ageing rural community (Skeldon, 1999), high labor mobility and

migration between rural and urban areas (Barker and Molle, 2004, Rigg, 1998), and growing diversification within agriculture (Hossain et al., 2002). Other factors include the thousands of hectares of fertile agricultural land which are diverted for industrial and urban use and increasing demand for non-agricultural water use (Alexandratos, 1995, Lefroy et al., 2000, Jones, 1997).

The impact of the transforming rural economy on the remaining farming community and farmers organizations is not yet fully understood. What is becoming clearer is that rural households who previously mainly engaged in farming activities have adapted to the growing opportunities such that they now earn a living in both on- and off-farm activities (Rigg, 2001). This trend can be observed in Bali too. The additional income from off-farm work gives greater security in times of unfavorable agricultural or climatic conditions. Likewise, the harvested rice secures a full plate of food for the farming household even in times of economic instability.

The implications of agrarian change for the organizations behind the farmers such as the subak - which is considered the backbone of rice cultivation in Bali - are even more obscure. One of the important features of the subak organization, often highlighted in the literature, is the emphasis on values such as trust, cooperation and mutual help among the members (Sutawan, 2000, Groenfeldt, 2003). These features which still exist today are socially monitored and sanctioned directly by farmers in the fields. However, the rural transformation currently under way might undermine the integrity of the subak system and its social framework. The modern *subak* is no longer an association of mainly subsistence farmers relying on mutual help and solidarity. The modern subak consists of farmers with different off-farm opportunities and different incentives.

The present paper intends to shed light on some of the aspects of the above discussion by means of a case study conducted in south central Bali. Present-day rice cultivation and labor

allocation by farming households¹ to the various on- and off-farm activities are analyzed. Current and possible future implications for the subak are discussed.

Bali – economic figures and trends

Economic figures for Bali show that the most important industry sectors today are agriculture and tourism. According to statistical figures for 2004, 35 percent of the total work force in Bali worked in agriculture, which was the largest ‘employer’ but had a market share (or GRDP²) of only 21 percent. The ‘trade, restaurant and hotel’ industry followed with 23 percent of the total labor force and the highest market share of all sectors, viz., 29 percent. Meanwhile manufacturing accounted for 14 percent of the labor force and 9 percent of the total market value (BPS Bali, 2005).

There has been a clear shift in the labor force and market value from the agricultural to the non-agricultural sectors, and most notably into tertiary sectors such as ‘trade, restaurant and hotel’ industry and other services. In 1976, for example, 61 percent of the population worked in agriculture with a market share of 53 percent. Only 12 percent worked in the trade sector with a market share of 7 percent and 11 percent worked in the services sector with 16 percent of the total GRDP (Bendesa and Sukarsa, 1980).

Tourism developed rapidly, starting in the late 1960s with 5000 tourists *per year* arriving at Bali’s international airport (1968) and growing almost exponentially to 4000 tourist arrivals *per day* in 2004, not including domestic travelers (Wall, 1996, BPS Bali, 2006). In the early

¹ A farming household includes all members of a household who share their income generated from a variety of different on- and off-farm activities.

² GRDP is the Gross Regional Domestic Product and is defined as the market value of all final goods and services produced within a certain region or country and certain time frame (definition from http://en.wikipedia.org/wiki/Gross_domestic_product)

stages, tourism centers were concentrated in the south of Bali around Kuta, Sanur and Nusa Dua which are all part of the Badung regency. With the arrival of increasing numbers of tourists every year, tourism facilities can now be found all over Bali.³

The many income possibilities directly and indirectly⁴ related to tourism were some of the prime reasons for Bali's rapid economic development. According to Pitana, 51 percent of people's income and 38 percent of Bali's employment opportunities are directly linked with the tourist industry (Pitana 2003). These numbers are only partly reflected in the figures stated above as the 'trade, restaurant and hotel' industry does not cover all activities related to the tourist industry. For example travel agencies and car rental businesses are combined in the transportation sector (Ptiana, 2003).

Higher living standards and a growing population have led to an expansion of urban areas. The regency of Badung which contains almost all the major tourist centers and the capital was in 2004, one of most densely populated places in Bali with 853 inhabitants per square kilometer, compared to the provincial average of 565 (BPS Bali, 2005).

Bali's irrigated rice areas have gradually decreased in recent years. Land utilization numbers from recent years show that the total area devoted to irrigated rice has been reduced between 2000 and 2005 from 85128 to 80211 hectares which corresponds to an average yearly loss of 983 hectares (BPS, 2007, 2003). Nevertheless, total production has increased from 780960 tons (2001) to 840891 tons (2006) with production rates increasing from 5.3 tons per hectare to 5.6 tons per hectare in the same time span (BPS, 2007, 2003). These figures put Bali ahead of all other Indonesian provinces in terms of production rates.

³ It must be noted that in the wake of the two Bali bombs (2002 and 2005), tourist arrivals dropped significantly. Although numbers have since recovered, see also [figure 4](#), many Balinese complain/state that tourists now prefer to stay in the main centers and are less inclined to 'cruise' the island.

⁴ With indirect income possibilities is meant those industries which produce goods used in the tourist industry.

Balinese Rice Cultivation and the Subak

The highest yields of rice are harvested in the large alluvial plains of south central Bali, one of the main cultivation areas of irrigated rice on the island. Water is abundant and the volcanic soils are rich and fertile. This is the 'rice bowl' of Bali where high yielding rice varieties are grown on paddy fields larger, on average, than elsewhere on the island. Fields are plowed with small hand-held tractors and chemical fertilizer and pesticides are used for an optimal yield. Up to five crops of rice are cultivated in a period of two years.

Yields harvested in this area in the dry season may be as high as 7.5t/ha⁵. Farmers grow fast-maturing modern varieties also known as high yielding varieties (HYV). HYVs were introduced in the late 1970's along with new crop management technologies (including chemical fertilizer, chemical pesticides and hand-held tractors) and improved irrigation infrastructure⁶.

The new technologies that came with the new varieties considerably reduced labor requirements in rice cultivation. This freed up more time which farmers could spend in the pursuit of other activities. However, quite to the contrary of the findings of White, Hart and others (White, 1976, 1989, Hart, 1986) for some areas in Java where only limited off-farm work was available, farmers in south central Bali were able to find off-farm work in nearby urban and tourist centers due to the rising demands for labor in tourism. The construction of hotels, roads, shops and other tourist infrastructure provided a wealth of off-farm labor opportunities for farmers. Although, rice cultivation has never been abandoned, time and

⁵ Personal communication with several farmers in the field, 2004-2005.

⁶ The Bali Irrigation Project (BIP) financed by the Asian Development Bank, focused on the rehabilitation and expansion of irrigation facilities. It was launched in 1979, physically integrating smaller irrigation infrastructure into large systems sharing a common permanent weir.

effort shifted from a single focus on agriculture to off-farm work in other sectors of the economy.

Farmers cropping rice are organized in well structured groups called subak throughout Bali. The subak commonly recognized as a socio-religious agricultural association constitutes one of the three public entities of a traditional Balinese village (*desa adat*)⁷ (Geertz, 1980, Sutawan, 2000). All farmers who cultivate rice in a defined geographic area and receive water from the same irrigation canals are members of a subak, landowners and sharecroppers alike. The irrigation infrastructure that diverts water to the field is jointly owned and maintained by all the subak members. Diversion is regulated by fixed proportional gateless division structures based on the principle of continuous flow⁸. Legal aspects of the subak are addressed by rules and regulations which are often passed down through generations of farmers by word of mouth.

Regular meetings usually at the sub-subak level basically ensure that the maintenance of the canals is attended to and that the forthcoming cultivation season is organized as all farmers in one subak transplant their rice at the same time. (They also guarantee continuity and regular exchange among the neighboring farmers since attendance is obligatory.) The synchronization of the cropping pattern which functions as a natural mechanism for pest control is one of the unique features that characterize the subak. Another important feature is the series of ceremonies that are held in conjunction with various stages in the cycle of rice cultivation. The ceremonies vary in scale, involvement and duration. The most elaborate ones involve all *subak* who are presumed to receive water from the same crater lake. Ceremonies at the field

⁷ The other two entities of a traditional Balinese village are the hamlets (*banjar*) which are responsible for regulating community life (usually several in one village) and the temple congregation (*pemaksan*) which organises and coordinates the vast religious rituals related to the *desa adat*.

⁸ The width and the height of the division structure defines the quantity of water that flows through it, which is in turn defined by the size of area to be irrigated.

level mark each rice growing stage. These are meant to ask protection for the rice crop against pests and diseases, and to guarantee a good harvest. The ceremonies are linked to a hierarchy of water temples which play an important role in the coordination of irrigation water and pest management (Lansing, 1991, Lansing, 2006, Pitana, 1993; Sutawan, 2000).

Indicators of rural transformation / agrarian change

Blurred boundaries between the rural and urban

A clear cut rural-urban dichotomy does not exist anymore in many parts of Asia. Large areas especially those close to big cities, cannot be termed rural anymore but they are not entirely urban either. Agricultural and non-agricultural activities are intermingled in densely populated agricultural areas such as the wet-rice growing areas surrounding cities in Japan, Taiwan, Thailand, Indonesia, the Philippines and China (Jones, 1997: 240). These so-called extended metropolitan regions accommodate a diversity of livelihoods engaged in rural and urban activities with a growing interdependency between agriculture and industry (Rigg, 1998). While these developments certainly have many positive aspects in as much as they offer attractive off-farm employment in nearby areas they may also have detrimental consequences for the farming community that remains competing for resources such as water and land.

In Bali, the main rice cultivating area is at the same time the economic heart of the island with the most important tourist centers - Kuta, Legian and Sanur - and the capital Denpasar located just at the southern end of the rice basket area. While the economy rapidly develops and more tourists arrive every day, urban areas, industries and tourist facilities expand and slowly but steadily creep into the main rice cultivating areas. This region belongs to Badung, the economically most prosperous administrative regency of Bali. As early as 1995, only 24

percent of total labor force worked in agriculture and 28 percent in the 'trade, hotel and restaurants' sector (BPS Badung, 1995). These statistical data shows that the agricultural work force is significantly lower compared to the rest of Bali, however one should bare in mind that the main urban centers are part of this region too.

A study of six subak in south central Bali shows that as much as 7.8 percent of the total area irrigated was lost between 1995 and 2000 (Wiguna, Lorenzen and Lorenzen, 2005). One of the six subak, subak D, for example, comprises 132 hectares of irrigated rice fields which are cultivated by 340 farmers divided into nine sub-groups. The tourist areas of Kuta and Legian as well as the capital city Denpasar are only three quarters of an hour away by car. The territory of Subak D is divided by a road of the length of 1.5 kilometers long and its fields extend to the west and the east of this road. This road connects two hamlets with a relatively large town with approximately 10000 inhabitants. Various enterprises have already been set up along the road, and more are in the planning and construction phase. On the one hand, the development of new businesses is welcomed by the local population as a source of new off-farm employment. On the other hand, however, as stressed by the local subak head, problems arise with those enterprises that illegally use the water from the irrigation canals that run along the road. Gentle reminders from the head of the subak to these shop owners have put the issue on hold for the moment. However, as more enterprises open up their doors a more rigid solution will eventually be required.

Another issue arising when urban and rural areas come together is the waste that clogs up irrigation canals. For example, the more irrigation canals flow through urban areas the more waste can be found in the system. This waste has to be cleared out by the farmers. The cleaning is organized in communal work sessions by all the farmers of the sub-subak groups who receive water from the same canal. Farmers currently seem to manage the load of work put upon them and do not complain. This may change in the future if they become less

farmers or if less farmers are inclined to participate in the communal work sessions and prefer to pay a fine.

Rural household labor allocation and diversification

With the rural economy transforming, rural livelihoods diversify and farming becomes less important within the total household economy (Rigg, 1998, Hart, 1994). This trend can be observed in particular in south central Bali where we have carried out research between July 2004 and December 2005 in a farming community of 1700 farmers who cultivate 740 hectares of rice in six different subak. Most of these 1700 farmers live in seven adjacent villages, making up an estimated 23 percent of their total population⁹.

Farmers interviewed in this area crop, on average, an area of 0.46 hectares on one to three fields¹⁰. They can be divided into three distinct groups: 'owners only' which represents the largest group among those interviewed, followed by 'tenants only' and, lastly, the 'owner-tenants' who cultivate both rented and owned land. 'Owners only' cultivate an average of 0.37ha, 'tenants only' an area of 0.56ha and 'owner-tenants' and area of 0.67ha. (For more details see table in appendix). 42 percent of all farmers work off-farm for an average of 5.6 days a week¹¹. Most farmers who work off-farm work in construction as bricklayers, painters or unskilled day laborers (46 percent of all respondents). Others are traders (rice, petty, other), waiters, plow operators, artisans (wood carvers, cabinet finishers, carpenters), or office workers (government, private or teacher). MORE DATA SEE NJ

⁹ Each farmer represents a farming household. There are seven villages with a total of 7350 household heads. CHECK DEFINITION KEPALA KELUARGA! SEE NOTES NJ

¹⁰ Numbers obtained are the results from a survey with 178 farmers in the area, which corresponds to roughly ten percent of all farmers.

¹¹ Please note that the number of days worked off-farm is only indicative. Many farmers take on casual work for shorter periods of time which may not be reflected in the given number.

The fact that many farmers work up to six or seven days off-farm intrigued us enough to make us look more closely at how rice cultivation is organized nowadays. The figure¹² in the appendix provides some idea about how on-farm work is organized in south central Bali. Labor required for one planting cycle for a field of average size is divided into outsourced and household labor.

The figures show that physically intensive labor in peak periods of the cultivation cycle such as transplanting, weeding and harvesting is outsourced to paid hired labor. This work used to be organized within the kin group or the hamlet by mutual help. The plowing of the fields is also outsourced¹³. The remaining soil preparation work is carried out by the farming household.

The day-to-day crop management is done by the farming household. Especially time-intensive labor such as monitoring field water levels and crop health and scaring birds away in the month before harvesting are passed on to other household members if the household head works off-farm. Other work in the field which is more flexible in terms of time is done in the mornings or evenings or on public holidays. This type of labor is not outsourced as it would be too costly.

To explore in more detail how a farming household organizes on-farm and off-farm we used time use surveys with several households over a period of four to five months which covered a whole planting cycle as well as the intervening period between that cycle and the next. Figure 3 shows the division of work of a household with three people involved in on-farm work: a father (66 years), his son (36 years), and his son's wife (32 years). Both, the son and

¹² These data are arrived at from figures obtained for a plot of 0.2 ha which we cultivated ourselves. The data were then extrapolated to the average size of a farmers' field. Final figures were verified through participant observation and personal communications with farmers.

¹³ Tractor owners / plow operators hire out their labor to farming groups. They travel from subak to subak in a particular region for continuous work.

his wife work as casual labor off-farm. They cultivate two fields in two different places amounting to 0.6ha. They do not outsource any labor except for the plowing of the fields. The diagram shows that the continuous work on the rice field is managed by the father who spends most of his time in the field. He does not have any responsibilities anymore towards the hamlet and does not pursue any off-farm work anymore. The son is mainly engaged in off-farm work. He works on-farm when more demanding physical work needs to be done, and generally on public holidays or when no off-farm work is available. The daughter-in-law also helps when needed on-farm, but unlike her father-in-law she also spends a considerable amount of time in preparing for and attending village ceremonies. As can be seen in figure 3 for instance, her off-farm work is reduced to almost zero during the month of October when she was been very busy with her village responsibilities (preparations for a huge village ceremony). This fact is also reflected in the number of hours she worked off-farm. She takes on off-farm work when it is available and when the time allows it. This example shows that each of the household members has a different priority. While the father's main priority is the work in the rice field, the son's main priority is to bring cash home from off-farm work and participate in community activities when required. The son's wife's priority, in turn, is the household work (religious and non-religious) as well as work meant to fulfill the household's responsibility towards the community. However, all are more or less flexible in shifting their priorities around in order to allocate the labor necessary for the cultivation of the rice field.

In summary, the above analysis shows that farming households wisely distribute tasks among available household members or outsource the labor required if it is necessary and affordable. Through diversification of household labor a higher income can be generated. Engaging in activities off-farm when these are available allows the household to be more flexible.

Changing gender roles in agriculture

It must be noted, however, that rural households diversified in their activities even before the introduction of HYV's. See for example Bray (1997:34) who states that

“...in many areas of South China peasant households grew rice almost as a sideline, investing most of their labor in commercial cropping or other forms of household commodity production.”

In Bali, for instance, rice cultivation has always allowed farmers to pursue other, off-farm activities during the months between transplanting and harvesting the crop. In earlier days, this was mainly agricultural wage labor on the fields of richer farmers¹⁴ or in plantations (mainly coffee) in the upland areas. In our study area, farmers went off to the upland areas to work as farm laborers. Nevertheless, agricultural modernization brought about changes in the way cultivation and land preparation is carried out, leading to a commercialization of rice cultivation and reducing the need of labor input. As we have seen in the previous section, farmers in our study area work in nearby urban centers as casual, non-agricultural laborers. Meanwhile, on their farms, hard manual work may be outsourced to paid labor whereas time-intensive but less physically-demanding work is distributed among household members.

As summarized by Rigg (1998), various studies in the 1990s have been carried out in rural areas describing the changes occurring in them. Mechanization and the reduced availability of labor have had different impacts in different regions in terms of changing gender roles. While in Thailand a study uncovered a ‘masculinization’ of agriculture, another in Laos found a ‘feminization’ of agriculture is developing, and in yet other regions the picture is more diversified (see Rigg for a more detailed account, 1998). In south central Bali, there is no clear trend so far about either the ‘masculinization’ or ‘feminization’ of agriculture although

¹⁴ Landholdings in the upland areas are much larger than in the lowlands. Farming households are depending on agricultural wage labor to cultivate the fields.

the mechanization of modern rice cultivation here has meant that both men and women now do work that was previously thought to be exclusive responsibility of one or the other gender.

- Soil preparatory work such as hoeing to prepare the field prior to plowing is nowadays carried out by both men and women depending on who is available to work on-farm. Plowing using hand-held tractors continues to be carried out mostly by men although some women have been seen using such tractors.
- Transplanting which used to be a task allocated to men, is now often done by women.
- Harvesting of rice was traditionally organized in mixed-gender groups comprising hamlet members, extended family or friends. Nowadays, harvesting and machine threshing is mainly done by Javanese men or mixed-gender Javanese teams hired by Balinese traders who buy the standing rice crop directly from the farmers (a transaction known by the Indonesian term 'tebasan'). To a lesser extent, harvesting and hand threshing¹⁵ are also done by women harvesters who work in groups that are paid for according to the area harvested. The women in such groups usually live in the same hamlet and are from a poorer background.
- Applying pesticides to a field is usually not carried out by women.

To summarize, traditional gender roles matter less today in the allocation of on-farm work to men and women. More importantly, work is now allocated to whoever is available and not engaged in off-farm work. Nevertheless, for communal work sessions and subak meetings traditional gender roles still hold sway. In our observations only men participated even in cases where women held the main responsibility to work the fields.

¹⁵ The reason given by women for why they prefer to continue threshing by hand is that they do not feel strong or competent enough to use a threshing machine.

An interesting fact that came out of this analysis is that farmers prefer to monocrop rice rather than following the recommendation of the agricultural extension service. This preference is discussed below.

Outcomes for the subak and rice cultivation in general

Shifting rights - Do all farmers have the same rights?

The move away from agriculture as the main income source for households has certain implications for the equal distribution of water among the farmers in a *subak*. Traditionally, the water share received by each member determines his rights and duties within the *subak* and it reflects the equity concept that has evolved over a long time and is mutually agreed on by all members (Sutawan, 2000). As we have observed in the field, this is the ideal form of water allocation. In reality, farmers take more than their shares if needed but, there is a socially-regulated strict distinction between stealing water and “borrowing” it. The manipulation of the water flow is labeled as “borrowing” as long as the farmer stays next to his water inlet, only “borrows” for a limited amount of time and returns the flow to normal before going home. Otherwise, a farmer will be accused of stealing water.

The average age of farmers met and interviewed in the field was 55. Half of them were grandparents, which implied that their responsibilities towards the household and the hamlet community had become minor compared to those who were still heads of households, i.e., the senior most household members with sons yet unmarried. This meant, they could spend considerably more time in the rice field. This was also evident in the survey, which shows that

82 percent of all the farmers who are grandparents do not pursue any off-farm work as opposed to 34 percent of all the interviewed household heads¹⁶.

Those who can spend more time in the field compared to those who are busy off-farm consequently also have more time to manipulate the water flow. The explanations such people gave to us were that they felt entitled to a greater share of irrigation water because their income relies solely on a good harvest. This is not entirely true in all cases, as most live in a household where income is also generated from other, off-farm sources as we have seen in the discussion above. However, it seems that those who are busily engaged in off-farm work and spend only little time in the field accept this form of subak rule breaking as an occupational hazard. And ironically, it is not the “borrowing” farmer who is ashamed of manipulating the system. It is the farmer who works off-farm who is ashamed because he neglects his rice fields. An interesting contrast is set here between the traditional value system and new economic priorities.

Weakening link to the village

The subak, once one of the three main constituents of Balinese village polity (Geertz, 1980:53), is of decreasing importance in Balinese social organization. As a farmers’ association, it cannot benefit anymore from the previously strong links and solidarity between the village and the rice field.

One example from the study area is the case of rice harvesting which used to be organized by the hamlet before the introduction of HYVs. Every household in the hamlet had to help harvest the fields of other members of their own hamlet. Values such as solidarity and

¹⁶ This randomized survey was undertaken in 2005. In it, 178 farmers belonging to the six subak of the study area were interviewed in the fields. (ie during transplanting/plowing more young male than later?!)

cooperation were carried from the *banjar* into the rice fields (Wiguna, Lorenzen and Lorenzen, 2005). Collective work which sometimes extended to transplanting and weeding as well is now abandoned. The reason is that too many hamlet members are nowadays engaged in off-farm labor and thus do not have the time to join hamlet-based agricultural activities (S. Lorenzen, work in progress). Nonetheless, ties with the village are to some extent still respected. For instance, if a farming household needs to recruit extra-household labor to transplant or weed the rice fields, female work groups from the same hamlet are approached and hired.

Rotational Cropping Patterns

Before the introduction of HYVs farmers planted two crops per year. Local rice varieties used to have a much longer planting cycle – some lasting up to six months - and were much more labor intensive. The rice crop was planted during the six months of the wet season followed by a non-rice crop during the dry season. The advantage of this cropping regime was that it not only allowed the soil to regain some of its fertility but also kept pest populations under control.

With the introduction of HYVs cultivation regimes changed. The vast quantities of chemical fertilizer applied on the fields led to massive pest outbreaks in the late 1970s and early 1980s. As a consequence, the government reintroduced a rotational cropping pattern including non-rice crops (*palawija*) in the late 1980s with the aim of enhancing soil properties (soil structure and fertility) and reducing pest and pathogen pressure on the main crop, namely rice¹⁷.

¹⁷ Non-rice crops that are commonly planted are pulses, corn, onion, pepper or other horticultural crops.

Alongside, new pest management strategies (known as IPM or Integrated Pest Management) were introduced quite successfully through field schools all over Indonesia¹⁸.

In the study area we observed quite a different rotational regime. While agricultural extension services recommended that all farmers in the area include non-rice crops in their rotations, we were confronted with quite a different picture. Many farmers we asked could not remember having ever planted anything save for rice since the Green Revolution began. Others said they had planted non-rice crops but only in the past. A daughter of a farmer recounted the following memory of her childhood:

My parents used to sleep in the field while they grew non-rice crops. I would bring fresh food to the fields and my mother would prepare and cook it. They would return home only after the harvest to sell the crop on the market.

The reasons for farmers switching to monocropping rice are several. First, it must be noted that the cultivation of non-rice crops is much more laborious compared to rice cultivation, especially the process of soil preparation. For the former, the fields need to be drained completely and raised seed beds have to be prepared to allow for controlled irrigation. Tractors to plow dry fields are not easily found as most tractors in use are specialized in plowing the wet paddy soils. The fact that continuous monitoring is required for a successful harvest is yet another reason. As many non-rice crops need to be harvested over a longer period of time, farmers fear theft if the fields are not constantly checked. In addition, while rice can be stored for several months, non-rice crops have to be taken directly to the markets for sale. Also, the marketing of non-rice crops is not as well organized as the marketing of rice. These factors explain why farmers are disinclined to grow crops other than rice.

¹⁸ IPM uses a more sophisticated approach to the cultivation of rice including counting present pest populations, calculating “break-even” points of pest damage and yields, and applying more focused and timely amounts of fertilizer and pesticides.

Moreover, rice cultivation allows farmers to take better advantage of readily available off-farm employment opportunities in comparison to the cultivation of other crops.

There is however some scientific concern regarding the monocropping of rice. As mentioned previously, intercropping with a non-rice crop helps to maintain soil fertility and improve the soil's physical properties. It also reduces rice pests and controls pathogen build-up. In particular, the cultivation of pulses helps to restore the nitrogen balance in the soil and reduces the need to add chemical fertilizer to the subsequent rice crop. On the other hand, aerobic¹⁹ soils are at risk of nitrate leaching. The question remains what happens in the future.

As figures for the area show, yields have slightly declined in the past ten years, although not significantly (see figure 5). Whether however this is due to the fact of continued monocropping remains unanswered. For the regency as a whole, statistic figures indicate increasing yields for the past couple of years (BPS Badung, 2005).

Farmers diversify their activities and adapt to the economic situation. They might even return to cultivate non-rice crops if they see an opportunity arise. For instance, in 2005, prices for chilies skyrocketed for a while due to crop failures in several regions of Bali and low quantities delivered to the markets. Some farmers immediately responded and turned some of their plots into chili fields. Others were hesitant and at last when they grew chili prices had already dropped. This shows however, that farmers are incredibly flexible not least because the subak allows for such flexibility too. Subak in the study area allow for growing other crops than rice even in the main rice growing season however for parts of the fields only.

¹⁹ Non-submerged soils

Conclusion

As the above examples illustrate off-farm work and to a lesser extent land conversion (though this has not been discussed here in detail) is having an impact on farmers' every day decision making and on the running of the *subak* system.

The literature on the *subak* systems emphasizes values such as trust, cooperation, and mutual help among members as main features of *subak* organization (Sutawan, 2000, Groenfeldt, 2003). These features which still exist today are socially monitored and their transgression is sanctioned directly by farmers in the fields. However, the decreasing farming community and increasing pressure on land and water resources might change the integrity of the *subak* system and its social framework.

The modern *subak* is not an association of mainly subsistence farmers relying on mutual help and solidarity. It consists of farmers with different off-farm opportunities and different incentives. Rice cultivation is still practiced but for many farmers the harvest alone does not determine if the family has to starve or can eat rice. The distinctions of rural and urban are not clear anymore. Households shift back and forth between agricultural and non-agricultural economic activities. They adjust to the employment options available at any given time, constantly trying to increase their income and status. This also suggests that we, as scholars and policy makers, need to rethink our notions of rural economy and rural life (Rigg, 1998, Barker & Molle, 2002). New approaches are required to support the agricultural sector in to ensure food security without compromising the environment. Or as Francesca Bray (1998) puts it:

“...the complexity and potential for diversification and development of rural economies are neglected by national governments and international funding agencies alike. Yet it is very clear that industrialization and urbanization alone

cannot solve the problems of population growth, hunger and unemployment, while they are likely to increase our environmental problems considerably. We need to work consciously towards strategies for redressing the balance between the rural and urban, agricultural and industrial sectors, strategies that privilege economic diversity and employment in the countryside rather than output and efficiency, and that encourage both social and environmental sustainability.”

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*Appendix – tables and figures**Table 1 - Results from farmers' survey*

Type of farmers	Percentage	Avg age	Ratio heads of family / grandparents ²⁰	Avg field size	Avg nbr of fields cultivated	Off-farm	Average days / week worked off-farm	Average off-farm wage / day
Owners only	104 (58 percent)	53.3	1.18	0.37ha	1.1	51 (49 percent of all owners)	5.7	IDR 35'010
Tenants only	49 (28 percent)	56	0.88	0.56ha	1.7	15 (31 percent of all tenants)	5.4	IDR 39'375
Owner-tenants	25 (14 percent)	56.3	0.83	0.67ha	2.4	8 (32 percent of all o&ts)	5	IDR 38'750
Total	178 (100 percent)	54.5	1.05	0.46ha (weighed)	1.5	74 (42 percent overall)	5.6	IDR 36'340

Source: survey of farmers by authors, 2005

²⁰ single and honorary old farmers are here neglected

Figure 1 – box plot age structure of different farmers groups

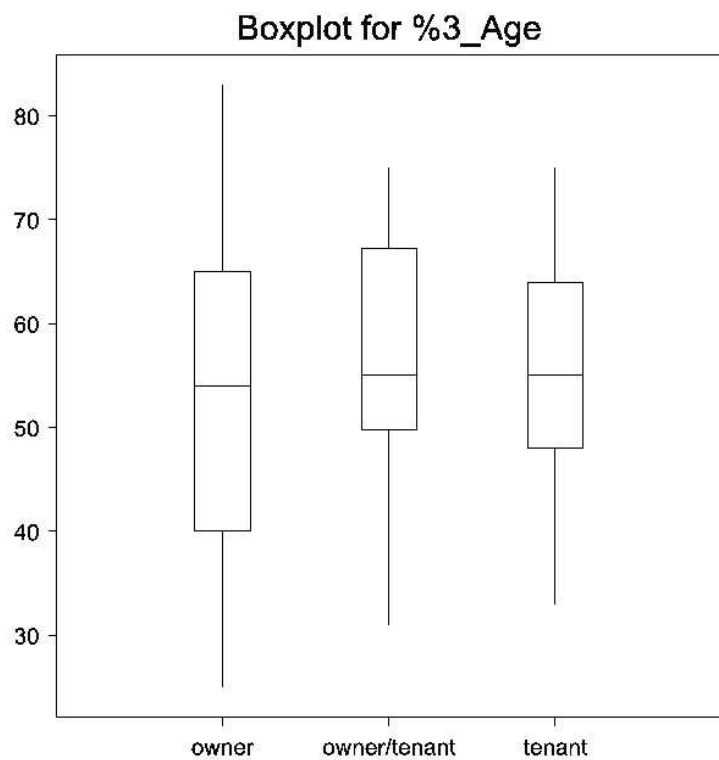


Table 2: Loss of irrigated land

Subak	Size (ha) 1995	Size (ha) 2002	Loss of land
1. Subak T	192	183	4.7 percent
2. Subak D	129	122	5.4 percent
3. Subak S	73	71	2.7 percent
4. Subak P	60	41	31.7 percent
5. Subak B	173	171	1.2 percent
6. Subak A	173	150	13.3 percent
Total	800	738	7.8 percent

Figure 2 - farm labor and outsourced labor

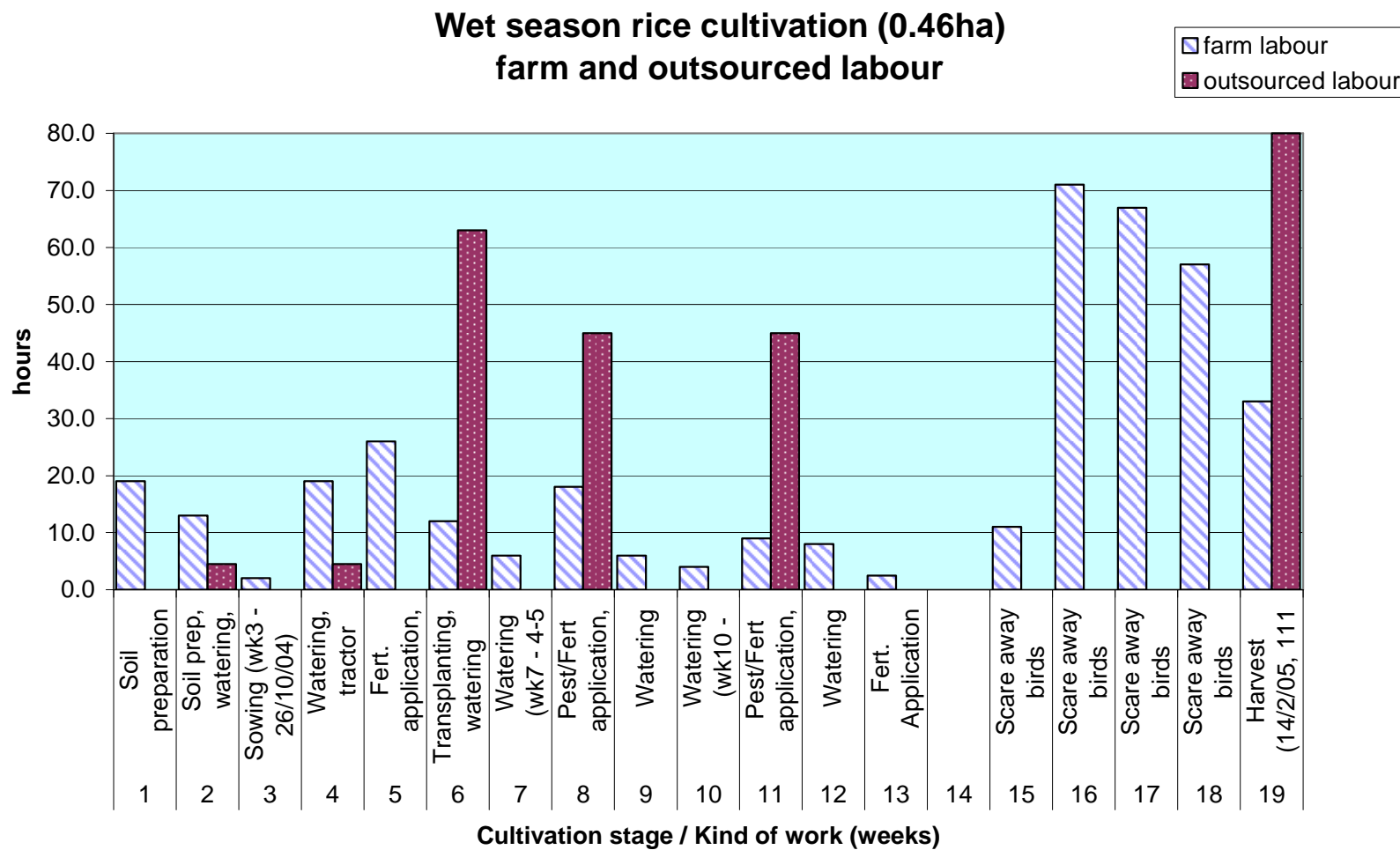


Figure 3 - time allocation for on-farm and off-farm work for a family of three people during one cultivation cycle

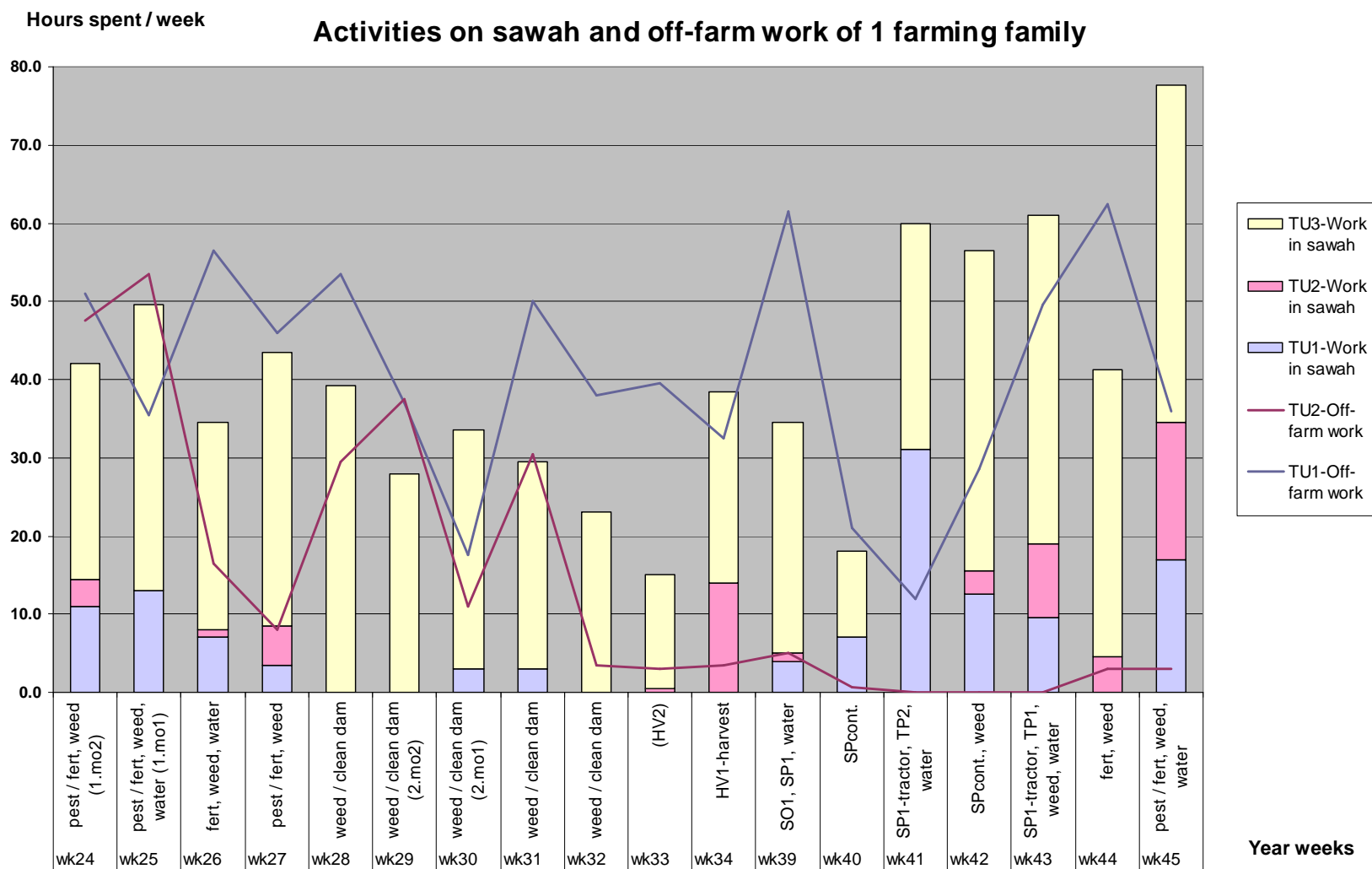
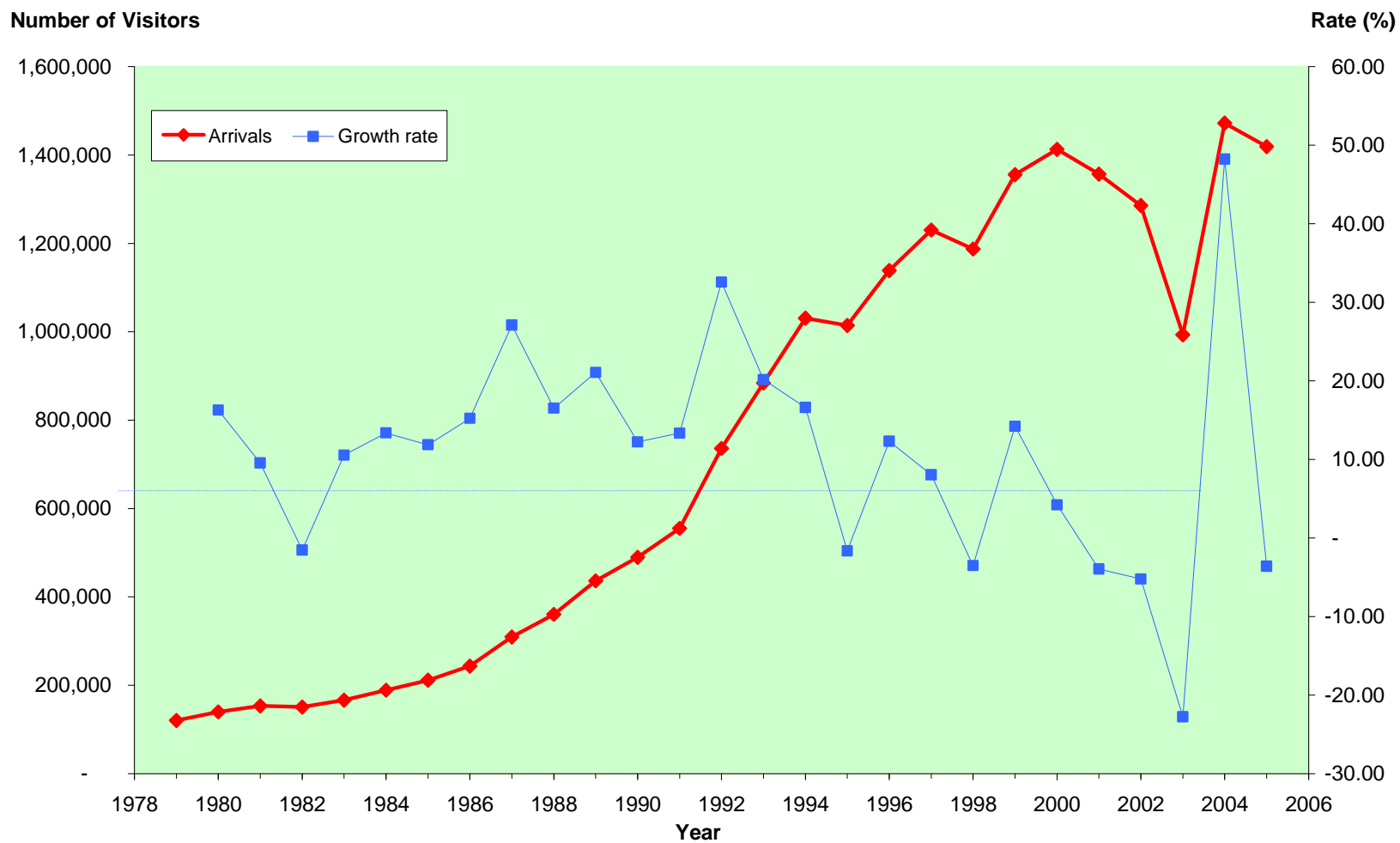


Figure 4: Visitor arrivals and growth rates 1979-2005



Source: Bali dalam Angka / Bali in Figures (1979-2005)

Figure 5 – Average yields in Mengwi 1995 - 2005

