The global problematic of diversification for rice/treecrops smallholders in Southeast Asia.

An example with rubber diversification and its impacts on family farmers' income in Mimot district (Kompong Cham province, Kingdom of Cambodia)

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Summary

Ecological vs economical sustainability of agricultural development is discussed in the first part of the paper to present the global problematic of rice/tree-crop for smallholders in Southeast Asia. An example is provided through a case study carried out in 2004 in Kompong Cham province (Cambodia), for the Family Rubber Project. The aim of this prospective analysis is to evaluate the impact of diversification with rubber cropping for smallholders and farms' ability to face risk when rubber provides a regular income improving the families' cash flow. The project offers technical support, a particular smallholders' expectations, and a planting credit allowing small and medium-scale farmers to avoid incurring debt towards local landlords at excessive rates. However; the selection criteria of candidates depends on their ability to reimburse the project, excluding de facto the poorest farmers. Thus the question of the compatibility of developing the rubber sector and helping the poorest farmers remains.

Introduction

In many upland areas of Southeast Asia, tree-crops have significantly developed as cash crop in replacement of rainfed rice with serious avantages in terms of incomes level and distribution, economic sustainability and for systems such as rubber, ecological sustainability. Main constraints are access to technical information and capital for crop establishment and during immature period. Agroforestry practices can provide incomes opportunities during immature period as well as income diversification (fruit and nuts, timber, medicinal plants…). The Cambodian case study presented in this paper illustrates through farming systems modelling the pros and cons as well as the constraints to move towards rubber planting in a traditional rice/cashew-nut trees area, however rubber remain the main alternative to intensify agriculture on a sustainable basis.

1 The global problematic of diversification for rice/treecrops smallholders in Southeast Asia.

Economic vs ecological sustainability

The sustainability of agriculture is becoming a major concern. The main questions concerning "ecological sustainability" are linked to the problem of degraded environment and fragile soils and thus fertility, biodiversity, and protection of watersheds. Several cropping systems offer potential solutions to these problems: agroforestry practices, permanent vegetal cover cropping systems, etc. Crop diversification and rapid technical change characterise the evolution of existing farming systems. The history of these innovations and innovation processes are key elements to analyse and understand and thus be in a position to make viable recommendations for development. Agroforestry practices vs monoculture, however not always incompatible but often complementary (Penot, 2001), is part of the debate on integrate or segregate vegetal biodiversity in tree-crop systems or in protected areas.

The notion of “economic sustainability”, places emphasis on the profitability of specific technical choices (margins analysis, income generation, return on labour and capital, analysis of constraints-opportunities, etc.) from the point of view of farming systems, at the regional level, and the “community level” where there are serious constraints with respect to land availability, and to access to capital and information. Analysis of farming systems and knowledge about smallholders’ strategies in the different contexts are thus key elements that should also be taken into account.
As sustainable development is on the way to becoming the decade “priority objective”, the rehabilitation of previously intensively managed agricultural or degraded land also merits consideration[1]. New approaches, such as « eco-development (I. Sachs, 1980), appear based on equity on needs assessment leading to a relative prudent ecological concern later included in the “sustainable development”.

[1] With respect to the latter, two different types of areas seem to be important: ecologically degraded areas such as *Imperata cylindrica* grasslands, which cover 25 millions ha in SEA, and former mining areas that require rehabilitation in Southeast Asia for instance).

Perennial crops in particular are subject to very significative and sometimes very rapid changes in plantation/re-plantation strategies in pioneer and post-pioneer areas. These changes characterise farmers‘ strategies through phases of investment, capital building, capital conservation, re-investment and eventually intensification or diversification or both. The impact these strategies have on land control, land-use dynamics (agreement on the definition of new types of “territories”[2] between stakeholders) and relations between stakeholders including those not directly involved in agricultural production, should be major topics of research if we are to gain a better understanding of farmers’ strategies in the present context of multiple crises. A constant factor that underlies such strategies is innovation: both the process of technical innovation (technical pathways) and of organisational innovation (farmers’ organisation, access to credit, etc.) are key elements to understanding and qualifying change.

Most perennial crops (cocoa, rubber, coffee …) are now facing a real boom after a phase of severe crisis during the period 1997-2002 (rubber, coffee in particular). Commodity prices are subject to volatility with large variations in time. Political changes have also resulted in new decentralisation policies in most countries (indirectly linked with democratisation in some countries) that might introduce new ways of local governance (including corruption). The major economic trend is towards globalisation generally considered as accompanied by a decrease in prices for most agricultural commodities. However recent market trends display the opposite for rubber, oil palm and cocoa. Concurrently, most Asian farmers enjoyed, willing it or not, direct links to markets over a relatively long period of time (absence of the commodity boards in Asia when it has been often encountered in Africa in the 1980’s and 1990’s), in particular in the case of coca, coffee, rubber, oil palm and coconut. Globalisation id therefore an old story for Asian farmers based on perennials.

Technical changes, innovations processes and societies as key topics for further research.

Therefore emphasis should also be placed on the history of innovation processes in the context of the change from pioneer fronts to increasingly stable post-pioneer areas. Crisis have been as well since long time considered as specific period for innovation (Mazoyer,M. & Roudart, L. (1997) To ensure the adoption and appropriation of technology by smallholders is efficient, further research is required on innovation processes and technical change in general using socio-economic tools. Negotiations between stakeholders and a better knowledge of the relations between the State and farmers seem essential to improve the effectiveness of future projects and development actions. Sustainable farming is even considered as the foundation of a new social contract (Landais, 2002).

Knowledge on process of innovation at farmers’ level and decision-making process (for both farmers and developers) is key research topic in sustainable development. And the analysis of farming systems, the characterisation of agrarian systems and the identification of stakeholders’ strategies are key components to a better understanding of these issues. The factors that determine change and the discriminators to be taken into account for the sustainable development of these

[2] In the French sense of “territoire”, defined by Caron, 2005.

commodities need to be related to each specific context. Important issues such as the effect of decentralisation, globalisation and its effects on prices, as well as on local economies and public policies, environmental themes (biodiversity, sustainability) are impossible to circumvent. The problems of coherence between social demand (including the process of innovation and technical change), the role of the state (the relationship between the State and farmers, between production and market) need to be investigated. This type of approach is applicable at several different levels, i.e. a small area, a watershed, or an agrarian region, by taking into account the different levels of intervention.

There is obviously also an overall objective, which is the "operational viability" of ongoing and future actions and scientific valorisation to be implemented in teams in the framework of project for scientific collaboration centred on the main topics listed above. As Jeff Sayer and Bruce Cambell point out *"cutting-edge agricultural technology is still needed but it has to be set in local contexts and be applied in ways that recognize the special conditions of poor farmers*" (which is generally the case in pioneer areas).

The historical dimension is very significant in this type of analysis even if economic commodity cycles can be very fast. So far, rebuilding the past with a modelling tool create new scenarios of evolution though a prospective analysis can be linked in order to improve the efficiency of development oriented research. In fact this raises the question of the real cost of the growth of perennial crops under conditions of recurring booms: which type of growth concerns each commodity? What is the rôle of each stakeholder? What are the main externalities (positive and/or negative.)?

Impact of technical change should take into account effect on sustainability on both farmers' livelihood and environment (Chambers & Conway, 1992). Success in diversification strategies required a certain number of conditions: capital or credit availability, technical options (innovations), information, markets, farmers' organisations in order to improve marketing etc …Path dependency appears as one very useful tool to identify trajectories and significant determinants of current situations (David, Paul A. 2000). Concentrating on perennial commodity crops such as rubber, fruits in this paper will serve to highlight current dynamics. Indirectly, the redistribution of growth among the different stakeholders of the perennial crops commodity system is a key in understanding dynamics and change not only to provide support for them but also to forecast them in different scenarios to provide a framework for the definition of agricultural policies.

2 The Cambodian case study

Introduction

Rice is the main agricultural product in Cambodia, despite low yields in comparison with the other Asian countries (in particular Vietnam and Thailand). If the vast central plain of the country is favourable for irrigated rice cropping, the eastern plateaux have been oriented towards rubber production since the 1920s. In particular, the plateaux of Kompong Cham province were cleared to establish estate rubber plantations belonging to French companies during the French colonial Indochina period. After a

period of troubles in the 1970s, rubber cropping again increased in the area, former estate plantations became "public economic establishments", that is to say, autonomous state properties, and the number of smallholders (with less than 10 ha of rubber) multiplied (Feintrenie, Jacqmin, & Penot, 2006).

To help re-establish the rubber sector, since 1995, the Cambodian state, with the help of donors from France (AFD)[3] and the World Bank, have supported actions in rubber sector at a national scale. The expected results are mainly to improve the income and living conditions of rural inhabitants and to improve the national economic balance. The smallholders' rubber project, whose leading institution is the General Direction of Rubber Plantations, in partnership with GRET[4] selects candidates for aid with rubber planting. The aim of the project is not only to re-establish former rubber areas but to create new ones, and to diversify agriculture in these areas. The first actions of the project took place in four sectors: Chamcar Leu, Tbong Khmum, Damber and Mimot of Kompong Cham province.

The case study presented here is based on a regional assessment of agriculture and farming systems in Mimot district, that was undertaken in 2004 with the of assessing the impact of the rubber plantation project on farmers' incomes.
Using data from the survey, we modelled the different types of farming systems which revealed the concentration of land tenure in favour of the richest farms. A process of indebtedness of the poorest farms and capitalization of the richest has led to the disappearance of the smallest farms. The consequences of this phenomenon are the multiplication of landless farmers since 1990, an increase in forest clearing fronts in the district, the appearance of new pioneer fronts and the search for an intensification of productivity (Feintrenie, Jacqmin & Penot, 2006).

After characterization of the farming systems, a standard representative farm was defined and modelled as follows:

- 0.50 ha plot of lowland rice, with one cycle per year for family consumption,
- 2 ha of "red soils" (red ferralitic rich soils on the plateau),
- One calf and a fattening pig unit (producing ten piglets per year),
- A poultry unit for family consumption.

To study the impact of a rubber plantation on agricultural income and farm production factors, two cases are now described in detail:

- The two hectares of "red soils" planted with cashew trees, or
- On hectare planted with cashew trees and the other with rubber

Cashew is the reference crop on "red soils" in Mimot district. The majority of these privately owned soils (or equivalent) is planted with cashew trees. At the beginning of the 1980s, the cashew tree provided the best strategy to occupy land and secure property rights. At present, rubber plantations are being developed for the same purpose but with a higher net margin/h and return to labour. In Mimot district, every farmer possesses a cashew tree plantation. Pig and poultry breeding are also very widespread, at a small scale.

Economic modelling as a tool of prospective analysis

[3] French Agency for Development
[4] Groupe de Recherche et d'Etudes technologiques

Olympe is a computer program developed by INRA/ESR[5] by Jean Marie Attonaty with the help of IAMM[6], Le Grusse Ph. Le Bars M.) and CIRAD (Penot E, Deheuvels O) to model farming systems.
Olympe is a tool for simulation and prospective analysis. It also has a module to aggregate farms and analyzes data which enables as well a regional approach and a flows analysis. It thus becomes possible to model farms in sufficient detail to allow identification of different sources of income and production costs (see frame n°2), to undertake cost-benefit analysis as a function of technical choices and crops, as well as a monthly analysis of labour requirements. Modelling can provide economic results for each cropping or livestock systems, as well as for the farm as a whole. It enables comparison of technical and economic results between cropping systems and between farms. Moreover, it allows simulation of the impact of any innovation on the farm as a whole. One of the main advantages is to implement prospective analysis over a long period (10 years) to monitor the impacts of price or changes in production systems on farmers' income.

Some parameters have to be defined to implement a simulation:

- Origin and use of farms' different sources of income
- Determining factors of farmers' strategies and farming system trajectories:
    - Technical and economic characteristics of each cropping system: cost of planting, production costs (labour and inputs, economic results)

Available production factors: land, capital, labour, as well as knowledge and access to credit.

    - Socio-economic environment: access to information, social cohesion, family and social obligations.

All this information was collected during surveys on inhabitants and farmers in Mimot district in 2004. The main results of the assessment are summed up in frame n°1 and calculations made with these data are explained in frame n°2.

Olympe enables simulation of several realistic pathways of a farm as a function of cropping choices and allocation of means of production decisions for a 10-year period (or more if periods are aggregated). This enables the real situation of an existing farm to be simulated, or the hypothetical situation of an imaginary farm, and makes it possible to include ongoing changes, such as diversification.

Impact of a rubber plantation in the framework of the project

Figure n°1 is a graph of the annual gross income of the family farms defined in the text. For each of these family farms, two graphs correspond to gross income, one for a high cashew nut price (O.50 US $/kg of green nuts paid to the farmer), one for a low cashew nut price (0.12 US $/kg of green nuts). Prices used here correspond to the maximum and minimum prices cited by farmers during the surveys.

[5] Institut National de Recherche Agronomique.
[6] Institut Agronomique Méditerrannéen de Montpellier.

The graphs cover several periods:

- In 2004, cashew and rubber trees were planted. For three years, cassava is used as an inter-crop, producing temporary income (see fig. 1).
- Between 2007 and 2009, gross income comes from breeding and rice cropping, and the trees are still in their immature period but intercropping is now impossible because of canopy closure (see fig. 2).
- In 2009 the trees begin to produce and several levels of income can then be distinguished, corresponding to different production phases of the perennial crop (see fig. 3).

The graph « poverty threshold for a family » allows situating gross income in comparison with minimum needs of a family. This poverty threshold was estimated according to farm households' surveys in Mimot district. It takes into account alimentary, clothing and medical care needs of a family composed by two parents, two children and one grand-parent. It is evaluated at US $585 /year.
During the period between the end of inter-line cropping and the beginning of tree productions, gross income does not cover the family's needs. In order to survive this unproductive period, farmers either have off-farm activities, or get into debt. In the villages surveyed, farmers often work for other farmers doing temporary jobs in the rice fields or red soils, some also sell or small handicraft.
Plantation of rubber trees in the framework of the project does not include direct charges, since all the costs to the farmer are covered by the project in the form of credit. Planting cashew trees does not cost anything either, as the farmers can freely harvest seeds in their neighbours' fields and sow them without fertilisation or treatment.

The three graphs underline the fact that planting rubber trees plantation leads to an increase in farm income. In addition, diversification of farm activities helps increase the farm's chances of overcoming economic and cropping risks. For example, a bad harvest of cashew nuts can be partially compensated by income from rubber. One advantage of rubber cropping is that production is spread out over the year (except in April, when there is a month break in tapping) rather than a single harvest. This characteristic is very advantageous in terms of farm cash flows.

Finally, one hectare of rubber requires two hours of labour per day throughout the year. The month break in bleeding is used to for general care of the plot. This regular distribution of labour is one of the advantages of this crop which does not require the employment of temporary workers for labour–intensive periods. However, rubber production requires a minimum of instruction for the farmer, especially how to tap the trees. Bad tapping practices can cause a drop in yield, and injury to the tree, or even death. The family rubber project aims to provide back-up for the smallholders and to teach them good bleeding and rubber cropping practices. During the survey it appeared that one of the main reasons for planting rubber trees within the framework of the project was free technical support. Indeed there is no other source of technical outreach in the district. Other expectations of farmers were increasing income, increasing the resilience of their farms by diversifying their activities and obtaining a regular income throughout the year.

However, as mentioned above, the selection of candidates for the project depends on their capacity to pay back planting credits and thus on guarantees they can

provide at the time they want to plant rubber trees. As a consequence, because they possess less than one hectare of land, the poorest farmers in the district are excluded from the project. Moreover, the lack of land or of any other source of income, prevents them from planting all their land with perennial commercial crops, because they would be unable to survive the immature period. Thus at the present time, the project cannot help the poorest farmers because it does not include land tenure issues. One possible answer to the lack of land and income is beekeeping (Feintrenie, 2004).

3 Prospective analyses: the resilience of family farms in the face of risk

Strategic prospective analysis comprises several steps: identification of the system concerned (here the world rubber market and its future) and key variables of change, building scenarios of change, defining potential strategic options, and lastly, defining strategic choices to promote a sustainable development policy. Prospective analysis is quite distinct from prediction. The aim is not to predict what is going to happen, but to identify possible and realistic scenarios. Thus, prospective analysis helps decision-making, coordination and negotiation processes between stakeholders. The identification of scenarios depends on the definition of working hypotheses, which generally depend on the analysis of constraints/opportunities and on series of real and observed prices. These hypotheses also take into account risks like climatic uncertainties, the impact of “el Niño”, price fluctuations and so on. Uncertainty is a key element in the analysis of family farm strategies (Penot, 2001).

Analysis of resilience analysis is an essential component in measuring the impact of any innovation or action on farming systems. Here we use the resilience concept as defined by Gunderson (Gunderson, 2002), as the capacity of a system to survive disruptions, *maintain and control its basic functions*. This definition allows some changes in the system, as long as the essential of the initial structure and correct functioning are maintained. It is based on the conditions required to maintain an initial equilibrium which may become unstable and lead to a new equilibrium. Resilience can be evaluated by the level of disruptions that can be absorbed by a system before a break or structural change occurs. This definition is well suited to agriculture, where social issues often replace technical issues in the search to understand change.

Analysis of the results of the case studies

Figure 2 compares gross income of farming systems with only cashew trees s, or cashew trees and rubber trees (on a total of two hectares of land). Simulations of the two farms were run with a low and a high price for cashew nut. The comparison highlighted the resilience of these two types of farms to economic uncertainty, here fluctuations in the price of cashew nuts.

The graphs suggest that the farm with no rubber trees is very sensitive to a drop in the price of cashew nuts. In the case of a minimal price, this farm cannot satisfy the needs of the family and enters process of indebtedness. This process indebtedness can be seen in Figure 3 which shows the cumulated balances of the two farms. A similar prospective analysis could be made on changes in rubber prices. There is no doubt that the gross income of farms with rubber trees would fall with a fall in the

price of rubber. Nevertheless, an increase in the number of different products on the farm increases the ability of a farm to face to economic risks. The overall resilience of any farming system is increased by diversification of its sources of income.

What would be the consequences of the official recognition and certification of Cambodian rubber?

At present, Cambodian rubber is not recognized on the international market. To be sold for export, it must transit Vietnam and be sold as "Vietnamese rubber". This is the reason for the lower price paid to Cambodian producers. In 2004, they were paid US $/0.76 kg (DRC 100), whereas Vietnamese producers were paid US $1.10 /kg. This difference is reflected in the gross income and cumulated balance of farms. The simulation of Cambodian farms with the same price as for Vietnamese rubber is shown in Figures 2 and 3. It is obvious that in this context, rubber production is economically more rewarding.
It is to be hoped that Cambodian rubber will soon obtain the international recognition it had before 1970. In this case, rubber farmers would receive a better price for their product and rubber cropping would become an exemplary sector for the development of family farms.

Conclusion
This case study revealed the advantage of cultivating rubber rather than cashew (the reference crop), on family farms in Mimot district. Thus, when rubber trees are planted with a minimum of essential technical knowledge (use of rubber clones that suited the environment and production objectives, knowledge of bleeding techniques and care of tree avoiding injuries, etc.) provided by project agents, it is more productive in terms of labour and land than planting cashew trees. Rubber enables an increase in farmers' incomes, which, in turn, can trigger a process of capitalization at the scale of the farming system. Like any other new activity that creates income, rubber production diversifies sources of income on the farm, and in this way gives farms more resilience in the face economic and cropping uncertainties. The particular advantage of the rubber tree is that it provides a regular income throughout the year, rather than a single harvest season. This ensures a constant cash flow that can be used to buy fertilisers or chemical products for the other crops, without the need to borrow money at excessive rates (common in this area). In addition, the rubber tree helps conserve the soil. For all these reasons, it appears desirable to develop this activity on family farms.

The family rubber project allows plantations to be created without the need for heavy investments, which is appropriate for smallholders who have little cash or capital. Technical help also enables farmers to learn a new cropping system with free instruction. The project appears to fulfil the inhabitants' expectations both in its objectives and in its methods. However, the aim of the project is not social; it is primarily a project to rebuild and develop the Cambodian rubber sector. The criteria used to select candidates for the rubber project do not favour smallholders. On the contrary, they enable farmers who already enjoy good economic health and capitalization dynamics to benefit from the project. Thus some absentee farmers who live in town and own more than 10 hectares of land can benefit from the project as well as very small producers who only have few hectares and have difficulty running their farms. Rubber could enable sustainable economic development of the poorest

farmers, and the beginning of a dynamics of capitalisation for the others. However, as mentioned above, the project is not based on social issues: its aims are focused on the development of the rubber sector.

It is right to question what kind of development is desirable for the rubber sector in Cambodia. What kind of development should be promoted: a sector dominated by a small number of large-scale producers or by a large number of smallholders? This choice partially determines the regularity of rubber production. Indeed, smallholders with diversified activities are less sensitive to the uncertainties of the rubber market. If the price for rubber decreases too much, smallholders stop bleeding their trees, wait for conditions to improve and in the meantime, rely on their other sources of income. Big rubber companies cannot afford this flexibility and the risk of bankruptcy is much higher. Thus concentrating on economic aspects, increasing the number of small and medium-scale producers is more favourable to a regular and reliable supply of rubber in the long term than concentrating production in the hands of a small number of large-scale producers. Due to the difficulty in guaranteeing the quality of the rubber, some may object to an increase in the number of smallholders; but the use of a payment grid based on strict quality criteria may be sufficient to overcome this problem.

References

Caron, P. (2005). A quels territoires s'intéressent les agronomes? Le point de vue d'un géographe tropicaliste. Nat, Sci et Soc. 13 : 145-153.

Chambers, R. & R. Conway (1992) 'Sustainable rural livelihoods: Practical concepts for the 21st century'. *IDS Discussion Paper No.296*. Brighton: IDS.

David, Paul A. (2000), "Path dependence, its critics and the quest for 'historical economics'", in P. Garrouste and S. Ioannides (eds), *Evolution and Path Dependence in Economic Ideas: Past and Present*, Edward Elgar Publishing, Cheltenham, England.

Feintrenie, L. (2004). *Diagnostic agraire du district de Mimot, province de Kampong Cham, Cambodge.*, CNEARC-ENITAB, Montpellier.

Feintrenie, L., Jacqmin, C., & Penot, E. (2006). L'exploitation agricole familiale au Cambodge depuis l'indépendance. *Cahiers Agricultures, 15 (6), numéro spécial : L'exploitation agricole, mythe ou réalité ?*

Gunderson, L. H. H., CS (2002). Panarchy: understanding transformations in human and natural systems, Island Press.

Mazoyer,M. & Roudart, L. (1997) *Histoire des agricultures du monde. Du néolithique à la crise contemporaine*. Editions du Seuil, collection Points Histoire, Paris, France, 705p.

Landais, E. (2002a) Sustainable farming: the foundations of a new social contract ? *In : Dossier de l'Environnement de l'INRA*, n°22 : 23-39.

Penot, E., Bars, M. L., Deheuvels, O., Grusse, P. L., & Attonaty, J.-M. (2004). *Farming systems modelling in tropical agriculture using the software "Olympe".* Paper presented at the Séminaire Ecomod 2004, International Conference on Policy Modelling, Paris.

Penot, E. (2001). Stratégies paysannes et évolution des savoirs : l'hévéaculture agro-forestière indonésienne. Thèse de doctorat. Faculté des Sciences Economiques. Montpellier, Université Montpellier I.: 360p.

Sayer J. and Cambell B. (2004). Improving livelihood and natural resources management in sub-Saharan Africa, annex 3 Insight – research to integrate productivity enhancement, environmental protection and human development. WWL and CIFOR.

Sachs, I. (1980) *Stratégies de l'écodéveloppement*, Editions Ouvrières, collection Développement et Civilisations, Paris, France.

Frame n°1: Main results of the regional assessment in Mimot district, in 2004

Kompong Cham province, in eastern Cambodia, is dedicated to rubber industry. In particular, Mimot district is characterized by its red soils plateaux that have been planted with rubber since 1925. Nowadays the district economy depends on the primary branch. Agriculture is of the family type, with average farms of between one and five hectares.

The main products in the district are cashew nuts, rubber, black pepper and fruit like durian-civet and rambutan. The District environment is quite heterogeneous: three kinds of agrarian systems exist at village level depending on their relief and soil characteristics, access to market and the level of specialization of their farming systems. Within these groups, farming systems can be identified by the combination of production units' that they practice (Feintrenie, 2004). Table 1 below sums up the characteristics of all the farming systems encountered in the district.

	Types of farming systems									
Cropping units	1	2	3	4	5	6	7	8	9	10
Cashew nut (ha)	1	0.5	1	1	2	0.5	0.5	1	2.5	1
Irrigated rice 1 cycle (ha)	1			0.5	0.5		0.3			
Irrigated rice 2 cycles (ha)		0.5								
Dry rice (ha)										CI
Cassava (ha)	0.5					0.5	1	0.5		
Durian civet (ha)	0.1	0.1								
Black pepper (Ares)				4 a		8 a				
Mandarin (ha)		0.1								
Rubber (ha)	1		2					1		
Total usable farm area (UFA) (ha)	**3.6**	**1.2**	**3**	**1.54**	**2,5**	**1.08**	**1.8**	**2.5**	**2.5**	**1**
Stocking units										
Heads of cattle									12	
No. of fattening pigs	2					2	2		2	
No. of calves and fattening pig		1	1	1	1			1		
Poultry (chickens)	3	3	3	3	3	3	3	3	3	3

Table 1: Description of different types of farming systems in the district of Mimot.

Frame n°2: Calculation of family farm income and cumulated balance

Calculation of family farm income (FFI):

GI = Gross Income= production x price

GVA = Gross Value Added
= GI – Home Consumption

NVA = Net Value Added
= GVA – absorptions???? (equipment, buildings, animals, plantation)

FFI = Family farm income = NVA - land rents
- taxes and duties
- interest on credits
- workers' wages
+ Direct subsidies

Calculation of cumulated balance:

Balance = FFI – family expenditures
+ family income

Cumulated balance = previous year's balance + this year's balance

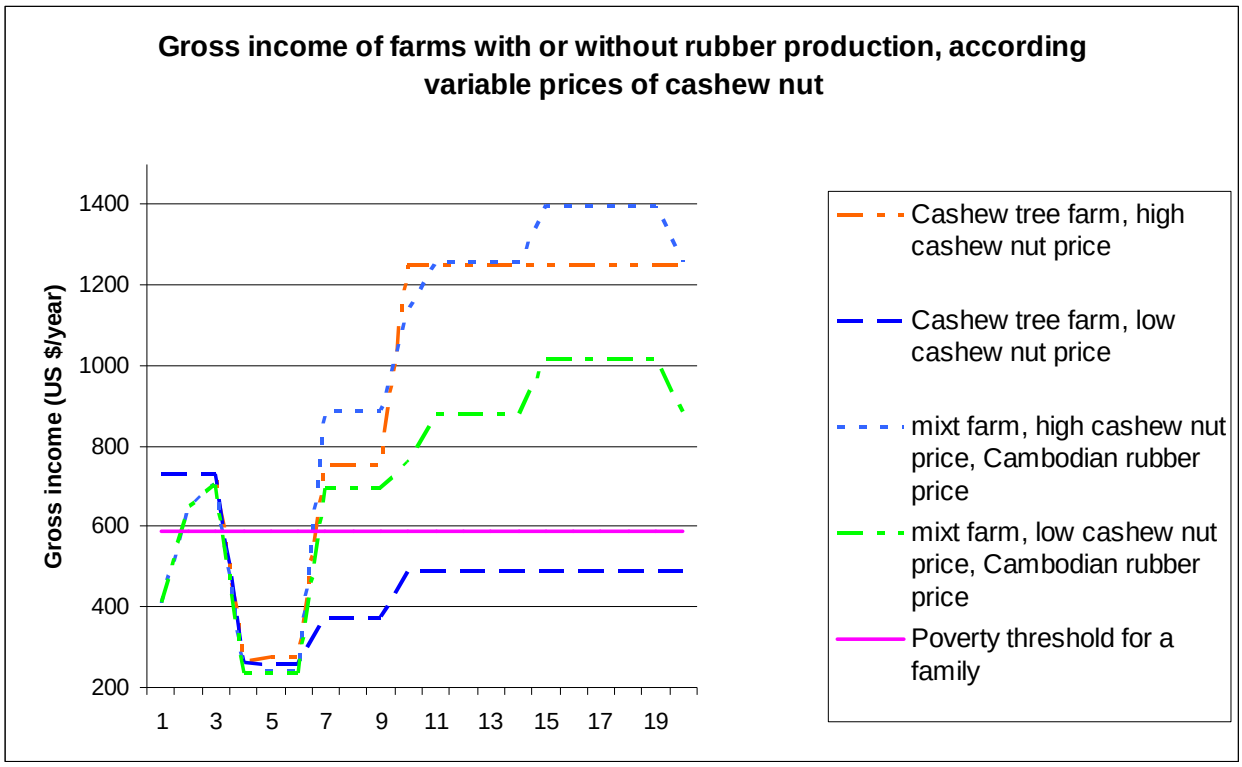

Figure 1: Farm gross income for minimal and maximal prices of cashew nuts on a farm with two hectares of cashew trees, and on another farm with one hectare of cashew trees and one hectare of rubber trees.

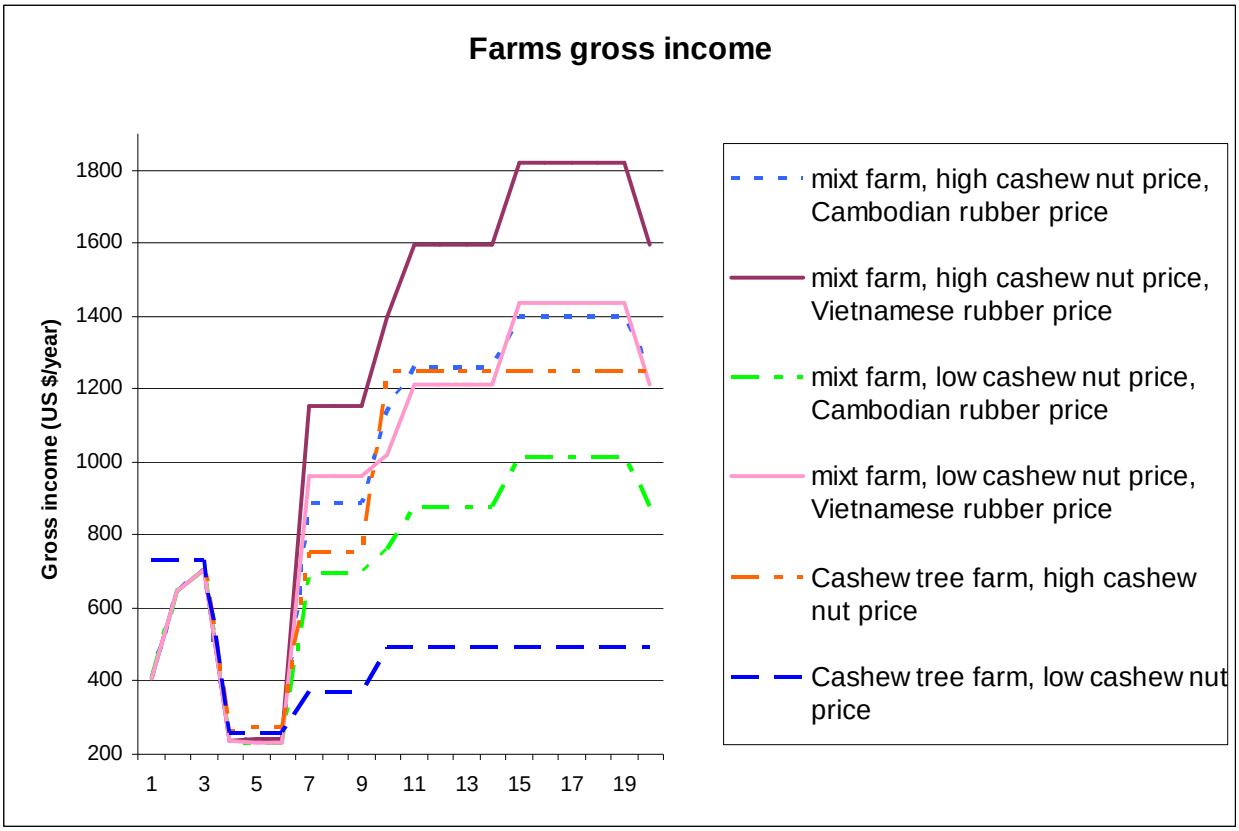

Figure 2: Gross farm income based on differences in the price of rubber (Cambodian price or Vietnamese price in 2004) and cashew nut.

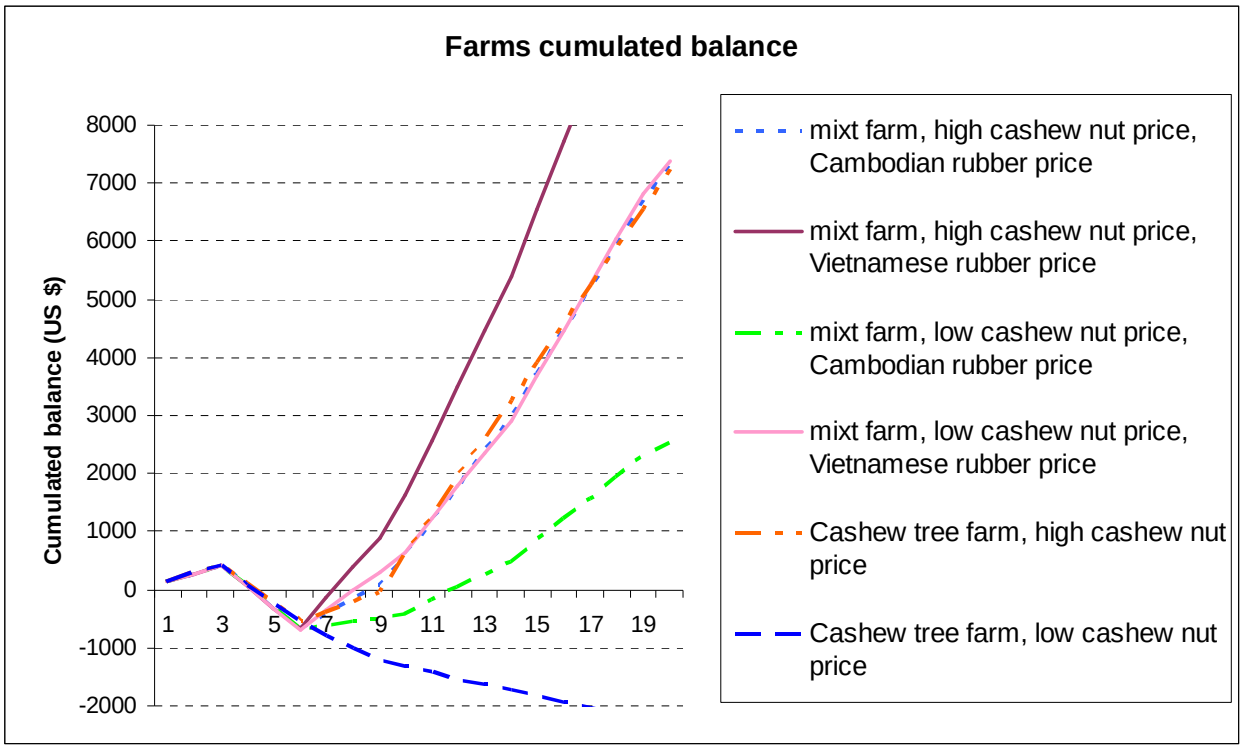

Figure 3: <u>Farms cumulated balance</u> evolution on 20 years