Agricultural Extension Services In Indonesia :

NEW APPROACHES AND EMERGING ISSUES

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ABBREVIATIONS AND ACRONYMS

AAHRD	Agency for Agricultural Human Resource Development
ADB	Asian Development Bank
AIAT/BPTP	Assessment Institute for Agricultural Technology
ARMP	Agricultural Research Management Project
BIPP	District extension center
BPP	Sub-district extension center
CIRAD	French Agricultural Research Centre for International Development
DAFEP	Decentralized Agriculture and Forestry Extension Project
DEC	District Extension Committee
EoP	End of Project
FEATI	Farmer Empowerment through Agricultural Technology and Information
FO	Farmers Organization
FMA	Farmer Managed Activity
GoI	Government of Indonesia
IAARD	Indonesian Agency for Agricultural Research and Development
ICR	Implementation Completion Report
Logit	Binary Logistic Regression Model
NGO	Non-governmental organization
PIP	Project Implementation Plan
PPL	Field extension worker
PMU	Project Management Unit
RPO	Rural Producers Organization
RT/RW	Administrative and geographic subdivisions at village level
UPKG	Village Extension Management Unit
WB	World Bank

Cover photographs courtesy Robin Bourgeois, CIRAD

EXECUTIVE SUMMARY

Indonesian agriculture is at a crossroads. Supporting the livelihood of millions of Indonesians, it needs to underpin renewed and robust growth of the economy; and be a key component of the Government's poverty alleviation strategy. The challenge for the future is to reinvigorate productivity gains among rural producers, and provide the foundation for long run sustainability of these productivity gains. Productivity gains are key to farmer income growth, and for this rebuilding the research and extension systems – that have seen a marked deterioration in recent years - will be critical.

The experience of the Indonesian decentralization of its extension system has been mixed, with adverse impact on extension through sharp reductions in funding, and removal of central-level guidance. At the same time, a series of positive debates and experimentation in management have taken place from a shift on top-down to participatory approaches, input and technology dissemination to dissemination of market and upstream information and technology, from centrally managed extension services to decentralized services, and some movement toward privatization of extension.

One such experimental approach was the World Bank-assisted DAFEP (Decentralized Agriculture and Forestry Extension Project – 2000-2005) which provided an impetus for demand-driven extension and for institutional reforms at the local government level. The development objective of the Decentralized Agricultural and Forestry Extension Project (DAFEP) was to assist the Government of Indonesia (GoI) in "*... enhancing farmers capacity to participate in extension activities, and in strengthening the capacity of the district-level integrated agricultural and forestry extension system which would promote economically viable, environmentally sustainable, and socially acceptable farming practices and increased farmers income*".

In this context, an assessment of the agricultural extension services, as seen through the lens of the impact evaluation of the DAFEP project, was deemed to be timely and relevant. This report thus has the following objectives:

(i) provide an overview of the institutional changes in agricultural extension in Indonesia;
(ii) present the results of the impact evaluation of DAFEP; and
(iii) discuss lessons learned and emerging issues in the new political and institutional context.

The Impact evaluation comprised a Benchmark survey (2001) and an End-of-Project (EOP) survey for collection of data related to a set of indicators corresponding to the project expected outputs.

SAMPLING METHODOLOGY

The DAFEP sample

The choice of the appropriate sampling size was based on the decision to use income dispersion as the key variable whose variance will be used for setting the sample size so that it represents as much as possible the whole project population. With 30 000 households directly targeted by the project, and a 95% confidence degree, a sample size of 400 randomly selected farmers was obtained. Due to possible "losses" throughout the project duration, the sample was increased to 450. The field selection of villages was based on the identification of districts and related sub-districts were the DAFEP was planned to be

implemented, and to select sub-districts that were the most representative of the district agro-ecological and socioeconomic conditions. 'Extreme' sub-district situations were first discarded based on meetings with local key respondents and consultation of local secondary data. Then, the sub-districts were randomly drawn. In each selected sub-district the process was repeated for the village selection, discarding 'extreme' villages. At village level, respondent households were randomly drawn using the list of registered DAFEP members. Replacement households were also drawn in case of the impossibility of finding any households in the first list.

For the purpose of the "with and without" comparison, a reference household sample of similar size and characteristics was selected with the same method in non-DAFEP districts. The process for selecting the respondent households mirrored the process used for selecting DAFEP households. The main difference was that the choice of district, sub-district and villages was conditioned by their resemblance to the district, sub-district and villages in the DAFEP sample. Then, at village level, respondent households were randomly selected from the list of village households, excluding known households that were known to be completely non farm households (for instance, pure traders or civil servants without any farm activity, neither the head of household nor the spouse or dependents were disregarded in the drawing). This was intended to minimize differences between DAFEP and Reference households due to agro-ecological and socioeconomic conditions.

The Spillover sample

In addition, a Spillover sample was added to estimate whether the project had also generated indirect effects in the area of implementation. The Spillover sample was built as a mix of households not participating in DAFEP activities but located in areas where extension workers were part of the DAFEP project and had been trained in and promoting DAFEP approaches. This sample included thus three cases of non DAFEP households according to whether they were located either: a) in DAFEP villages, b) in non DAFEP villages but still in DAFEP sub-districts, and c) in non DAFEP sub-districts but still in DAFEP districts. However, the results from this sample were inconclusive/or of marginal importance and hence, are not presented in the main report.
Impacts

Income and Welfare

The analysis of the income data indicate that DAFEP was successful in significantly increasing farmer net crop income per hectare as well as non-farm income. In fact, non-farm incomes showed a significant increase across all samples. However, due to the problem of a significant number of cultivated but non-harvested parcels, a better proxy of farmer welfare was obtained through the use of expenditure data. Three indicators were used for impact assessment on welfare: yearly expenses, assets value and share of food expenses in total consumption expenses. The difference between Before and After situations for these three welfare indicators is significant for all samples. ***DAFEP households experienced a significant improvement of their welfare situation based on yearly expenses and asset value per capita, a result that is associated with the significant improvement in non farm income.*** A welfare distribution analysis based on Gini coefficient, Skewness and Kurtosis indicates that ***inequality decreased in all samples for yearly expenses*** but it increased significantly for the DAFEP sample with regards to asset distribution compared to the Reference sample. However, since the trend is common to DAFEP and Spillover samples it is difficult to relate it with an effect of the project.

Productivity and Technology. The project was expected to generate a 5% increase in productivity of the main farming systems by EoP. Using the gross value of all harvested crops per hectare and the yield of the main crops (rice, maize, soybean and coconut) indicated that. Tests results indicate that there is ***no significant change in the total value of agricultural production*** when comparing Before and After situation in DAFEP and Reference samples while the Spillover sample experienced a significant decrease. ***Rice yield has remained unchanged*** in all samples indicative of lack of up-take of improved technologies (including improved seeds) and lack of irrigation. Percentage of ***area devoted to rice fell sharply*** in all three samples. Only in the case of ***soybean yields*** a significant change can be observed in the DAFEP sample. DAFEP households achieved an 8% agricultural growth but significant attribution can be made to the project.

Four proxy indicators were used as a measurement of technical changes: the total value of input per hectare, an input/output ratio measured in monetary value for the main crops, a diversification index, and the value of trade income per hectare. Results show that households in all samples have increased their use of inputs in constant value. ***Input use efficiency changes are significant for rice in the DAFEP sample*** and for soybean in both samples. Diversification was high to begin with and did not change significantly. Comparison between DAFEP and Reference sample shows that the project cannot be associated in a significant way with an intensification process that could bear witness of a technological change. However, the magnitude of changes that took place in input efficiency between DAFEP and Reference tested significant for rice. In the DAFEP sample, households traded a larger amount of products before and after the project compared to the Reference sample but the impact of the project on trade income per hectare is not tested significant.

Extension. The cluster of qualitative extension indicators includes six ordinal indicators: availability of agriculture information (AAI), willingness to pay for agriculture information (WPAY), accessibility of extension workers (AEW), extension meeting frequency (EMF) and improvement in access to agricultural information (IAAI), and general access to extension services (GAES), a composite indicator. Results indicate that households have better accessibility to agricultural information, but they don't show change in the willingness to pay for agricultural information. Accessibility to extension workers increased significantly in all samples. Improvement in the availability of agricultural information is rated as positive and non significant for the DAFEP respondents and positive and significant for the Reference sample

Links. The links refer to the relationships between farmers and the upstream and downstream agricultural environment. The cluster included six ordinal variables: accessibility of input markets (AIM), accessibility of agriculture input information (AAII), joint purchase of agriculture input (JPAI), accessibility of output markets (AOM), joint marketing of agricultural outputs (JMAO), and improvement in upstream and downstream links, a composite indicator (IUDI).

All households have significantly better accessibility (fewer barriers) to input market in general. However, trends are not significant for accessibility to input information, joint purchasing of inputs, access to alternative output markets, and joint marketing of agricultural commodities. Altogether, the composite indicator shows a significant positive for all household samples. There is a significant difference between DAFEP and Reference JPAI and JMAO. For JPAI, the Reference sample shows a significantly higher positive change while the figure is reversed for JMAO. For all other indicators, there is no significant difference.

Empowerment. This cluster includes ordinal variables: participation in implementing development projects (PIDP), desire to participate in decision making (DPDM), group meeting frequencies (GMF) and interest in group activities (IGA); and nominal variables: participation in village joint activities (PVGA), participation in village decision making (PVDM), knowledge on decision making process at a village level

(KDMP) and benefits from joining group activities (BJGA). A composite single indicator reflects farmers' confidence to join decision making processes (CJDM).

Participation in implementing development projects has significantly increased in all samples and the desire to be involved in decision making process has increased. The composite indicator shows a significant increase confidence to join decision making process. Nominal variables analysis shows increased participation to village decision making process. However, this trend is similar in all samples and cannot be linked to the project but likely to more global changes such as the ongoing decentralisation process.

Correlation analysis. Decomposition of economic and welfare clusters and correlation analysis indicate that agribusiness activities are the main factor explaining the observed trend in agriculture-related income increase. Also, while in all samples the percentage of households with non farm income has drastically increased reaching 95%, the structure of non farm income remains stable. Remittances and other subsidies share increased and indicate that households become more dependent from external sources of income. In all samples the trend is that monetary non food routine expenses are progressively taking over monetary food expenses. This indicates a slight improvement in general welfare; however, as education expenses and asset acquisition remain stable, this improvement does not translate into an accumulation process or a long term strategy. Transfers from the households are limited and confirm that the net flow of transfer is positive towards the rural households.

Institutional Reforms

At district level, the institutionalization of integrated extension services remains tenuous. Some districts, recognizing potential benefits from farmer-led approaches to extension using the DAFEP model, have supported integrated extension centers through guaranteed on-going finances and Bupati decree. In districts where decentralized, farmer-led extension is working well, and benefits accruing from application of DAFEP principles are recognized, there has been strong support from the head of the district (Bupati) and district parliaments in institutionalization of BIPP's (e.g. Magelang district Central Java and Maros District in South Sulawesi). Where there was strong support for DAFEP, funding has also been provided for expansion of DAFEP concepts to other districts (e.g. in Maros district Rp 800 m for expansion to an additional 20 villages during 2005). Elsewhere support is weaker and in some cases BIPPs have either been abolished (Banyumas, Kotabaru, Tanah Laut, Timor Tengah Selatan Districts), or their echelon level downgraded in effect restricting the career path and status of extension staff. In many cases BIPPs/KIPPs are seen simply as cost centers and their potential contribution to poverty alleviation is not recognized.

District Extension Committees (DECs) were established by Bupati decree in the participating districts to provide district level policy support for farmer-led extension, facilitate flows of information to meet farmer demands, assist in building linkages between farmer groups with NGOs, Universities and Industry. As such, the DEC was envisaged as potentially playing a pivotal role in achievement of DAFEP objectives. While their objectives rely on committee members representing all influential sub-sectors (Government, NGO, Research Institutes, Farmers, Agro-business, etc.), most DECs remained dominated by Government through an over-representation (usually 50 % or more) or perceived authority of Government members, and as yet have largely failed to realize their potential. DECs have not received information from BIPP/KIPPs on actual benefits accrued from implementation of DAFEP at farmer level except for verbal reports and, where DEC is active (e.g. Magelang district), members have assessed impacts of FMAs for themselves through farm visits. This information failure significantly reduced the effectiveness of DECs in fulfilling their roles such as establishing priorities for extension effort. Further external support and clearer definition of roles and responsibilities for both BIPPs and DECs is essential to consolidate progress so far.

Summary of Impacts

The most significant changes occurred in the cluster of income and welfare indicators, DAFEP household showing a significant improvement in their overall welfare situation compared to the Reference sample. With respects to increasing households' income by 5% as targeted at the beginning of the project, there is evidence of success (in constant terms). The direct impact of DAFEP on technology and productivity indicators is very limited. In particular there are no significant changes in the yield of rice and in net income from trade.

In relation to the qualitative indicators, the project seemed to have not very much affected the target group as far as attitudes, skills and practices related to extension are concerned. While positive changes occurred between the Benchmark and the EoP surveys, these cannot be considered as an impact of the project. In all other clusters, the only significant changes occur on the households' practices related to join purchasing of inputs and outputs, with the Reference performing "better" (more joint purchasing) in input purchase and the DAFEP performing "better" (more joint purchasing) in output purchase. Even in these cases, changes are significant between samples but not when compared with the Benchmark situation.

Farmers and NGOs however were enthusiastic about the DECs: NGOs because of the information forum it provides to focus and refine their district programs and farmers because, often for the first time, they have direct access to decision-makers. On the other hand, DEC meetings have often dealt with inconsequential issues and failed to engage decision-makers who are often represented by staff members with no end-of-line authority. There are examples of how DECs have facilitated engagement of research institutions in partnerships with farmers to solve issue-specific topics however, it will take time before these committees mature and begin to tackle long-term, industry-wide or whole farming systems approaches to improving productivity. Partnerships with industry initiated through DECs have also begun to show benefit. For example, farmers have been able to negotiate a direct marketing agreement for rice produced throughout the Gowa district whereby they now receive 20% more for their product. But ***overall, institutional development impact has been modest at best.***

Concluding Remarks and Emerging Issues

The empirical evidence substantiates the structural shift underway in Indonesian agriculture from low value to high value crop and livestock activities. ***Diversified farming*** will be the solution for farmers whose scale of operations or land quality does not enable them to support a family from rice farming income. Diversification means switching to higher-valued crops, livestock and fish production in response to new types of consumer demand. Small farmers will need technical assistance from either the public or private sector if they are to respond successfully to these new market opportunities. Agricultural extension faces a major challenge in Indonesia, similar to public sector extension systems in many countries, to develop an effective institutional mechanism for disseminating technology relevant for small-scale producers. National development priorities include improving extension, and acknowledge that new approaches will be required in the context of the changed institutional context of decentralized extension service delivery. There is growing evidence of significant benefits to decentralized extension systems which partner the public sector capacities with the private sector and civil society. Passage of the new law on extension for agriculture fisheries and forestry (Law 16/2006) now explicitly recognizes private sector provision and supports a multi-provider system. Local governments need to be assisted to take up applicable models as a part of: (i) moving from top-down to participatory approaches to extension subject matter prioritization and delivery; (ii) shifting the balance from input and technology dissemination to dissemination of market and upstream information and technology; and (iii) moving from centrally-managed extension services to decentralized services, and increase space for private delivery of extension services.

The stagnant level of rice yields points to the ***need for research*** on how to increase yields without increasing costs – i.e., how to improve rice profitability- in the interests of both farmers incomes and stability of food prices. Nevertheless the fact that rice based indicators were not significantly different in DAFEP and reference groups is not surprising since the choice of enterprises for focus by farmers was open and incentives for rice have been poor.

Private extension services will assume greater importance in the dry-land cash cropping sub-sector in eastern Indonesia. This is because exportable commodity production is being increasingly supported by the private sector. However, the government will continue to have an important role in coordination, quality assurance, oversight, training, and provision of information services. The evolution from a publicly-financed and publicly-delivered service to one that is publicly-financed but privately delivered has begun. Although the long-term goal is privately-financed and privately-delivered services, there will continue to be a role for government in providing a basic minimum extension service to serve the needs of poor farmers. The present policy stance in Indonesia is also providing a more supportive environment for a range of ***rural producer*** organizations. In all these initiatives, it is important that measures are put in place to better link agricultural research and extension; the separation of these functions with the organization of the MOA has made it difficult to focus on farmers' problems when setting the research agenda, while at the same time achieving effective dissemination of research results.

Strengthening information systems will support higher rural productivity. DAFEP was predicated on the idea that lack of information was a binding constraint in farm incomes. The data on diversification and decline in rice areas shows that other factors were probably at least as important - for example agricultural prices, which would have been declining for rice during the implementation period. Secondly, the constraint of credit to apply any new ideas, particularly in Eastern Indonesia but also elsewhere owing to various access constraints in the banking system was a critical factor - the FMA grants did not increase access to implementation credit.

The low capacity of rural information and communication technologies (ICT) development is widely acknowledged to be a barrier to increasing rural incomes and productivity. Rural communities need up-to-date information on sources, availability and costs of inputs for production, and also on the potential of different techniques and technologies used for production, processing and marketing. The information that is often most relevant to improving livelihoods is non-technical, including the role and responsibilities of different institutions in the provision of key services, such as agricultural extension, credit, health and education, and where to go and who to ask for more specific information. ICT offers an opportunity to make rapid progress. It is important that information is available in an appropriate format and language, and that rural communities have the capacity to access, analyze and act on it. With decentralization and the new political and institutional environment in Indonesia, there is an opportunity to use ICT to support the agricultural development agenda and to improve the delivery of agricultural services in innovative ways.

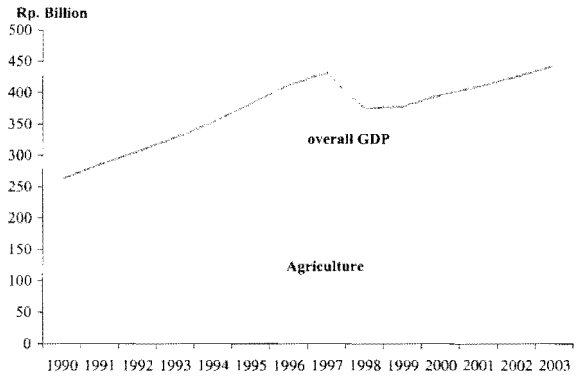
Introduction

1.1 Agriculture averages half of rural households incomes, with the rest coming from rural non-agricultural activities, petty trading and seasonal construction work. There are important regional variations between Java and off-Java. Despite this regional diversity and agriculture's secular decline as part of Indonesia's structural transformation, the sector remains the core for rural household incomes. The sector[1] employs the largest share, 45 percent, of Indonesia's labor and contributes the second largest share, 17.5 percent, of GDP. Agricultural sector productivity growth (along with price changes) has remained the most important way out of poverty.[2]

1.2. Between 1968 and 1992, Indonesia sustained rapid growth in both crop and animal production, with annual output growth averaging nearly 4 percent. "Green revolution" technologies brought large increases in rice yields, and the area under non-food crops grew rapidly outside of Java. However, growth began to slow during the end of this period, and by the 1990s appeared to have stagnated. But Indonesia's agricultural productivity growth has slowed and is low both historically for the country and compared with others. Agriculture total factor productivity growth fell from annual gains of 2.5 percent over 1968-92 to annual contractions of 0.1 percent from 1993 to 2000 (Fuglie, 2004). (See Table 1.1, Figure 1.1). Part of the slowdown was a natural result of slowing growth in demand for food products by Indonesian consumers, as population growth slowed and adequacy of food energy intake was achieved. But a major cause of the agricultural slowdown has been the relative decline in public and private investments in the agricultural sector. Both government spending and private investment in agriculture in Indonesia fell in the 1990s as a percentage of agricultural GDP.

[1] Agriculture is defined here to encompass forestry and fisheries, consistent with GOI statistical conventions.
[2] McCulloch, Neil, Julian Weisbrod and Peter Timmer (2006). "The Pathways out of Poverty in Rural Indonesia – an empirical assessment."

Figure 1.1 GDP and Agriculture
(Rp. billion, 1993 base GDP)



Source: BPS, World Bank staff calculation

Table 1.1. Level and composition of agricultural output in Indonesia

	Average annual growth rate during period		
	1961-67	**1968-92**	**1993-2000**
Crop and animal outputs, total	1.2	4.8	1.0
Food crops, all	1.3	5.1	-0.1
Risse, paddy	1.7	5.5	0.7
Cassava	-0.5	1.9	0.2
Maize	11.3	7.8	1.6
Horticultural crops, all	2.7	3.3	3.9
Fruits, all	3.0	3.7	4.3
Vegetables, all	2.9	4.0	3.9
Non-food crops, all	0.8	5.3	2.9
Cane sugar	1.4	5.6	-4.1
Rubber	0.4	2.8	0.8
Animal products, all	1.4	5.7	0.9
Meat	1.5	6.0	0.8
Milk	-0.6	5.1	2.9
Fish products, all	4.6	4.4	4.3
Forest products, all	-1.5	0.7	-3.5
TOTAL FACTOR	-	-	-
PRODUCTIVITY	0.7	2.6	-0.1

Source: Fuglie and Piggott (2003) cited in ADB/IFPRI 2004.

1.3. There are several reasons for this. First, investment in irrigation stalled with the crisis, with the result that much of the current irrigation infrastructure is in poor condition. Second, , the technical options for improving agriculture have become more specific to smaller agro-ecological areas with less widespread benefits than earlier Green Revolution technologies. Finally, agricultural extension services have suffered a serious decline and serve fewer farmers, particularly since decentralization.

1.4. The Green Revolution policies that favored monoculture agriculture and excessive use of water and fertilizer have caused a decline in the quality of the land resources, water resources, and living environment over the last three decades (IFPRI/ADB 2004). The decline of the quality of agricultural land has contributed to declining land productivity growth that, along with the trend of lowering real commodity prices, has tended to slow growth in farm incomes. Rapid political

change has resulted in a declining role for the central government and increasing responsibilities for regional and local governments. The role of the central government is evolving toward primarily *facilitating* and *servicing*.

1.5. **Context and objectives of the report**: Indonesian agriculture is at a crossroads. Supporting the livelihood of millions of Indonesians, it needs to underpin renewed and robust growth of the economy; and be a key component of the Government's poverty alleviation strategy. The challenge for the future is to reinvigorate productivity gains among rural producers, and provide the foundation for long run sustainability of these productivity gains. Productivity gains are key to farmer income growth, and for this rebuilding the research and extension systems – that have seen a marked deterioration in recent years - will be critical.

1.6 The experience of the Indonesian decentralization of its extension system has been mixed, with adverse impact on extension through sharp reductions in funding, and removal of central-level guidance. At the same time, a series of positive debates and experimentation in management have taken place from a shift on top-down to participatory approaches, input and technology dissemination to dissemination of market and upstream information and technology, from centrally managed extension services to decentralized services, and some movement toward privatization of extension.

1.6 One such experimental approach was the World Bank-assisted DAFEP (Decentralized Agriculture and Forestry Extension Project – 2000-2005) which provided an impetus for demand-driven extension and for institutional reforms at the local government level. The Bank will also embark on a major agricultural services project – the Farmer Empowerment through Agricultural Technology and Information (FEATI) – starting mid-2007. FEATI draws on many of the elements piloted under DAFEP and will support the implementation of the new Extension Law that was passed in late-2006. In this context, an assessment of the agricultural extension services, as seen through the lens of the impact evaluation of the DAFEP project, was deemed to be timely and relevant. This report thus has the following objectives:

(iii) provide an overview of the institutional changes in agricultural extension in Indonesia;
(iv) present the results of the impact evaluation of DAFEP; and
(iii) discuss lessons learned and emerging issues in the new political and institutional context.

1.7. The report is structured as follows. This introductory chapter is followed by a brief history of agricultural extension services in Indonesia. Chapter III presents the salient features of DAFEP, the methodology used for the impact assessment, and descriptive statistics. Chapter IV presents the detailed results of the analysis for the quantitative and qualitative indicators. Chapter V presents an assessment of the Farmer-Managed Activities and the district-level institutional reforms. The concluding chapter presents the lessons learned and emerging policy issues.

Agricultural Extension in Indonesia– A Brief History[3]

2.1 Agricultural development was a priority for the early Indonesian governments especially the increase in the production of food commodities like rice. From 1948 to 1950, the government's Kasimo Plan (*Rencana Kasimo*) involved the extension workers in overall village development, and developing livestock, perennial crops, fisheries, crafts, and small industries. The Kasimo Plan was followed by the Special Welfare Plan (*Rencana Kesejahteraan Istimewa-RKI*), and later under the "Guided Democracy" period of the early 1960s, the rice self-sufficiency movement (*Gerakan Swasembada Beras*), and was conducted nationwide through mass campaign. In practice, all these programs failed due to an excessive reliance on command and control methods.

2.2 The failure of the earlier programs created a new thinking to return the agricultural extension activities to their original basic principles, such as promoting voluntary participation, farmers' independence, and democratic norms. This culminated in the launch during the 1965/1966 planting session, of the Mass Guidance (*Bimas – Bimbingan Massal*) program in five provinces. The BIMAS approach consisted of a package of programs to support production, consisting of provision of credit (through *Bank Rakyat Indonesia*, BRI, a large state-owned bank, operating in rural areas), farmer extension services (by the field agricultural extension workers or PPL - *Penyuluh Pertanian Lapangan*), and the Local Office /Agency of Agriculture – *Dinas Pertanian*), affordable and subsidized agricultural inputs-production tools (supplied by distributors, small shops, and village cooperatives) and the processing and marketing of agricultural products (managed by village cooperatives, farmers' groups, and private firms). The Bimas program relied on the training and visit method (T&V) method that was heavily favored by the Bank[4] and other donors from the mid-70s-90s and was eventually supplanted in the late-1990s with the onset of decentralization (detailed below).

[3] This chapter draws from SMERU (2004).

[4] See Anderson, Feder and Ganguly (2006) for an excellent overview of the evolution and eventual abandonment of the T&V approach in Asia and Africa.

2.3 The institutional arrangements for agricultural extension have undergone myriad changes and several policy reversals in the last three decades. This has, in no small measure, contributed to the deterioration in management, professionalism, mobility, and administration of the agricultural extension system. In 1972, the government established the Agency of Education and Agricultural Training (*BPPLP –Badan Pembinaan Pendidikan dan Pelatihan Pertanian)* that was targeted to develop centralized education plans for the agricultural sector. When its name was changed to the *BPLPP (Badan Pendidikan, Latihan, dan Penyuluhan Pertanian)* or the Agency of Agricultural Education, Training, and Extension), all of the duties, authorities, and responsibilities for education, training, and extension in the agriculture sector in the regions were shifted from every Directorate General (DG) of the Ministry of Agriculture (MoA) to the BPLPP. However, while all agricultural extension activities nationwide were supposedly conducted by the Center of Agricultural Extension under the *BPLPP*, technically every DG of MoA still continued agricultural extension activities. This overlap resulted in the Presidential Decree No. 62/1983, which transferred the management of agricultural extension to the *Bimas* Control Agency *(BP Bimas)*[5]. Thus, the extension authority of the Directorate Generals in the Ministry of Agriculture was transferred to *BP Bimas.*

2.4 This centralization of extension management was later deemed to be inefficient and through a Joint Decree of the Ministry of Home Affairs (MoHA) and MoA No. 65/1991, the government returned the responsibility of managing agricultural extension activities to each of the Directorate Generals in the MoA. This reversal of policy after eight years resulted in the agricultural extension workers moving from a *polyvalent* (multi crops)-orientation to their old functions as sub-sector extension workers. Along with this new policy, the government also created the National Committee of Agricultural Extension *(KPPN- Komisi Penyuluh Pertanian Nasional)* at the national level and the Communication Forum for Agricultural Extension Workers *(FKPP-Forum Komunikasi Penyuluh Pertanian)* in the provincial and district level. In 1993, this was changed again, through Presidential Decree No. 83/1993, where the coordination of agricultural extension activities was moved to the Center of Agricultural Extension, under the Secretary-General of the Ministry of Agriculture. Extension activities that were in the past done by each Directorate Generals were shifted to the Center of Agricultural Extension.

2.5 In 1996 the Ministry of Agriculture modified the structure of extension institutions by forming *BIPP (Balai Informasi dan Penyuluhan Pertanian* or District Agricultural Information and Extension Service) in every district. This action was based on the consideration that farmers require a more comprehensive agricultural extension, the one that is more people and system-oriented rather than commodity-oriented. All agricultural extension activities at the district level was transferred from each *Dinas* to *BIPP.* In this new structure, *PPL* (field agriculture extension workers) were transferred back to RECs and formed a *PPL* Team, and the RECs building assets were also transferred from *Dinas* to *BIPP.* The main duties of this institution were to manage extension system and to integrate extension programs from the four *Dinas* into one system. The budget for *BIPP* and RECs activities, included salaries and operational costs for extension, funded by the central government through regional subsidies, and through a special assistance fund for the agricultural extension. However, this move elicited opposition from the local *Dinas*, especially the *Dinas* Foodcrops who feared losing their identity in the new *BIPP.* Other complications followed including objections from the State Ministry of Administrative Reform Apparatus (or

[5] To organize the implementation of the *Bimas* program, in 1969 (through Presidential Decree No. 95/1969), the government established the *Bimas* Control Agency (BP Bimas), an organization outside the Ministry of Agriculture, headed by the Minister of Agriculture.

Menpan) in 1997 stating that the formation of BIPP as Local Unit Implementers (*Unit Pelaksana Daerah*) was not in line with government policy and that it could only be "a non structural task-force" to integrate field agriculture extension workers. The common woes of agricultural extension workers world-wide - relatively poor incomes, poor incentives, and poor facilities, lack of opportunities to up-grade their skills and education – were exacerbated in the Indonesian context by the unusually high number of changes in the policy, institutional, and organizational arrangements.

Impact of Decentralization

2.6 The fall of the Suharto regime in 1998 and the passage of Law No 22, 1999 on Local Government resulted in one of the most ambitious decentralization programs in the world. Indonesia's ongoing decentralization process since 2001 has resulted in financial resources, personnel and responsibilities for delivery of basic services being devolved to an ever growing number of more than 400 district governments. The lift of the ban to free press in 1998 and later, with the revision of the decentralization law in 2004, the direct election of regional heads, have created a more open political environment. These changes have presented both challenges and opportunities for improvement in local governance. The challenges are amplified as they are not only related to institutional or technical issues but also political. Projects requiring construction or purchase of goods are favored for obvious rent-seeking opportunities and poverty programs get short shrift. Overall, the environment for "good governance" at the local level is weak and corruption similar to the national situation is endemic. Systemic capacity issues affecting the districts include: weaknesses in public policy, exclusionary budget planning and management practices; poor standards of service delivery and accountability to end users; weak financial management, procurement and internal controls; limited local resource mobilization capacity, and barriers to improving the local investment climate.

2.7 With decentralization beginning in 2001, including for extension, local governments had increased authority to chose the organization for their services. While about a hundred chose to retain the newly-introduced, unified extension structure, the other two thirds reverted to a fragmented structure and some eliminated BIPPs and set up new extension institutions. Studies like Hadi (2003), Indonesia Rapid Decentralization Apraisal (IRDA) and SMERU (2002) have shown that decentralization has brought about a deterioration in the delivery of public services like health, education, and infrastructure (road and irrigation).[6] Poor governance, despite increased district income as a result of central government grants, has undermined the structure of the extension system built up over 20 years. Management, professionalism, mobility, and administration of the agricultural extension system, as well as respect among farmers, have almost disappeared in many districts. Of the total field extension workers (PPLs), there are only 2,559PPLs (6.38%) who hold bachelor degrees, while the rest (37,450 PPLs) hold *sarjana muda* (associate degrees) or lower qualifications, mainly training from agricultural high schools.

2.8 Neglect of many aspects of the public service including agricultural extension is due in part to the lack of accountability of local government to electors. Regional autonomy has changed not only the relationship among levels of government (central-province-district/city) but also the format of the accountability of local government. The responsibilities of local governments, in relation to agricultural extension, are detailed in the Ministry of Home Affairs Decree No. 130-67/2002

[6] A recent World Bank study, "Making Services Work for the Poor in Indonesia" (2006) however states that some human development outcomes have actually improved and that the reality is more nuanced. However, low efficiency of public spending, low quality of services, and inequalities in access and outcomes are still persistent problems.

which explains the nine functions of local government in supporting extension services. The Decree has been largely ignored by local government in favor of a focus on infrastructure rather than human resource development projects. Regulations on the accountability of local parliament to the public and the executive to the public are largely neglected. Regional autonomy as practiced does not enable the public to supervise both executive and legislature's accountability. As a result, local government can be run simply based on agreements between the executive and the legislature, without paying any serious attention to either public aspirations or to Ministerial Decrees from the central government. The multitude of institutional arrangements and inconsistent policies have created doubt and uncertainty in the extension service. The situation is aggravated by their inability to gain the trust of farmers through consistent under funding by the districts since decentralization. An example of under-funding of extension from Java is given below.

Table 2.1. The allocation of operational expenditures of agricultural extension in (in rupiah) in the district of Cianjur (West Java)

Description	Prior to Decentralization	After Decentralization
Fuel and exploitation fund	Rp.40,000/month	None
Fixed field allowance (UJT)	Rp.90,000-110,000	Rp.55,000/month
Lodging fund	Rp.600,000/year	None
Stationery for instructor	Rp.150,000/year	Rp.50,000/year
Demonstration funds	Rp.5 million/year	None
Operational funds	Rp.5 million/year	Rp.500,000/year
Stationery	Rp.200,000/year	Rp.100,000/year

Source : SMERU (2004)

Recent Developments

2.9 The current President of Indonesia, Susilo Bambang Yuhhoyono, has taken a strong leadership role in developing an agenda for the revitalization of the agriculture, fisheries, and forestry sector *(Revitalisasi Pertanian Perikanan dan Kehutanan/RPPK)* that was formally presented in June 2005. The RPPK is a general strategy aimed at improving the welfare of farmers, fishermen and forest communities, and increasing the competitiveness and maintaining the sustainability of agricultural, fisheries and forestry products. This general strategy also forms the main part of the National Agenda for Community Welfare Improvement *(Agenda Nasional Peningkatan Kesejahteraan Masyarakat).*

2.10 The RPPK focuses on, inter alia, the development of human resource capacity and participatory empowerment of farmers through improved information systems, training in community agribusiness development, increasing funding for long-term technological research and development to improve agricultural competitiveness. This is also reflected in the Government of Indonesia (GOI) Medium Term Plan, 2005-2009 (RPJM) which recognizes the importance of diversification to improving efficiency and farmer welfare and the growing importance of globalization in agricultural competitiveness. The RPJM calls for revitalizing agriculture through the development of agribusiness linkages to improve farmers' incomes and for greater diversification to reach an ambitious sectoral growth rate of 3.9 percent.

2.11 The systems that the central government is now aiming for include an increased reliance on farmer/producer organizations, decentralization of authority and budget responsibility a greater role for

non-governmental provision (universities, agribusinesses, NGOs, farmer organizations (FOs), and other private sector providers) of agricultural services who have been active in many areas but which have remained at the periphery of driving the government's agenda on agricultural modernization due to lack of a conducive policy environment. The transfer of new agricultural technologies to farmers by private plantations, seed companies, agricultural chemical companies, animal production firms and food processing companies continues to rise. In November 2006, the Government promulgated a new Extension Law[7] (Lax No. 16/2006) that is aimed at revamping the extension services with increased coordination between the district, provincial and central levels, establishment of clear norms and standards for agricultural extension institutions at all levels of government, and most significantly, a recognition of the importance of a multi-provider extension system .

Role of the World Bank

2.12 The World Bank (WB) has had a long-standing relationship with the Government of Indonesia (GOI) with regard to its financing of agricultural technical services. The Bank supported GOI in the development of its agricultural research services since 1975 and its extension services since the late 1960s. In addition to, and complementary to the extension projects, the Bank also supported agricultural education and training in a series of training and capacity building projects to support GOI's long-term strategy of improving and expanding pre-service and in-service agriculture sector training. The WB has also financed smallholder cattle development, tree crop development, and more recently research management and integrated pest management projects (See Table2.2).

Table 2.2 World Bank-assisted Technical Services Projects in Indonesia

Name of Project	Closing Year	Loan Amt. ($USm)
Second Agricultural Research Management Project	2002	$19.0
Treecrops Smallholder Development Project	2000	$76.9
Integrated Pest Management Training Project	1999	$25.2
Agricultural Research Management Project	1996	$35.3
Third Agricultural Extension Project	1993	$55.0
Smallholder Cattle Development Project	1993	$32.0
Third Agricultural Training Project	1992	$63.3
National Agricultural Research II Project	1990	$62.9
Decentralized Agric. and Forestry Extension Project	2005	$18.0

The centralized extension system, preferred under the T&V method supported by the Bank lasted from the 1970s to the early 90s during the period of implementation of the series of agricultural extension projects.

A Paradigm Shift

2.13 Despite over 30,000 public extension agents, Indonesia's national system was not reaching farmers, leading to roll-out of a basic reform that received World Bank support for piloting innovations beginning 1999 through the Decentralized Agricultural and Forestry Extension Project. Instead of five separate, commodity-defined, technical services, these would be combined in unified, District-

[7] Covering agriculture, fisheries, and forestry.

level, extension agencies. Moreover, these agencies would take a farming-systems approach to meeting farmers' extension needs. Initially, 20 of the country's 400+ Districts would pilot the new approach. The project development objective was to assist the Government of Indonesia in enhancing farmers' capacity to participate in and lead extension activities and in strengthening the capacity of the district-level integrated agricultural and forestry extension system which would promote economically feasible, environmentally sustainable, and socially acceptable farming practices and increase farmers' incomes.

2.14 The project objective was consistent with the Government's policy thrust towards increased decentralization, increased effectiveness of public services, encouraging self-reliance among rural communities and withdrawal of its support where it is not needed or where it can be provided by private sectors and others. Drawing on experiences of earlier pilot projects in Indonesia it was recognized that effectiveness of extension could be achieved through: (i) putting the farmer first, (ii) reorganizing public extension where district extension services of agriculture, forestry and fisheries are integrated, and (iii) involving NGOs and lead farmers as part of the extension effort.

2.15 The following chapters examine the impact of the DAFEP approach in greater detail.

The Decentralized Agricultural and Forestry Extension Project[8]

3.1 The DAFEP project was implemented in 16 districts in 9 provinces between February 2000-March 2005. The total cost of the project was US$ 23.57 M, of which US$ 18 M comprised the World Bank loan. It was structured into 3 components to test and implement extension reforms at farmer, district and central levels:

(i) Enhancement of farmers' capacity to participate and to lead extension activities (US$ 7.89 million, 34% of total costs) to support (a) revitalization of farmer groups and organizations of farmers' networks; (b) building farmer capacity to participate in and to lead extension activities; and (c) promotion of participatory extension methods and provision of media and technical support.

(ii) Strengthening the district extension system (US$ 11.16 million, 47% of total costs) to support (a) the introduction of institutional and management reforms at district level; (b) building the capacity of extension staff in the participating districts; and (c) strengthening the extension support and delivery systems in participating districts.

(iii) Provision of central extension policy and project management support (US$ 4.42 million, 19% of total costs) to support (a) the improvement of extension policy and special studies; (b) strengthening the central extension support systems; and (c) provision of technical assistance and project management support.

3.2 The project started in 2000 and was completed in 2005. The Centre for International Cooperation in Agricultural Research for Development (CIRAD), based in France, was contracted to ensure a

[8] This section draws from the DAFEP Project Appraisal Document (Report No19421-IND), 1999 and the DAFEP Implementation Completion Report (ICR), Report No. 33582, November 2005.

comprehensive assessment of this project. CIRAD proposed an impact analysis methodology that was accepted by DAFEP Project Management Unit (PMU) and the World Bank. This methodology was a two-step process consisting in a "Benchmark" survey and an "End of Project" (EoP) survey for collection of data related to a set of indicators corresponding to the project expected outputs.[9] See Annex 2 for a description of the methodology and the indicators.

3.3 The rationale for establishing a two-step survey entrenched in the need to perform a reliable evaluation. For this reason, the applied methodology included three samples of 480 farmers each, respectively called "Dafep", "Reference" and "Spillover". These samples were designed so that they made possible a "before-and-after" and "with-and-without" analysis resulting in a more accurate evaluation of the real project impact. A set of 39 indicators, consistent with DAFEP logical framework as indicated above, was elaborated for measuring the multi-dimensional impacts of the project on the targeted farm household population. The benchmark survey was completed in October 2000 and the EOP survey in August 2006.

3.4 Sampling Methodology

The DAFEP sample

3.5 The choice of the appropriate sampling size was based on the decision to use income dispersion as the key variable whose variance was used for setting the sample size so that it is representative of the project population. With 30,000 households directly targeted by the project, and a 95% confidence, gave rise to a sample size of 370 randomly selected farmers. Due to possible "losses" throughout the project duration, the sample was increased to 450. The field selection of villages was based on the identification of districts and related sub-districts where DAFEP was planned to be implemented, and to select sub-districts that were the most representative of the district agro-ecological and socioeconomic conditions.

The Reference sample

3.7 For the purpose of the "with and without" comparison, a Reference household sample of similar size and characteristics was selected with the same method in non-DAFEP districts. The process for selecting these households mirrored the process used for selecting DAFEP households. The main difference was that the choice of districts, sub-districts and villages was conditioned by their similarities to the districts, sub-districts and villages in the DAFEP sample.

The Spillover sample

3.8 In addition, a Spillover sample was also selected in order to estimate whether the project also generated indirect effects in the areas of implementation. The Spillover sample was built as a mix of households not participating in DAFEP activities but located in areas where extension workers had been trained to, and expected to apply, the DAFEP approach. This sample included three different situations of non DAFEP households according to where they were located: a) in DAFEP villages, b) in non DAFEP villages but still in DAFEP sub-districts, and c) in non DAFEP sub-districts but still in DAFEP districts. (for more details on smapling methodology, see Annex 1)

[9] Refer in particular to the project logical framework as stated in Annex 1 (pp 1-5) of DAFEP Project Implementation Plan - Annexes -, July 1999, National Centre for Agricultural Extension, Ministry of Agriculture.

Data Analysis

3.9 Since the main point of the analysis was to assess whether DAFEP had an impact, the key indicator in fact was the significance of a difference observed between the DAFEP and the Reference sample, difference being expressed for each indicator as the variation between the changes that occurred in the DAFEP sample and the changes that occurred in the Reference sample. Statistical treatment of data thus differed according to the type of indicator and whether the samples were considered as independent (for comparison of means and averages and dispersion, and for *Before* and *After* comparison) or as dependent (for comparison of individual longitudinal data and for regression analysis). The process of analysis included two steps. The first step consisted in conducting statistical work on each indicator in order to assess the impact of the project. The second step consisted in multivariate analyses such as principal component and factorial analysis, applied to these indicators in order to provide, whenever possible, a more complete understanding of how this impact took place and to what extend it was due to the project.

3.10 A T-test was used (with adjustment to the error degree of freedom using Satterthwaite's formula) within each sample to assess whether the situation *After* was significantly different from the situation *Before*. Then, a Binary Logistic Regression Model (logit) was applied to test the significance of the means' difference between DAFEP and Reference. For each model, the dependent variable was the membership of the respondent household to the different samples and the independent variable was the indicator. (For further details on the data analysis, see Annex 1).

Descriptive Sample Statistics

3.11 The first section of this assessment presents a general description of the samples' main features, to give the reader a better understanding of the general situation of the respondent households. As indicated earlier, the indicators are regrouped in six clusters (quantitative and qualitiative) so as to provide a more structured and legible reporting. The quantitative variables are continuous and numerical while the qualitative indicators are discrete and distributive..

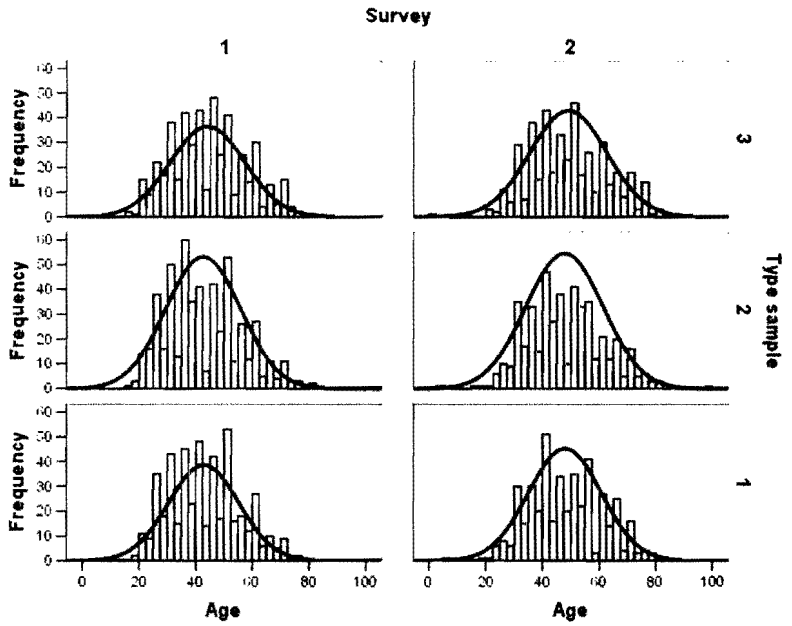
3.12 In all cases, in each cluster, data analysis starts with presentation of the results for the *Before* and *After* situation along with the results of the significance test. These are discussed and then, the results from the cross sample analysis (DAFEP vs. Reference test) are presented and discussed. This latter part of the analysis is the main output of this research work. While the *Before/After* comparison is a necessary step in the process, it is only mainly presented because it provides the material (the values of the difference between the *Before* and *After* situations for each sample) for the significance test of DAFEP impact. Absolute values are thus less important than relative changes.

3.13 An overview of the samples

Profile of respondents

3.14 *Age*. The average age of respondents in the Benchmark survey is 43 and 48 in the EoP. This indicates a real consistency in the data collection process, in particular with respect of re-interviewing the same households after five years.

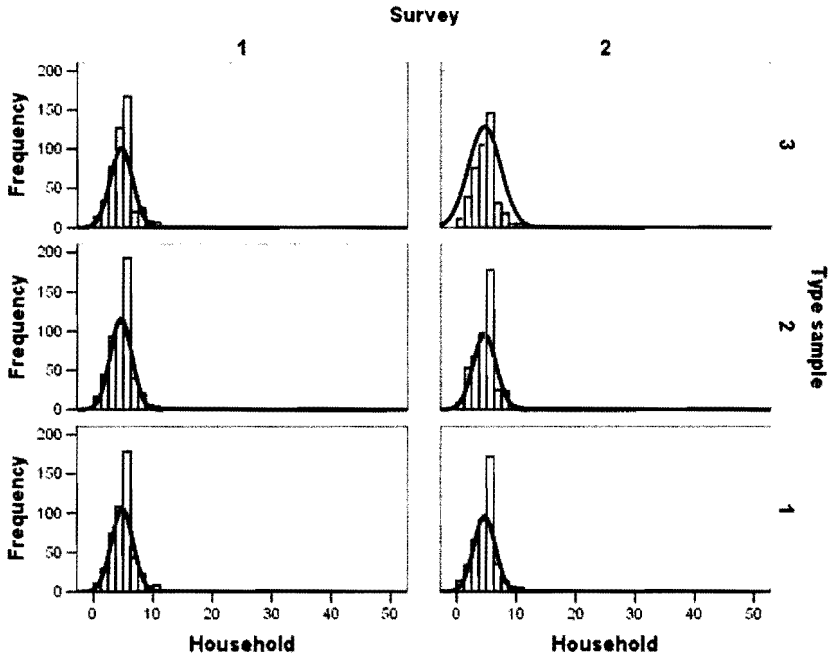
Figure 3.1 Age distribution of households' heads.



Notes: For x (survey) 1=Benchmark ; 2=EoP Survey; For y (type sample) 1=DAFE ; 2=Spillover ; 3=Reference

3.15 *Education and Family Size.* More than 60% of the respondents have an educational level equal or below the end of Elementary School. This proportion is similar and unchanged in the *Before* and *After* surveys and across the DAFEP, Reference and Spillover samples. The structure of education distribution shows no particular differences between samples. The average size of family members remained almost unchanged (4,68 before and 4,65 after).

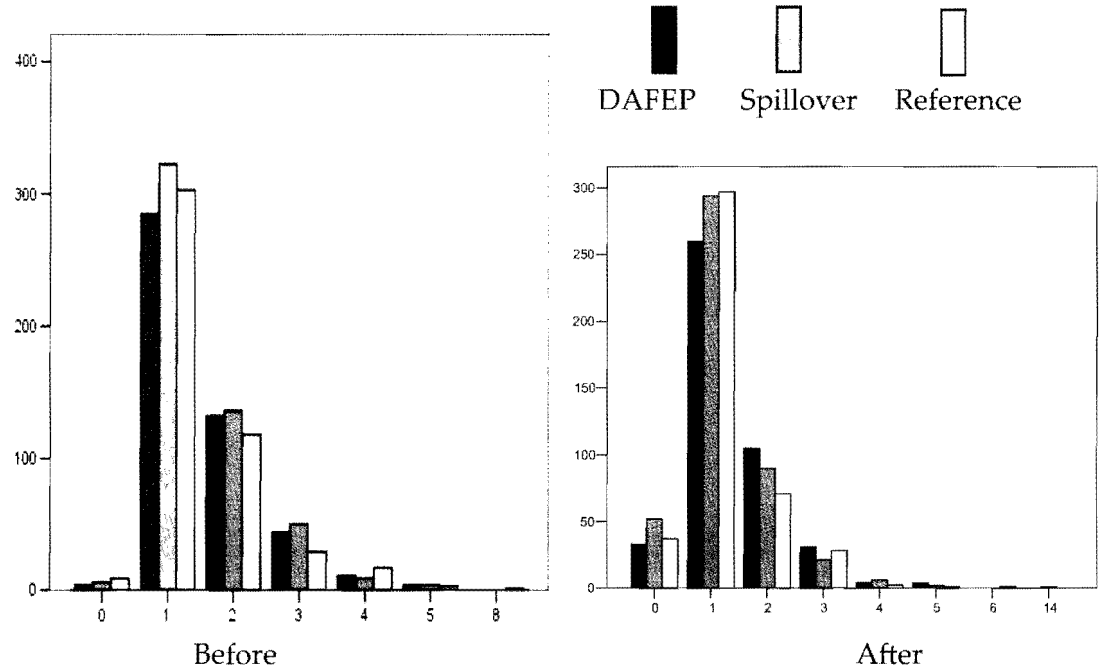
Figure 3. 4. Distribution of family size in the Benchmark survey.



Notes: For x(survey) 1=Benchmark ; 2=EoP Survey; For y (type sample) 1=DAFE ; 2=Spillover ; 3=Reference

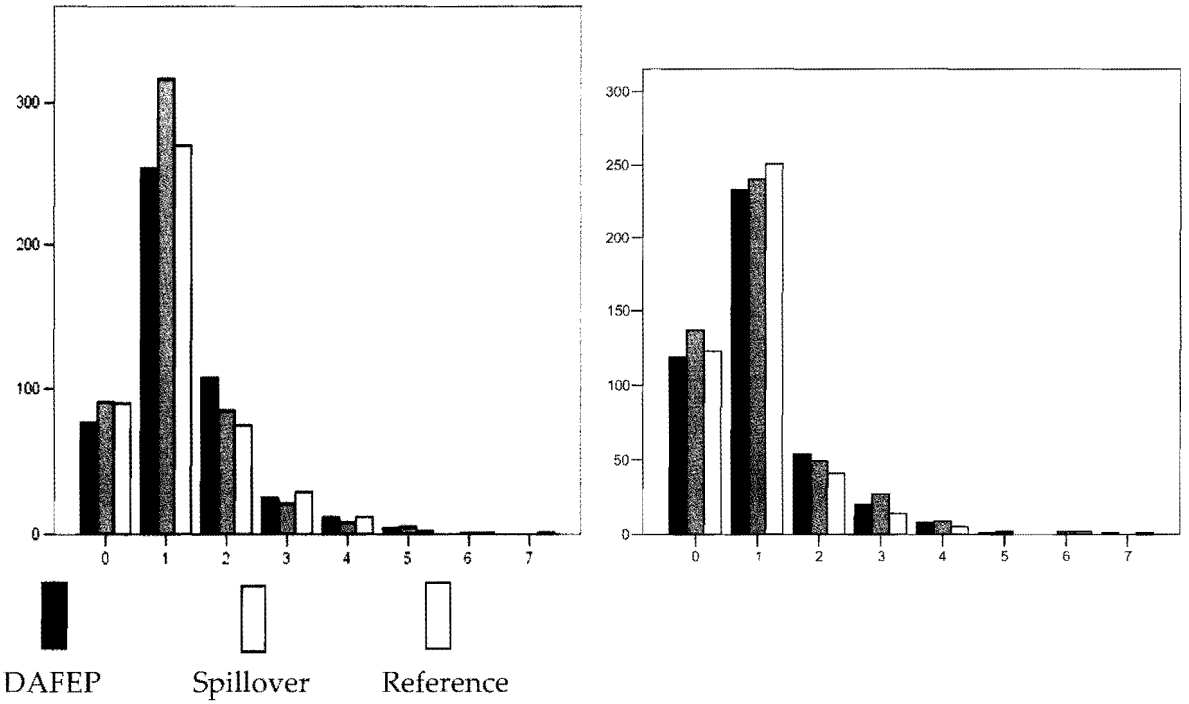
3.16 *Agricultural workers.* The structure of the distribution of male workers in agriculture is similar in the three samples in the Benchmark survey and similar also in the EoP survey. Most of the households (more than 60%) have two people working in agriculture. Changes in the Before/After situation are relatively small, with the exception of an increasing number of households with no workers in agriculture (from 1 to 10 %). This either indicates an increase in the income level that makes labouring as wageworker less needed or because other job opportunities have appeared.

Figure 3.5. Evolution of male agricultural labour force (number of households members)



The structure of distribution of female agricultural workers has also evolved similarly across the three samples. The relative share of households with 0, 1 or 2 female agriculture workers, were respectively 17%, 56%, 18% in the Benchmark and 28%, 54%, and 10% in the EoP survey.

Figure 3.6. Evolution of Female agricultural labour force (number of households members)



3.17 *Crops*. The total planted area did not significantly change across samples, but it did across time. It covered altogether almost 1,800 hectares in the Benchmark and only 1400 in the EoP survey. The reduction comes in fact from the rice cultivated area dropping from 1150 ha to 800. However, this is partly due to the reduction in the sample size (erosion of the sample). Importance of paddy for the respondent households is shown in Table 3.4 below.

Table 3.4. Distribution of land and cropped land in the samples

	EoP					
	All	Dafep	Reference	All	Dafep	Reference
Nb of Households	1172	384	384	1067	329	330
Total area	1729	560	597	1407	452	502
Land/Household	1,48	1,46	1,56	1,32	1,37	1,52
Paddy (Ha)	1109	359	362	797	234	281
	64.1%	64.1%	60.6%	56.6%	51.8%	56.0%
Maize (Ha)	143	38	54	129	48	49
	8.3%	6.8%	9.0%	9.2%	10.6%	9.8%
Soybeans (Ha)	59	18	22	54	13	21
	3.4%	3.2%	3.7%	3.8%	2.9%	4.2%
Others (Ha)	418	145	158	427	157	151
	24.2%	25.9%	26.5%	30.3%	34.7%	30.1%

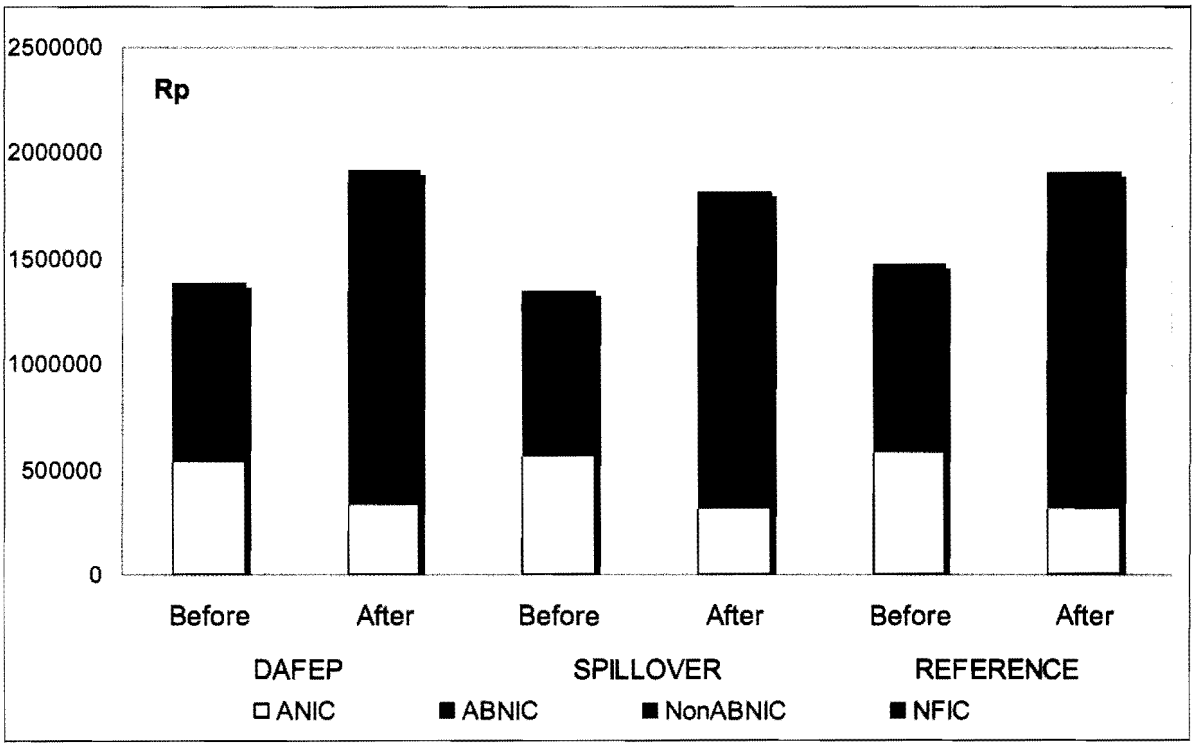
The majority of households plant one or two crops per year and a few up to five different crops. There is no particular difference, except for a slight increase in the total number of households planting more than three crops in the DAFEP sample compared to the Reference sample in the EoP survey.

Table 3.5. Number of crops grown and corresponding share of households

Survey	Number of Crops	Household count			Total
		DAFEP	Spillover	Reference	
Before	1	48%	51%	51%	575
	2	40%	39%	37%	441
	3	11%	9%	12%	121
	4	2%	1%	0%	9
	5	0%	1%	1%	6
	Total	384	384	384	1152
After	1	46%	53%	52%	488
	2	41%	37%	35%	366
	3	8%	7%	10%	81
	4	5%	2%	2%	28
	5	1%	1%	0%	4
	Total	329	308	330	967

In relation with income assessment and the measurement of the project's expected achievement to raise income by 5% over the project period, five indicators were used[10] : total net income per capita (TNIC), agricultural net income per capita (ANIC), agriculture-related income per capita (ARNIC), agribusiness net income per capita (ABNIC) and non farm income per capita (NFIC), the first one being the sum of ANIC, ARNIC and NFIC, while ABNIC is a subcomponent of ARNIC. As shown in the text box below, all these indicators are needed due to the diversity of income sources at individual household level. These indicators measure the net value of monetary inflows of the household during the surveyed period (one year starting from the date of interview backwards). ANIC refers exclusively to the total value of yearly agricultural production (crops, animals and forest products). ARNIC includes selling of labour force, renting out of production factors such as land or equipment, and processing of agricultural products (ABNIC). NFIC includes other jobs, trade, sources of income such as remittances, etc.

Figure 3.7. Comparison of income indicators in 2001 constant value



Note: NonABNIC= ARNIC-ABNIC

The samples show a marked increase in non-farm incomes. Agricultural net income per capita in contrast has declined. The significance of these results will be analyzed in subsequent chapters.

[10] All these indicators are only for farming households. In the EoP survey, 967 of 1067 households had cultivated lands. Other households are either landless or are not farming anymore. The income indicator for the whole sample is the yearly expenses per capita (see Welfare indicators).

DAFEP Impact: Analysis of Quantitative and Qualitative Indicators

4.1 This chapter presents the detailed results of the data analysis starting with the quantitative indicators and followed by the qualitative indicators.

Income and Welfare Cluster

4.2 The income data described in the earlier section have their limitations in that at the time of the EOP survey, about 20 percent of the plots were cultivated but not harvested. This affected the value of several indicators, in particular agricultural net income per capita, yields, total production value per ha, input use efficiency, trade income per capita. This situation influenced the results in particular when comparing the *Before* and *After* results, since at Benchmark data collection period those cases were almost non-existent. Some analytical adjustments were made (see Annex 1) in order to minimize the effect of the missing production data when comparing the results. The yearly expenditure data (which excludes input expenditures) was also analyzed separately as an indicator of farmer welfare.

rence comparison

Table 4.1. Before/After comparison of income indicators (farming households)

Sample	Condition	TNIC	ANIC	CNIHA	ARNIC	ABNIC	NFIC
DAFEP	*Before*	1,375,117	545,359	7,296,341	215,599	80,054	614,160
	After	1,905,571	344,270	8,502,606	269,614	218,743	1,293,366
	Difference[11]	**530,454**[s]	**(201,089)**[s]	1,206,265[ns]	**54,015**[s]	**138,689**[s]	**679,206**[s]
		38,6%	*(36,9%)*	*16%*	*25%*	*173,2%*	*110,6%*
Reference	*Before*	1,489,872	584,633	6,562,847	220,112	49,577	663,164
	After	1,945,716	326,004	6,509,380	348,600	285,991	1,226,376
	Difference	**455,844**[s]	**(258,629)**[s]	(53,468)[ns]	**128,488**[s]	**236,414**[s]	**563,212**[s]
		30,6%	*(44,2%)*	*(1%)*	*58,4%*	*476,9%*	*84,9%*

Note for all quantitative tables:
* indicates that the difference between Before and After is significant using either T-Test or Confidence Interval.
** indicates that it is not significant.

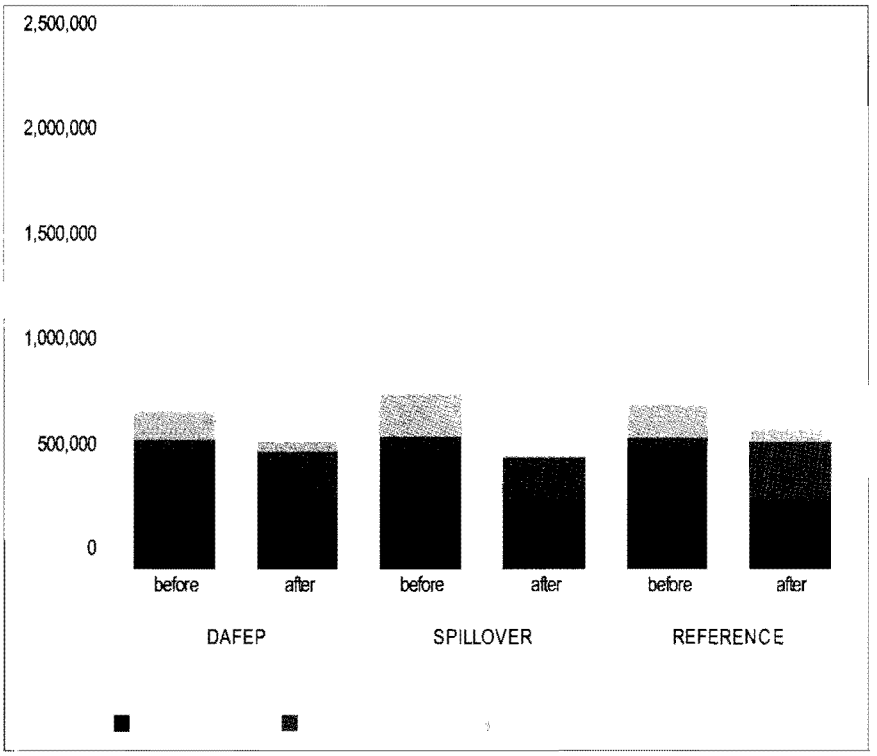
Interpretation

4.3 The difference in TNIC between *Before* and *After* situation for the DAFEP and Reference samples is significant and quite high (more than +30%) in constant terms. In the case of ANIC the difference between *Before* and *After* situation for DAFEP and Reference samples is significantly negative and high (around -40%) in constant terms. However, for the reasons explained in the Methodology chapter, ARNIC cannot be used as an indicator of absolute performance because of the problem of not-yet-harvested parcels. For this reason, an alternative indicator was built - the crop net income per hectare (CNIHA) - based on the results from the harvested parcels. This indicator, while it does not include all parcels in the sample, helps nevertheless to reduce the bias since changes are calculated per hectare and not per capita. The table shows that the difference between *After* and *Before*, based on this indicator, is not significant in both samples. Furthermore, what most matters, again, is not the absolute value of the changes but the significance between samples. As the problem similarly affected all samples in the EoP survey, the results of significance analysis presented are still valid.

4.4 Changes in ARNIC and in particular ABNIC are significant in both samples in constant terms, with a spectacular increase in ABNIC. The rate increase in the Reference sample is above that of the DAFEP sample. NFIC most contributes to the changes in TNIC. For this indicator, the *Before* and *After* situation is significantly different for the samples; income has been multiplied by two. The analysis in the annex on multivariate analysis provides a better understanding of the observed trends in agricultural income and in non farm income. The graph below synthesises the above results, expressed in constant rupiah at 2001 value.

[11] Significance of resultsAlternative calculation taking into consideration the variation in the number of respondents between *Before* and *After* sample is fully identical, therefore the simple difference, easier to understand is used here. This applies to all indicators using units per capita.

Figure 4.1. Comparison of income indicators in 2001 constant value



Note:

AIC=Agric. Production; AGBC, Non-AGBC=Agric.related; NFIC = Non-farm.

Table 4.3. Significance analysis of income indicators (DAFEP vs Reference)

Variable	Condition	Test Result	Output
TNIC	*Before*	*Significant*	*DAFEP < REF*
	After	Not Significant	
	Change	Not Significant	
ANIC	Before	Not Significant	
	After	Not Significant	
	Change	**Significant**	**DAFEP > REF**
CNIHA	*Before*	*Significant*	*DAFEP > REF*
	After	*Significant*	*DAFEP > REF*
	Change	Not Significant	
ARNIC	Before	Not Significant	
	After	*Significant*	*DAFEP < REF*
	Change	**Significant**	**DAFEP < REF**
ABNIC	*Before*	*Significant*	*DAFEP > REF*
	After	Not Significant	
	Change	**Significant**	**DAFEP < REF**
NFIC	Before	Not Significant	
	After	Not Significant	
	Change	**Significant**	**DAFEP > REF**

*Note : *significant at 10% with DAFED < REF)*

Interpretation

4.5 The table above presents the results of the logit analysis for each of income indicator, starting with the condition before the project *(Before)* and after the project *(After)*. It shows also whether the changes in *between Before* and *After* conditions in the DAFEP sample are significantly different from the changes in the Reference sample and what is the nature of the change (> indicates higher; < indicates lower).

4.6 This table shows that the change in the situation of households in the DAFEP sample was significantly different from the Reference households for some indicators. DAFEP had no significant impact on TNIC. However, the following section on Welfare which uses another indicator as a proxy of household net income (YEC) for all households shows a positive effect attributable to DAFEP. Meanwhile, as far as farming households are concerned, the significance tests indicate that the project did not achieve the objective of raising households' income by 5 percent over five years, compared to a sample of reference farmers. However, given that TNIC is computed with the

incorporation of ARNIC and given that ARNIC cannot be satisfactorily used for the difference test, this conclusion must be taken with extreme caution. This does not mean either that DAFEP had no impact on households' income at aggregate level. In any case, the results show that there are other (more powerful) factors at work that have affected all samples in a similar way.

4.7 According to the testing method, change on households' agricultural income (ANIC) is related to the existence of DAFEP. However, for the reason indicated earlier (influence of 20% of not yet harvested parcels), no conclusion can be directly derived about the real significance of these changes. The results for CNIHA indicate that although DAFEP households had a significantly higher net income in both *Before* and *After* situations, there is no effect that can be directly related to DAFEP in the comparison of the change level according to the testing method. The DAFEP project cannot, thus, be associated with a significant change in farmers' agricultural incomes.

4.8 Reference households have performed better than DAFEP households with respect to ARNIC and ABNIC. Conversely, positive changes in NFIC are significantly higher for the DAFEP sample compared to the Reference sample. Further analysis will be needed to identify which components of NFIC are related to this trend and whether they can be associated with some features of the project, and to clarify the factors behind the observed significant results (see Annex 2).

4.9 It is problematic that even though the DAFEP sample showed significantly better income and welfare outcomes compared with the Reference sample, it is hard to explain why from the other evidence presented particularly since there is little change in the DAFEP sample on the agricultural practices/outcomes on which, presumably, DAFEP interventions would have had the largest impact. Most of the income growth was on the non-farm side of household activity. The difficulty in explaining why the DAFEP sample had these results opens the analysis to the critique that there was selection bias in the choice of DAFEP communities by the project managers in the districts - e.g. more accessible, more open, more active, better organized, more social cohesion, which gave them a better foundation for improving non-farm income. However, the choice of the Reference sample was sufficiently rigorous to neutralize this critique of the results. One possible explanation could be that the farmers' benefited from the capacity building through DAFEP activities and this might have enabled farmers to become more confident and engage successfully non farm activities. However, this could not be tested. It is also *theoretically possible* of having positive externalities of the project that might have impacted on non-farm incomes, and thus that there might be an unexpected systemic effect affecting the DAFEP sample because of the DAFEP.

Welfare impact

4.10 Three indicators are used as proxies for DAFEP impact assessment on welfare: yearly expenses per capita (YEC), assets value per capita (AVC) and share of food expenses per capita in total consumption expenses (SFC). As indicated earlier, the first one is equivalent to the total net income of all households, including households without agricultural income. It reflects the level of instant wealth in the household (amount of money circulating) while the second one reflects the state of more permanent wealth. Both are expressed in constant Rp/cap with 2006 values deflated by the increase in consumer price index.[12] The third one represents the relative importance of the budget needed by the household to fulfil the basic food needs of its members. It is calculated as a ratio between the amount of monetary expenses allocated for the purchase of food and the total budget

[12] As the sample is not spatial and represent a population spread over nine provinces, a uniform deflator was applied based on the evolution of the national price consumer index from July 2001 to July 2006 from the Indonesian Central Bureau of Statistics. The deflator is 58,06%.

of routine consumption (including housing, clothing, education, etc.)[13]. The general trend observed everywhere in the world is that the less the share, the wealthier the household.

Results of Before/After analysis

Table 4.4. Before/After comparison of welfare indicators

Sample	*Condition*	*YEC*	*AVC*	*SFC*
DAFEP	*Before*	1,139,661	3,846,761	48.81%
	After	1,588,995	4,983,783	42.90%
	Difference	**449,334**[s]	**1,801,296**[s]	**-5.91%**[s]
		39,4%	46,8%	13,8%
Reference	*Before*	1,229,715	4,347,160	50.12%
	After	1,587,028	5,232,200	43.57%
	Difference	**357,313**[s]	504,786[ns]	**-6.55%**[s]
		29,0%	11,6%	12,8%

Interpretation

4.11 The difference between Before and After for the three welfare indicator for all samples is significant. The result for YEC indicates that DAFEP households have seen their income increase by at least 10% more than the non DAFEP samples. They show also a 30% increase in assets per capita compared to the Reference sample. The changes in food expenses share to consumption expenses (-5%) are similar in all samples.

[13] In this calculation, rice produced and consumed by the household is not included since the objective is not to measure absolute but relative changes. It is assumed that the Dafep and the Reference samples do not differ significantly on rice self consumption. In the Benchmark survey, the average self sufficiency rate per household was 43 weeks for both Dafep and Reference samples. In the EoP this rate is 30 weeks also for both samples. Thus, the assumption is valid.

Results of DAFEP/Reference comparison

Table 4.5. Significance analysis of welfare indicators (DAFEP vs Reference)

Variable	Condition	Test Result	Output
YEC	*Before*	*Significant*	*DAFEP < REF*
	After	Not Significant	
	Change	**Significant**	**DAFEP > REF**
AVC	Before	Not Significant	
	After	Not Significant	
	Change	**Significant**	**DAFEP > REF**
SFE	Before	Not Significant	
	After	Not Significant	
	Change	Not Significant	

Interpretation

4.12 The expenditures in the DAFEP sample were significantly lower before the project started, a result that is consistent with the observation of DAFEP and Reference income situation before the beginning of the project (see Table 4.1). There are no significant changes in households' shares of food expenses between samples. Table 4.5 indicates that DAFEP households experienced a significantly higher change in the improvement of their welfare situation based on yearly expenses and asset value per capita. As YEC is also a proxy to household total net income, it indicates that a positive association can be made between the fact that the households belonged to the DAFEP project and an increase in their income and global wealth. This phenomenon however, is not independent from the results related to non farm income (NFIC).

Welfare distribution analysis

4.13 In addition to the analysis of changes related to individual household welfare level, the potential impact of the project on equity through the measurement of wealth distribution (consumption per capita and assets per capita) was also computed within each sample. The shape of data distribution (that is, to what extent the distribution differs from a normal -Gaussian- shape) is characterized with several indicators reflecting asymmetric distribution and/or inequalities such as Skewness, Kurtosis, and Gini coefficients. The changes in the distribution indicators are thus compared between samples so as to identify whether the DAFEP sample significantly differs from the Reference sample.

Table 4.6. Before/After comparison of welfare distribution

	Skewness		Kurtosis		Gini Coefficient	
	Before	After	Before	After	Before	After
YEC						
DAFEP	1.68	**0.95 s**	2.83	**0.10 s**	0.37	0.36 ns
Reference	1.48	1.00 s	2.13	0.19 s	0.36	0.36 ns
AVC						
DAFEP	2.39	**6.23 s***	7.61	**59.57 s***	0.50	**0.58 s**
Reference	3.39	**2.89 s***	16.69	12.34 ns	0.60	0.53 ns

Note : s means significant at 10%*

Interpretation

4.14 In both samples, the Skewness and Kurtosis of YEC decreased. This means that the shape of the curve representing the distribution of expenses tends to get closer to a Gaussian shape with a flatter form. It indicates an overall reduction of inequalities in expenses per capita. This result is confirmed by a slightly decreasing Gini coefficient in all samples. However, the test between DAFEP and Reference samples indicates that none of these changes is significant.

4.15 However, assets per capita shows a reverse trend for the DAFEP sample, the distribution becoming more unequal as both Skewness and Kurtosis increase, a fact confirmed by an important increase in the Gini coefficient. The Reference sample shows an opposite trend with an important drop in Skewness and Kurtosis as well as Gini coefficient. The tests indicate that this change is significant between DAFEP and Reference samples.

Productivity and technology cluster

4.16 The project was expected to generate a 5% increase in productivity of the main farming systems by EoP in the villages. While not detailed, the concept of productivity seemed then to refer to land productivity, i.e. the volume of agricultural output as measured in units per hectare. Participating farmers were also expected to adopt new/improved farming practices introduced by DAFEP extension workers.

Productivity Impact

4.17 Land productivity as described above could not be directly measured since it would require a compound of various crops and it is impossible to mix tons of paddy with number of coconuts. Therefore, two proxies were used to measure the impact of DAFEP on this issue. The first one is an aggregate indicator, the gross value of all harvested crops divided by the total area of cropped land (HCHA). The second one is a specific indicator (the yield) for each of the main crops that is then analysed at plot level (xYLD)[14]. However, this indicator cannot fully represent productivity changes since not all crops could be analysed for statistical reasons[15].

[14] *x* is to be replaced by the name of the corresponding crop.

[15] Number of plots varies and the minimum number of required observations depends on the observed standard deviation of the Yield variable. The crops where the number of plots meets statistical requirement are rice, maize, and soybean.

Results of Before/After analysis

Table 4.7. Before/After comparison of productivity indicators

Sample	Condition	HCHA	RiceYLD	MaizeYLD	SoybeanYLD
DAFEP	*Before*	10,547,283	3,587	2,247	1,074
	After	11,416,023	3,565	2,400	1,831
	Difference[16]	868,740^{ns}	(22)^{ns}	152^{ns}	757^{s}
		8%	*(1%)*	*6.8%*	*70%*
Reference	*Before*	9,007,712	3,680	2,095	785
	After	9,052,828	3,684	2,127	813
	Difference	45,116^{ns}	4^{ns}	33^{ns}	28^{ns}
		0%	*1%*	*2%*	*4%*

Interpretation

4.18 There is no significant change in the total value of agricultural production when comparing *Before* and *After* situation in DAFEP and Reference samples. Rice yields have remained unchanged in all samples and changes in maize yields are not significant. Only in the case of soybean a significant change can be observed in the DAFEP sample. However, this result is based on a smaller number of observations and the sensitivity of the crop to local climatic conditions is high.

[16] Alternative calculation taking into consideration the variation in the number of respondents between Before and After sample have also been made. Significance of results is fully identical, therefore the simple difference, easier to understand is used here. This applies to all indicators using per capita unit.

Table 4.8. Significance analysis of productivity indicators (DAFEP vs Reference)

Variable	Condition	Test Result	Output
HCHA	Before	*Significant*	*DAFEP > REF*
	After	*Significant*	*DAFEP > REF*
	Change	Not Significant	
RiceYLD	Before	Not significant	
	After	Not significant	
	Change	Not significant	
MaizeYLD	Before	Not significant	
	After	*Significant*	*DAFEP > REF*
	Change	Not significant	
SoybeanYLD	Before	Not significant	
	After	*Significant*	*DAFEP > REF*
	Change	**Significant**	**DAFEP > REF**

Interpretation

4.19 Households in the DAFEP sample show a significant difference for the total value of gross harvest in the Before and After conditions compared to the Reference sample, however the rate of changes observed between the two periods is not significantly different. DAFEP households achieved an 8% agricultural growth. The only significant difference in yield changes is observed for soybean where households in the DAFEP sample improved much more than in the Reference sample.

Technology Impact

4.20 The measurement of the adoption rate of new technologies by farmers was not included in the methodology. The effect of DAFEP on technological change and on change in production systems is also quite difficult to measure since new/improved farming practices introduced by extension workers are location-specific and thus vary widely from one place to another. Four proxy indicators were identified whose combination can be reasonably considered an appropriate measurement of these changes. The first one is the total value of input per hectare (TVIHA). It is sought to reflect a higher intensity in cropping patterns and therefore through DAFEP/Reference comparison the impact of the extension services in terms of intensification. While this proxy could be disputable in developed countries where modern and already capital intensive agriculture is seeking to become more effective by reducing input use, it is still considered relevant for the case of Indonesia given the current low level of input use by households. The second indicator is an input/output ratio measured in monetary value (IOR) for rice, maize and soybeans. Thus, a lower ratio means higher input efficiency.

[17] DAFEP targets were specified as a given percentage of farmers per village. Data collection would have required a representative sampling at village level for each project village resulting in a very high survey cost.

4.21 Changes in production systems are estimated through a diversification index (DI) and the calculation of trade income per hectare (TIHA). The former is simply obtained by counting the number of different crops grown by households in the sample, whatever the number of respondents growing the crops. The latter indicates an orientation towards more commercial agriculture and is therefore an indirect measurement of the capacity of the extension system to be more agri-business oriented[18]. When associated with a higher diversification index at sample level, it would be acceptable to consider that it helps measure an evolution of production systems. TIHA was calculated using the method indicated for computing CNIHA.

Results of Before/After analysis

Table 4.9. Before/After comparison of technology indicators

Sample	Condition	TVIHA	IORrice*	IORmz*	IORsbn	Ncrop	TIHA
DAFEP	*Before*	1,100,887	34.3%	33.5%	55.59%	20	8,034,896
	After	1,419,359	28.5%	27.9%	31.26%	21	7,795,273
	Difference	318,472^{ns}	**(5.9%)^{s}**	(5.6%)^{ns}	**(24.3%)^{s}**	1	(239,622)^{ns}
		28.9%	*17.2%*	*16.7%*	*43.7%*		*(3.0%)*
Reference	*Before*	909,305	32.48%	14.73%	43.71%	19	6,954,288
	After	1,146,299	31.0%	20.08%	23.76%	20	7,227,059
	Difference	236,994^{ns}	(1.4%)^{ns}	(5.3%)^{ns}	**(19.9%)^{s}**	1	272,771
		26.1%	*(4.3%)*	*(35.6%)*	*(45.5%)*		*(3.9%)*^{ns}

Note: TVIHA difference for DAFEP and Reference is significant at 10% level.

Interpretation

4.22 TVIHA shows that households' inputs use increased in both samples in constant value. For IOR, changes are significant for rice in the DAFEP sample and for soybean in both samples. Diversification as measured by the total number of different crops grown does not change. The diminution in the value of trade income per hectare affects both DAFEP and Reference samples.

[18] As indicated in the Immediate Objectives in Appendix 2, DAFEP PIP Annexes.

Table 4.10. Significance analysis of productivity indicators (DAFEP vs Reference)

Variable	Condition	Test Result	Output
TVIHA	*Before*	*Significant*	*DAFEP > REF*
	After	Not Significant	
	Change	Not Significant	
IORrice	Before	Not Significant	
	After	Not Significant	
	Change	**Significant**	**DAFEP > REF**
IORmz	*Before*	*Significant*	*DAFEP > REF*
	After	Not Significant	
	Change	Not Significant	
IORsbn	*Before*	*Significant*	*DAFEP > REF*
	After	Not Significant	
	Change	Not Significant	
TIHA	*Before*	*Significant*	*DAFEP > REF*
	After	Not Significant	
	Change	Not Significant	

Interpretation

4.23 Changes in the total value of input used per hectare are not significant between DAFEP and Reference. The project cannot be associated in a significant way, given the testing methods, with an intensification process that could bear witness of a technological change. However, the magnitude of changes that took place in input efficiency between DAFEP and Reference is tested significant for rice. In the DAFEP sample, households traded a larger amount of products before and after the project compared to the Reference sample but the impact of the project on trade income per hectare is not tested significant.

Qualitative assessment results

4.24 This section briefly summarizes the results of the assessment of qualitative indicators. As indicated earlier, these are grouped into four clusters so as to provide a more comprehensive approach. These clusters correspond respectively to extension, links, empowerment and awareness and are composed of nominal and ordinal variables. The following section presents the results of the extension and links cluster only.

Extension cluster

4.25 This first cluster of qualitative indicators directly refers to this issue through a series of six variables that have been designed to assess the impact of DAFEP on access to information. These are five ordinal indicators: availability of agriculture information (AAI), willingness to pay for agriculture information (WPAY), accessibility to extension workers (AEW), extension meeting frequency (EMF) and improvement in access to agricultural information (IAAI), and two nominal indicators: the best sources of agriculture information (SAI), and extension methods applied (EMA). The ordinal variables are combined into a single indicator reflecting general access to extension services (GAES).

Comparing the Before and After situation in the samples

Table 4.11. Before/After comparison within each sample for ordinal extension indicators

Sample	Level	AAI	WPAY	AEW	EMF	IAAI	GAES
DAFEP- Household	5%	+ S	+ NS	+ S	- S	+ NS	+ S
	10%	+ S	+ NS	+ S	- S	+ NS	+ S
Reference - Household	5%	+ NS	+ NS	+ S	- S	- S	+ S
	10%	+ S	+ NS	+ S	- S	- S	+ S

Interpretation

4.26 Households have better accessibility to agricultural information (AAI), but they don't show any change in the willingness to pay for agricultural information although there is positive trend in this attribute (WPAY). Accessibility to extension worker increases significantly in all samples, but paradoxically there is a significant negative change in extension meeting frequency. Improvement in the availability of agricultural information is rated as positive and non significant for the DAFEP respondents and positive and significant for the Reference sample. Altogether changes are positive and significant for all household samples. However, chi-square tests applied to GAES indicates that the degree of these changes altogether is not significant.

[illegible] of Information and Extension Methods

Table 4.12. Before/After comparison of the best sources of information

SAI	DAFEP- Household			Reference- Household		
	Before	After	Sig.	Before	After	Sig.
No knowledge	1.9%	1.4%	-ns	3.8%	1.8%	-s
Other farmers	**14.6%**	**27.0%**	+s	**15.9%**	**30.5%**	+s
Farmer trainer	10.50%	3.5%	-ns	11.3%	3.9%	-s
Village leader	6.41%	9.9%	+s	6.0%	8.0%	+s
Farmer groups	**19.24%**	**13.7%**	-s	18.8%	16.4%	-ns
Extension workers	**35.42%**	**29.4%**	-s	**33.3%**	**25.7%**	-s
Traditional market	1.60%	2.8%	+ns	1.0%	1.3%	-ns
Sellers/distributors	**0.44%**	**2.2%**	+s	0.9%	1.9%	+ns
Social organizations	0.87%	1.5%	+ns	0.9%	1.0%	+ns
Traders	1.02%	1.39%	+ns	1.21%	1.13%	-ns
TV/radio	5.83%	3.55%	-s	5.14%	4.66%	-ns
Newspapers	1.46%	1.08%	-ns	0.45%	1.29%	+ns
Poster	0.58%	0.15%	-ns	0.15%	0.16%	+ns
Other	0.15%	2.32%	+s	0.15%	2.25%	+s

Interpretation

4.27 Households had been given the possibility to choose two best sources of information from a list of more than 10.[19] Significance tests highlight a shift in the sources of agricultural information from extension workers and farmer groups to other farmers. Here, "other farmers" refer to farmers with no specific position as "official" sources of information (as opposed to contact farmers, group leaders). Significance tests highlight a shift in the sources of agricultural information from extension workers and farmer groups to other farmers. This result is difficult to interpret. On one hand, one might say that extension workers were less important as best source of information, but on the other hand, it could be argued that extension workers were successful in linking farmers with other farmers, the latter becoming their best source of information. However, since the results are highly similar in all samples, it is hardly likely that the project had an effect on this trend.

[19] This list was not given to the farmers so as not to influence them and make them choose the answers that they thought would please the enumerator. However, in the Benchmark survey enumerators had read the list to the household members at the time they discussed the topics, introducing thus a bias in the frequency of people unable to provide an answer, which explain the difference between Before and After on this point. This applies also for the next EMA nominal indicator.

Table 4.13. Before/After comparison of extension methods implemented household samples

EMA	DAFEP- household			References- household		
	Before	After	Sig.	Before	After	Sig.
No knowledge	**1.2%**	**15.7%**	**+s**	**3.8%**	**21.1%**	**+s**
PPL visits	**21.5%**	**17.9%**	**-s**	**21.5%**	**18.0%**	**-s**
Small meetings	**23.5%**	**13.5%**	**-s**	**18.2%**	**16.1%**	**-s**
Big meetings	**16.0%**	**14.0%**	**-s**	**17.2%**	**9.9%**	**-s**
Farmer teacher	3.7%	3.6%	-ns	**4.1%**	**2.5%**	**-s**
Internship	1.5%	0.2%	-s	0.9%	0.2%	-ns
Demplot	**12.0%**	**21.5%**	**+s**	14.4%	19.8%	+ns
Evaluation meetings	1.2%	0.9%	-ns	1.3%	0.8%	-ns
Radio Broadcast	0.0%	0.0%	+ns	0.5%	0.4%	-ns
TV Broadcast	0.0%	0.5%	+ns	0.3%	0.4%	+ns
Newspappers	0.0%	0.0%	+ns	0.0%	0.0%	+ns
Field study	4.0%	4.2%	+ns	2.8%	1.6%	-s
Meeting private ind.	0.6%	0.2%	-ns	0.3%	0.6%	+ns
Meeting researchers	1.0%	0.4%	-ns	1.3%	1.0%	-ns
Courses/exercises	4.9%	5.1%	+ns	2.4%	4.7%	+ns
Others	8.8%	2.4%	-s	10.9%	2.7%	-s

Interpretation

4.28 The results show that in the household samples meetings with the PPL (field extension workers) were less frequent than in the Benchmark survey. Conversely, demonstration plots increased significantly in DAFEP and not in Reference. While the first results could be interpreted as the reduction of extension presence at village level, it could also be considered as a higher efficiency of extension activities, since less meetings and visits are accompanied with more hands-on field activities in the DAFEP sample.

The Links cluster

4.29 This cluster relates to the expected effect of DAFEP on changes in farmers knowledge, attitudes and skills. The cluster here focuses on the links between farmers and their upstream and downstream agricultural environment. The cluster includes five ordinal variables: accessibility of input markets (AIM), accessibility of agriculture input information (AAII), joint purchase of agriculture input (JPAI), accessibility of output markets (AOM), and joint marketing of agricultural outputs (JMAO). One nominal variable is also related to this cluster, sources of capital (SC). These variables are combined into a single indicator reflecting the improvement in upstream and downstream links (IUDI).

Table 4.14 Before/After comparison within each sample for ordinal links indicators

Sample	Level	AIM	AAII	JPAI	AOM	JMAO	IUDI
DAFEP- Household	5%	+ S	+ NS	- NS	+ NS	- NS	+ S
	10%	+ S	+ NS	- S	+ NS	- NS	+ S
Reference - Household	5%	+ S	+ NS	- NS	+ NS	- S	+ S
	10%	+ S	+ NS	- S	+ NS	- S	+ S

Interpretation

4.30 All households have a significantly better accessibility (fewer barriers) to input market in general. Although there is no significant change in accessibility to input information, there is a positive trend. Joint purchasing of inputs has not experienced a significant change, and the tendency is negative. There are no significant changes in the access to alternative output markets, although again the tendency is positive. Again, there is no significant change in joint marketing of agricultural commodities, and the negative tendency is similar to the joint purchased of inputs. The composite indicator (IUDI) resulting for the computation of the former ones shows a significant positive change in overall links upstream and downstream agriculture for all households samples.

Cross comparison DAFEP versus Reference

4.31 Chi-square tests indicate that for JPAI and JMAO there is a significant difference between DAFEP and Reference. For JPAI, the Reference sample shows a significantly higher positive change compared to DAFEP (that is more joint purchase of input). Conversely, DAFEP sample shows a significantly higher positive change in joint marketing of agricultural products. For all other indicators, including the composite indicator IUDI, there is no significant difference.

Nominal variables analysis: Source of Capital

Table 4.15. Before/After comparison of the sources of capital for the farmer sample

SC	DAFEP-household			Reference-household		
	Before	After	Sig.	Before	After	Sig.
Individual	49.7%	91.0%	+s	49.0%	93.0%	+s
Close Relative	32.1%	4.6%	-s	28.4%	4.6%	-s
Lenders	18.2%	4.3%	-s	22.6%	2.3%	-s

Interpretation

4.32 All samples follow a similar pattern with similar magnitudes showing a decrease in the share of external sources of capital in favour of own capital. This trend can be associated with the increase in total income at household level, in particular with non farm income.

Synthesis of the results

4.33 The following tables provide a synthesis of the results. Highlighted in **Bold case** are indicators where changes occurred between Before and After situations, where there is a significant difference between DAFEP and Reference and where this difference favours the DAFEP sample. Indicators in ***Italic Bold case*** correspond to situations where the difference favours the Reference sample. When indicators are not highlighted, either there is no change in the *Before* and *After* situation, or that these changes are not significant when comparing DAFEP and Reference samples.

4.34 The table shows that most significant changes occurred in the Income and Welfare cluster of indicators, **DAFEP households showing a significant improvement in their overall welfare situation compared to the Reference sample** (positive changes in yearly expenditures that are a proxy of total net income for all households and in non farm income and assets per capita). The project thus succeeded in increasing households' income by 5% as targeted at the beginning of the project, (in constant terms). DAFEP households also performed better in agricultural income per capita, though the difference in the *After* and *Before* situation is negative for all samples.

4.35 However, the analysis of the technology and productivity cluster shows that significant changes in favour of DAFEP households are rare. They relate to only three indicators: soybean yield and input use ratio in rice and soybean cultivation. Altogether the direct impact of DAFEP on technology and productivity indicators has been limited. In particular, there are no significant changes in the yields of rice, the major and most common crop grown in the samples and in net income from trade.

4.36 In relation with qualitative indicators, this impact evaluation study shows that, based on the statistical approach used, - sampling, conception of the questionnaire, data collection, data analysis and significance tests-, the project seemed to have not very much changed the target group as far as attitudes, skills and practices related to extension are concerned. Indeed, while positive changes have occurred in this field between the Benchmark survey and the EoP survey, they cannot be specifically considered as an impact of the project.

Table 4.16. Presentation of significance results for DAFEP performance indicators (at 5% level): Cluster of Income and Welfare indicators

	Significance	
	Before/After*	DAFEP vs Reference**
Total Net Income per capita (Rp) farming households	**Yes +**	**Yes DAFEP**[20]
Agricultural Net Income per Capita (Rp)	**Yes -**	**Yes DAFEP**
Crop Net Income per Hectare (Rp/Ha)	No	No
Agriculture Related Net Income per Capita (Rp)	***Yes +***	***Yes Reference***
Agribusiness Net Income per Capita (Rp)	***Yes +***	***Yes Reference***
Non Farm Net Income per Capita (Rp)	**Yes +**	**Yes DAFEP**
Total Yearly Expenses per capita (Rp) all households	**Yes +**	**Yes DAFEP**
Total Asset Value per capita (Rp)	**Yes +**	**Yes DAFEP**
Share of food expenses (%)	**Yes +**	No

*Notes : * The + or – sign indicates the sense of the change (better or worse)*
*** The name of the sample (DAFEP or Reference) indicates which one shows a better performance*
**** Nominal indicator, no test of significance, but changes in all samples follow a similar trend.*

Table 4.17. Presentation of significance results for DAFEP performance indicators: Cluster of Technology and productivity related indicators

	Significance	
	Before/After*	DAFEP vs Reference**
Gross crop value per hectare (Rp/ha)	No	No
Rice Yield (t/ha)	No	No
Maize Yield (t/ha)	No	No
Soybean Yield (t/ha)	**Yes***	**Yes DAFEP**
Coconut Yield (t/ha)	No	No
Total value of input per hectare (Rp/ha)	No	No
Input/output ratio rice (%)	**No**	**Yes DAFEP**
Input/output ratio maize (%)	No	No
Input/output ratio soybean (%)	**Yes +**	**Yes DAFEP**
Diversification index (number)	No	No
Trade income per hectare (Rp/ha)	No	No

*Notes : * The + or – sign indicates the sense of the change (better or worse)*
*** The name of the sample (DAFEP or Reference) indicates which one shows a better performance*
**** Nominal indicator, no test of significance, but changes in all samples follow a similar trend.*

[20] At 10% level

Table 4.18. Presentation of significance results for DAFEP performance indicators: Cluster of Extension related indicators

	Significance	
	Before/After*	DAFEP vs Reference**
Extension methods implemented	Yes	No***
Sources of agriculture information	Yes	No***
Access to agriculture information	Yes +	No
Willingness to pay for agriculture information	No	No
Access to extension workers	Yes +	No
Extension meeting frequency	Yes -	No
Improvement in access to agricultural information	Yes +	No
General access to extension services	Yes +	No

*Notes : * The + or – sign indicates the sense of the change (better or worse)*
*** The name of the sample (DAFEP or Reference) indicates which one shows a better performance*
**** Nominal indicator, no test of significance, but changes in all samples follow a similar trend.*

Table 4.19 Presentation of significance results for DAFEP performance indicators Cluster of Links Related Indicators

	Significance	
	Before/After*	DAFEP vs Reference**
Accessibility of input markets	Yes +	No
Accessibility of agriculture input information	No	No
Joint purchase of agriculture input	***No***	***Yes Reference***
Accessibility of output markets	**No**	**Yes DAFEP**
Joint marketing of agricultural outputs	Yes - (Reference)	No
Sources of capital	Yes	No***
Improvement in upstream and downstream links	Yes +	No

*Notes : * The + or – sign indicates the sense of the change (better or worse)*
*** The name of the sample (DAFEP or Reference) indicates which one shows a better performance*
**** Nominal indicator, no test of significance, but changes in all samples follow a similar trend.*

The results from the multivariate analysis (see Annex 2) largely endorse the above findings.

4.37 Overall, the results indicate that DAFEP extension agents were judged as "not good" to "good enough" on important key factors such as being experienced, having suitable knowledge on new technologies, having knowledge/understanding of local conditions, etc. Furthermore the study showed that the main qualities that were expected from extension workers by farmers are "experience" and "technical knowledge". This still corresponds to the traditional approach of extension services as

the means for transfer of technology. Finally, according to the farmers, the benefit of joining farmer groups were mainly exchange on farming/cultivating techniques (30.3%) and exchange of village development (23.0%). The benefit of exchange on farming/cultivating techniques shows a significant decrease meanwhile other benefits have increased significantly. Unfortunately detailed data on the other benefits cannot be processed in a similar way. The conclusion is that there was no significant change of routines done by extension workers, the DAFEP activities did not result in something more ground-breaking such as joint marketing in groups or joint purchasing.

4.38 ***Weaknesses of the Impact Evaluation:*** Given the fact that the Farmer-Managed Activities (FMAs) - Component 1 - was a major institutional innovation piloted by the project, the design of the EOP survey did not specifically identify the beneficiaries of the FMAs and of its impacts. The households selected in the DAFEP sample are households who participated in DAFEP activities, but since not all households received grants for FMA, there is no perfect overlap between DAFEP membership and FMA. The DAFEP sample was a sample of households participating in DAFEP activities. Many of the households in the benchmark survey (carried out before the implementation of the FMA component in 2002) did not participate in the FMA activities. This limits the usefulness of the evaluation to a certain extent. The analysis may have been more useful had it targeted FMA grant recipients versus the rest - DAFEP (FMA recipients) Spillover (same village not FMA recipients) and the Reference (non-DAFEP, non-FMA similar villages). The funding of grants for addressing market failures in information was at the core of the project. The analysis unfortunately does not reveal whether this was a necessary part of the project or a desirable feature of future projects. Finally, the number of indicators (39) while attempting to be comprehensive perhaps could have been simplified to focus on key indicators that would have sufficed to demonstrate the impact of the project. Data quality and reliability are in general satisfactory (see Annex 1 for more details).

Assessment of Farmer-Managed Activities and Institutional Reforms[21]

5.1 A major weakness of the impact evaluation was that many of the households in the DAFEP sample did not participate in the farmer-managed activities (FMA) of component 1, the core institutional innovation of the project. Further, the impact of the institutional reforms at the district-level were also not addressed. This section draws from the data and analysis of the FAO team that was responsible for the preparation of the ICR.

5.2 Development of FMAs and action planning to village communities to assist in change from reactive to proactive farming was facilitated by participatory rural appraisal (PRA) techniques whereby farmers having common interests were involved in assessment and ranking of problems, potentials and alternative solutions. Various PRA techniques were evaluated in early phases and these were reduced to five to seven assessed by farmers to be the most useful. A supplementary PRA approach was specifically developed to cater for agro-forestry to focus on the community and its needs and identify potential benefits of trees.

5.3 The first cycle of FMAs was started in most districts in September 2002 with sub-district extension workers playing a leading role in their preparation. Understanding of extension staff, farmers and other stakeholders of DAFEP principles and concepts was poor. Farmer participation rates were low, planning processes were poorly understood and FMAs often had little relationship to better farm management or improved profitability of farm enterprises. Nevertheless, many of these early FMAs proved highly successful (Annex 4) thereby demonstrating to farmers what could be achieved. The second cycle of FMAs was again delayed (until late in 2003), as was the third cycle, which commenced

[21] This chapter draws from DAFEP supervision reports and the DAFEP Implementation Completion Report, Report No. 33582, November 2005.

in November 2004. Nevertheless, by 2005 most participating villages had enthusiastically adopted the DAFEP model of farmer-led learning. There had been a marked improvement in the quality of FMA submissions, associated family agro-business plans and village action plans. Most participating villages visited by the ICR team reported examples of high adoption rates following training and numerous examples of high returns to the training investment (Annex 3). Isolated examples were noted where elite groups appeared to have captured the FMA process for personal gain with limited flow-on to other village members. Participation of women has increased dramatically under DAFEP at all levels from farm budgeting, planning, income generating activities to village decision making through UPKGs and representation on DECs.

5.4 From the Impact evaluation however, there were also complaints that the Farmer Managed Activities (FMA) activities did not allow for the acquisition of physical items directly related to agricultural production such as inputs, tools and equipment, credit/revolving funds. Building or rehabilitation of farm infrastructure was prohibited too. The philosophy behind the FMAs was that farmers participation in extension activities would be funded. Purchasing of inputs and equipment was authorised provided these would be used exclusively for extension purpose. Other types of activities included the funding of studies by farmers, exhibitions, visits to other areas, farmer field schools, demonstration plots, etc. Many participants expressed regret that the project did not supply them directly with credit, equipment or inputs for agricultural production.

Institutional Reforms:

5.5 The establishment of the Rural Extension and Information Centers at district (Balai Informasi dan Penyuluhan Pertanian BIPP) and sub-district (Balai Penyuluhan Pertanian BPP) levels were meant to consolidate extension programs and staff of isolated district agricultural service units for provision of sub-sector advice (food crops, estate crops, livestock, fisheries, and forestry). DAFEP aimed to strengthen this process by facilitating team-building within and between sectors and encouraging staff to develop an integrated extension program using farming systems approaches including agro-forestry.

5.6 At district level, the institutionalization of integrated extension services remains tenuous. Some districts, recognizing potential benefits from farmer-led approaches to extension using the DAFEP model, have supported integrated extension centers through guaranteed on-going finances and Bupati decree. In districts where decentralized, farmer-led extension is working well, and benefits accruing from application of DAFEP principles are recognized, there has been strong support from the head of the district (Bupati) and district parliaments in institutionalization of BIPP's (e.g. Magelang district Central Java and Maros District in South Sulawesi). Where there was strong support for DAFEP, funding has also been provided for expansion of DAFEP concepts to other districts (e.g. in Maros district Rp 800 m for expansion to an additional 20 villages during 2005). Elsewhere support is weaker and in some cases BIPPs have either been abolished (Banyumas, Kotabaru, Tanah Laut, Timor Tengah Selatan Districts), or their echelon level downgraded in effect restricting the career path and status of extension staff. In many cases BIPPs/KIPPs are seen simply as cost centers and their potential contribution to poverty alleviation is not recognized.

5.7 District Extension Committees (DECs) were established by Bupati decree in the participating districts to provide district level policy support for farmer-led extension, facilitate flows of information to meet farmer demands, assist in building linkages between farmer groups with NGOs, Universities and Industry. As such, the DEC was envisaged as potentially playing a pivotal role in achievement of DAFEP objectives. While their objectives rely on committee members representing

all influential sub-sectors (Government, NGO, Research Institutes, Farmers, Agro-business, etc.), most DECs remained dominated by Government through an over-representation (usually 50 % or more) or perceived authority of Government members, and as yet have largely failed to realize their potential. DECs have not received information from BIPP/KIPPs on actual benefits accrued from implementation of DAFEP at farmer level except for verbal reports and, where DEC is active (e.g. Magelang district), members have assessed impacts of FMAs for themselves through farm visits. This information failure significantly reduced the effectiveness of DECs in fulfilling their roles such as establishing priorities for extension effort. Further external support and clearer definition of roles and responsibilities for both BIPPs and DECs is essential to consolidate progress so far.

5.8 Farmers and NGOs however were enthusiastic about the DECs: NGOs because of the information forum it provides to focus and refine their district programs and farmers because, often for the first time, they have direct access to decision-makers. On the other hand, DEC meetings have often dealt with inconsequential issues and failed to engage decision-makers who are often represented by staff members with no end-of-line authority. There are examples of how DECs have facilitated engagement of research institutions in partnerships with farmers to solve issue-specific topics however, it will take time before these committees mature and begin to tackle long-term, industry-wide or whole farming systems approaches to improving productivity. Partnerships with industry initiated through DECs have also begun to show benefit. For example, farmers have been able to negotiate a direct marketing agreement for rice produced throughout the Gowa district whereby they now receive 20% more for their product. But overall, institutional development impact has been modest at best.

5.9 DAFEP's principles of integrated, farmer-led extension based on establishing public-private partnerships have been enthusiastically accepted by many front-line extension workers. Such change requires extension workers trained in new extension methodologies of facilitation, participative processes, media etc. These extension workers require a whole systems approach to agriculture including business management and marketing. They are not technical specialists but generalists, and their role is one of facilitating technology transfer rather than providing this themselves. Under the DAFEP model, technical expertise in specialist fields is provided by agro-business, research institutions and relevant Dinas, facilitated by DEC. Management at the district level has yet to understand and put these principles into practice. Outside of DAFEP, training for extension workers continues to focus on acquisition of technical skills and not new extension methodologies.

Concluding Discussion and Emerging Issues

6.1 Overall, the report card of DAFEP is mixed. While on the one hand, the project succeeded in improving farmer welfare, the impact on productivity and technological change was limited. Nonetheless, the lessons learned from DAFEP have important implications for the future of agricultural service delivery in Indonesia in the context of the broader structural transformation that is already underway. This chapter discusses some of the emerging issues.

Diversification and Rural Productivity

6.2 Perhaps the most striking result from the DAFEP impact evaluation is the secular increase in non-farm incomes across the board. This is a clear indication that diversified farming will be the solution for farmers whose scale of operations or land quality does not enable them to support a family from rice farming income alone. Between 2001 and 2006, there was further fragmentation in the landholdings with the average area/household declining from 1.48 hectares to 1.32 hectares. Rice areas also shrunk from 64 percent of total cropped area to 56 percent. There was a dramatic increase in the cultivation of chillies across all samples. This also confirms broader trends in the economy. The most rapidly growing type of farming is horticulture, with horticulture farmers nearly doubling between 1993 and 2003 to 38 percent of all farm households (2003 Agriculture Census). Rapid urbanization and income growth is fueling changes in food consumption which increased by 8 percent (per capita, real) over 1996-2002. (Susenas, 2005). This consisted almost entirely of growth in high-value food consumption while per capita consumption of low-value grains and tubers actually declined (Susenas, 2005). Even rural households remaining primarily engaged in agriculture can be expected to continue to rely on diversified income from other labor and business sources (because of small land holdings); these already account for half of rural household incomes nationally (PATENAS).

6.3 Diversification means switching to higher-valued crops, livestock and fish production in response to new types of consumer demand. Small farmers will need technical assistance from either the public or private sector if they are to respond successfully to these new market opportunities. However, with the recent steep increase in rice prices[22], the Government is taking important steps in several areas to boost productivity in the agricultural area notably the promotion of hybrid seeds, irrigation investments etc. However, current policies still fail to address the structural problems which inhibit productivity growth in the sector. In particular, public expenditures are still currently biased towards subsidies (on fertilizer, seed and credit) despite evidence suggesting that these subsidies have very limited impact on production or productivity.

Strengthening Farmer Organization

6.4 Farmer associations/rural producers organizations (RPOs) in Indonesia are still considerably weak. During the 32 years of "New Order" era (1966-98), Government policies called for a total control of the State over all the functions that could have been performed by RPOs which inhibited the rise of genuine and independent RPOs. Official organizations such as HKTI (Association of Indonesian Farmers Groups and Fishermen Groups), the KTNA (National representative of the farmer, the "best farmers" are the members), and the village cooperatives (KUDs) were the only ones permitted to operate under the aegis of the state. While there was some success from these state-sponsored groups in supporting the rice intensification package in some irrigated areas, the numerous cases of malfeasance and negative environmental impacts (decreasing soil fertility, increasing pests) resulted in a general distrust of farmers towards all forms of State intervention in organizational development. Yet experience from other countries indicate that strong RPOs can be a key asset for agricultural development. However, due to the unpleasant recent history, the development of genuine farmers' organizations is still a slow process and RPOs in Indonesia are still on need of a firm basis on which to establish their growth (Roesch et al, 2002).

6.5 With support from DAFEP, the Village Extension Management Unit (Unit Pengelola Kegiatan Gabungan – UPKG) received an annual grant (FMA grant) to finance extension activities identified by a group of farmers and approved by the District Extension Committee. The UPKG scheme is an embryo of a village farmer organization/association and through this farmer groups developed project proposals to receive training to start up or improve their farming activities (for example fish growing, duck rising, biological coffee, corn, vanilla, bee-keeping etc.). There is a need however to clearly separate the role of UPKG which is a farmer village committee (UPKG selects project proposals) from the role of producer groups who prepare and implement projects. The UPKG/FMA scheme can be improved and systematized as an effective way to facilitate small farmers' access to technology and markets. UPKG leaders should be accountable to the farmers to ensure that UPKG is inclusive and not serving a few large or influential farmers as some of the evidence seems to suggest. The village-level producer groups need to be encouraged to federate at district and provincial levels. These federations could then engage in partnership activities with private enterprises and/ or extension and/or research institutions with appropriate technical assistance that keeps the government at arm's length. In addition to technical support, farmer associations/federations also need to receive organizational support to help them resolve inevitable organizational management

[22] Rice prices have increased by 110% since January 2004 – far faster than the general rate of inflation (32% over the same period). This large increase in the price was the main reason for the increase in poverty between 2005 and 2006 – the 37% increase in the rice price over the least year alone makes it likely that poverty will increase again in 2007. The main reason for the dramatic increase in prices is government policy. Although the fuel price rises in 2005 triggered high inflation, the increase in rice prices has been far higher than the increase in input costs for rice production. Moreover, world rice prices have been quite stable – Indonesian prices are now 73% above world prices. The main reason for the increase in prices is the rice import ban in place since January 2004 causing periodic but increasing shortages in supply as imports can not fill the gap. The effect has been particularly severe this year because of a moderate El Nino which has delayed planting and will delay the harvest. (World Bank, 2007, forthcoming)

difficulties which will arise when implementing their activities (issue of free riders, internal conflicts, accountability mechanisms to members and member organizations, transparency, participation etc.). While the approach has its danger in that farmer groups remain active only as long as a project provided subsidies or access to resources (Gary, Zijp, Byerlee, et al. 2002), there are other examples (Senegal, Colombia, Mali, Equador) where RPOs are increasingly partnering with research and extension agencies. With Indonesia moving towards a more pluralistic institutional arrangements for extension, building the capacity of RPOs and other service providers will be essential to empower users and expand the pool of qualified service providers.

Research-Extension Linkages

6.6 The institutional and management reforms (supported by the World Ban, WB and the Asian Development Bank, ADB) has helped IAARD to transform its organizational structure and institutional culture towards a demand-driven, "farmer first" strategy. The establishments of the 14[23] Assessment Institutes for Agricultural Technology (AIAT) to serve the regionalization of agricultural R&D has arguably been the most significant change in the National Agricultural Research System (NARS). While some progress has been made over the past 10 years, capacity remains generally weak and is substantially failing to deliver improved technologies and practices to farmers and agribusiness. Indonesia's agricultural research expenditure has declined dramatically since the early 1990s compared with its neighbors. Real expenditure on public agricultural research in 2000 was no greater in real terms than a decade earlier, and presently ranks Indonesia near the bottom compared with other Asian countries in terms of agricultural research spending relative to agricultural GDP. However, the separation of the research and extension functions within the organization of the MOA (between IAARD and AAHRD) has also militated against both ensuring focus on farmer's problems while setting the research agenda, and effective dissemination of research results which have till now, relied heavily on the use unidirectional 'technology transfer' approaches, supported by field extension methods such as demplots, as the primary farmer extension method over the past decade. The province-level BPTPs are the major adaptive R&D providers at this level, and they are being required to continue an evolution from being research organizations to technology assessment and knowledge transfer units.

6.7 Development of a more multidisciplinary/farming systems approach as piloted by DAFEP is needed to tackle identified real-world production issues that often span several segments of a value-chain, rather than the present situation where researchers usually work in disciplinary isolation, often producing research outcomes that address only part of the original problem and therefore have limited immediate application. The stagnant level of rice yields points to the need for research on how to increase yields without increasing costs – i.e., how to improve rice profitability- in the interests of both farmers incomes and stability of food prices. Nevertheless the fact that rice based indicators were not significantly different in DAFEP and reference groups is not surprising since the choice of enterprises for focus by farmers was open and incentives for rice have been poor. Donors (including the Bank) have also pursued separate projects under the research and extension agencies that has also contributed to the disconnect. Building on the lessons of DAFEP, the Bank's new Farmer Empowerment through Agricultural Technology and Information (FEATI) project, will for the first time combine research and extension in a more comprehensive approach) which responds to the above set of issues.

[23] 13 of which are fully functional today – Maluku having been burned down during sectarian violence in 1999.

6.8 DAFEP was predicated on the idea that lack of information was a binding constraint in farm incomes. The data on diversification and decline in rice areas shows that other factors were probably at least as important - for example agricultural prices, which would have been declining for rice during the implementation period. Secondly, the constraint of credit to apply any new ideas, particularly in Eastern Indonesia but also elsewhere owing to various access constraints in the banking system was a critical factor - the FMA grants did not increase access to implementation credit.

6.9 Evidence from the survey shows that extension workers are not the most important source of information and extension. This confirms other findings elsewhere (Faure and Kleene, 2004) stating that farmers learn more from others farmers than from external advisors. Projects like DAFEP intend to promote a paradigm change in the profile of effective extension workers. Technical skills become less important than communication skills, ability for facilitation, and a capacity for human relations. Commitment is also a key issue that is facilitated if the extension worker comes from the area, has rural roots, speak the local language. As a key issue is whether the farmers trust them and confide in their capacity, we should also make sure that the beneficiaries are involved in *"defining criteria for selection and quality standards (an expert is only an expert if s/he is recognised)" (Christoplos and Kidd 2000). Contemporary thinking on new extension roles emphasizes that the new extensionist will often need to be one-third management specialist, one-third communications specialist, and one-third technical specialist.* (Gary, Zijp, Byerlee, et al. 2002:26).

6.10 While DAFEP envisaged that information of interest to farmers would be disseminated through printed, visual and audio media, there is little evidence to indicate that this was successful. It was intended that a Farmers' Information and Technology Promotion Service (FITPS) be established at the district extension centers to improve farmers' access to information on technology, credit, markets and farmer network activities. However, the ICR notes that it was difficult to ascertain how demand for the material was identified and farmer groups have not rated it highly. Similarly, there has been little or no recognition of other services of FITPS.

6.11 ICTs as tools are still underutilized in extension services (Alex et al, 2004). The low capacity of rural information and communication technologies (ICT) development is widely acknowledged to be a barrier to increasing rural incomes and productivity in Indonesia. Rural communities need up-to-date information on sources, availability and costs of inputs for production, and also on the potential of different techniques and technologies used for production, processing and marketing. The information that is often most relevant to improving livelihoods is non-technical, including the role and responsibilities of different institutions in the provision of key services, such as agricultural extension, credit, health and education, and where to go and who to ask for more specific information. ICT offers an opportunity to make rapid progress. It is important that information is available in an appropriate format and language, and that rural communities have the capacity to access, analyze and act on it. With decentralization and the new political and institutional environment in Indonesia, there is an opportunity to use ICT to support the agricultural development agenda and to improve the delivery of agricultural services in innovative ways.

Future of Extension Services in a Decentralized Context

6.12 Extension faces a major challenge in Indonesia, similar to public sector extension systems in many countries that are seeking to advance structural, financial and managerial strategies to reform extension (see for example Rivera, 1991; Rivera and Gustafson, 1991; Rivera and Zijp, 2002). The

literature indicates that there is no one-size fits all even in the same country. However, the public sector continues to play an important role in coordination and poverty reduction objectives. Various extension approaches need to be considered and have to be flexible to accommodate changing policies, technologies and the needs of farmers. While there is a move towards a more pluralistic system of extension funders and service providers, the public sector still continues to play an important role. Private extension services will assume greater importance in the dry-land cash cropping sub-sector in eastern Indonesia. This is because exportable commodity production is being increasingly supported by the private sector. However, quality enhancement for service providers – public or private – continue to be a big gap in Indonesia and elsewhere (Alex et al, 2004).

6.13 National development priorities include improving extension, and an acknowledgment that new approaches will be required in the context of the changed institutional context of decentralized extension service delivery. However, evidence from DAFEP indicates that the commitment of local governments is key to improving extension service delivery. Local governments need to be assisted to take up applicable models as a part of: (i) moving from top-down to participatory approaches to extension subject matter prioritization and delivery; (ii) shifting the balance from input and technology dissemination to dissemination of market and upstream information and technology; and (iii) moving from centrally-managed extension services to decentralized services, and increase space for private delivery of extension services.

6.14 Participatory extension approaches such as those pioneered by DAFEP face their own challenges (Alex, et al 2004). These approaches require changes in the roles for extension workers – from messengers to facilitators – and changes in the way messages are transferred to farmers, organizational structures, facilities offered to local communities. While DAFEP was reasonably successful in some respects, the results of the qualitative analysis shows that it is quite a challenge to change the mental processes and working routines that extension workers have had for over two decades. In these routines, technology and production are the key words and the processes are invariably linear and top-down. Similarly, changing farmers' routine and expectations with regard to extension services is also challenging. Farmers too, for decades have lived with the custom of grouping in order to get funds and doing what the government tells them to do. Indonesia, as elsewhere, much learning is still needed on how to develop democratic procedures, inclusiveness, and linkages that integrate rural communities. The dramatic increase in the importance of non-farm incomes underscores the premise that *extension is being forced to embrace a broadened mandate [...] shifting from an "agricultural" to a "rural" focus in programs, recognizing that agricultural productivity may not always be the best way to improve peoples' livelihoods* (Alex, et al. 2002). The promise of participatory extension is that local people who have a sense of ownership in projects and activities learn to be independent through appropriate technical support. This independence and self-reliance is the ultimate purpose of promoting participation in extension development

ANNEX 1. Methodology and Indicators

1. Indicators

A list of 39 indicators was established in consultation with DAFEP PMU and World Bank staff. These indicators reflected the concern of the project designer to assess various (economic, social and technical) impacts the project was expected to have on the target group. As a result of the multidimensional function of the project, this list included quantitative and qualitative indicators divided into six clusters. The final list of indicators includes 15 quantitative indicators measuring income, welfare, productivity and technology changes and 30 qualitative indicators related to changes in extension, links, empowerment and awareness, as presented below.

Cluster of Income and Welfare indicators
- Total Net Income per capita (Rp)
- Agricultural Net Income per Capita (Rp)
- Crop Net Income per Hectare (Rp/Ha)
- Agriculture Related Net Income per Capita (Rp)
- Agribusiness Net Income per Capita (Rp)
- Non Farm Net Income per Capita (Rp)

Cluster of Welfare indicators (all indicators are in Rp/capita)
- Total Yearly Expenses per capita (Rp)
- Total Asset Value per capita (Rp)
- Share of food expenses in the household consumption budget (%)

Cluster of Productivity and Technology indicators
- Gross crop value per hectare (Rp/ha)
- Yield (t/ha) for rice, maize, soybean, and coconut
- Total value of input per hectare (Rp/ha)
- Input/output ratio (%)
- Diversification index (number)
- Trade income per hectare (Rp/ha)

Cluster of Extension related indicators[24]
- Availability of agriculture information (perception, ordinal)
- Willingness to pay for agriculture information (perception, ordinal)
- Accessibility of extension workers (perception, ordinal)
- Extension meeting frequency (factual, ordinal)
- Improvement in access to agricultural information (perception, ordinal)
- Sources of agriculture information (factual, nominal)
- Extension methods applied (factual, nominal)
- General access to extension services (composite, ordinal).

[24] 'Ordinal' refers to the possibility to rank the factors so that results can be measured with scores. 'Nominal' indicates that there are several options and results are expressed in a distributive form (share). 'Factual' relates to what the respondents do, or to what happened. 'Perception' relates to what the respondents think

Cluster of Links related indicators

- Accessibility of input markets (perception, ordinal)
- Accessibility of agriculture input information (perception, ordinal)
- Joint purchase of agriculture input (factual, ordinal)
- Accessibility of output markets (perception, ordinal)
- Joint marketing of agricultural outputs (factual, ordinal)
- Sources of capital (factual, nominal)
- Improvement in upstream and downstream links (composite, ordinal)

Cluster of Empowerment related indicators

- Participation in implementing development projects (factual, ordinal)
- Desire to participate in decision making (perception, ordinal)
- Group meeting frequencies (factual, ordinal)
- Interest in group activities (perception, ordinal)
- Participation in village joint activities (factual, nominal)
- Participation in village decision making (factual, nominal)
- Knowledge on decision making process at a village level (perception, nominal)
- Benefits from joining group activities (perception, nominal)
- Confidence to join decision making processes (composite, ordinal)

Cluster of Awareness related indicators

- Poor people's participation in extension activities (perception, ordinal)
- Willingness to contribute for poor people's participation in extension (perception, ordinal)
- Awareness of poor people (perception, nominal)
- Women's participation in extension activities (perception, ordinal)
- Willingness to contribute for women participation in extension (perception, ordinal)
- Women's role in agriculture (perception, nominal)

Table A.1 summarizes the sampling approach used for the DAFEP performance evaluation process and the number of respondent households in each sample and for the two surveys.

Sampling Methodology

The DAFEP sample

The choice of the appropriate sampling size was based on the decision to use income dispersion as the key variable whose variance was used for setting the sample size so that it is representative of the project population. With 30,000 households directly targeted by the project, and a 95% confidence, gave rise to a sample size of 370 randomly selected farmers. Due to possible "losses" throughout the project duration, the sample was increased to 450.

However, a full random selection of households among project participants was likely to yield a widely dispersed, and therefore cost wise unmanageable, sample. Thus, a two-step process was used without loosing the degree of confidence (Deaton, 1997). This process consisted in randomly drawing first a number of villages, and then similarly, a number of households in these villages. Based on calculations (Salant and Dillman, 1994) a draw of 30 villages and 15 households per village satisfied at the same time confidence level requirements, equal distribution of village (three villages per participating province x 10 provinces) and a 450 households sampling. The field selection of villages was based on the identification of districts and related sub-districts were the DAFEP was planned to be implemented, and to select sub-districts

that were the most representative of the district agro-ecological and socioeconomic conditions. 'Extreme' sub-district situations were first discarded based on meetings with local key respondents and consultation of local secondary data. Then, the sub-districts were randomly drawn. In each selected sub-district the process was repeated for the village selection, discarding 'extreme' villages. At village level, respondent households were randomly drawn using the list of registered DAFEP members. Replacement households were also drawn in case of impossibility to find the corresponding households in the first list.

The Reference sample

For the purpose of the "with and without" comparison, a Reference household sample of similar size and characteristics was selected with the same method in non-DAFEP districts. The process for selecting these households mirrored the process used for selecting DAFEP households. The main difference was that the choice of districts, sub-districts and villages was conditioned by their similarities to the districts, sub-districts and villages in the DAFEP sample. Then, at village level, respondent households were randomly selected from the list of village households, excluding households that were known to be completely non farm households (for instance, pure traders or civil servants without any farm activity, including activities of the spouse or dependents). With this process, differences between DAFEP and Reference households were minimized as external heterogeneity due to agro-ecological and socioeconomic conditions was sought to be reduced.

The Spillover sample

In addition, CIRAD proposed the addition of a Spillover sample, in order to estimate whether the project had also generated indirect effects in implementation areas. The Spillover sample was built as a mix of households not participating in DAFEP activities but located in areas where extension workers had been trained to, and expected to apply, the DAFEP approach. This sample included three different situations of non DAFEP households according to where they were located: a) in DAFEP villages, b) in non DAFEP villages but still in DAFEP sub-districts, and c) in non DAFEP sub-districts but still in DAFEP districts.

nentation

District	Sub-district	Village	Household	Sample name	No of Households	Theory	Implementation	
							Benchmark	EoP
DAFEP	DAFEP	DAFEP	DAFEP	DAFEP	30x15	450	480	360
			Non DAFEP	Spill-over	10x15	450	528	350
		Non DAFEP	Non DAFEP		10x15			
	Non DAFEP	Non DAFEP	Non DAFEP		10x15			
Non DAFEP	Non DAFEP	Non DAFEP	Non DAFEP	Reference	30x15	450	480	357

Data collection and processing

Collecting data

Data was collected at household level with the same interface forms used for data entry in the Access database where the Benchmark data was stored. This option was selected so as to limit the problem of data coding, a frequent source of errors. Supervisors in charge of each province were trained by Cirad staff and in turn they trained filed enumerators in each province. These five-to-six day training events enabled the participants to get familiar with the aim of the project, with the purpose of the survey, with the sampling method, with the interview techniques, and with the various forms. In addition, a special training was given to the staff in charge of operating computers for data entry and to the supervisors for quality control. All supervisors and operators did a pre-testing exercise under the supervision of the trainers to get used to the forms. They did also a pre-test with the enumerators before starting the field work. During the training of supervisors and enumerators the need to interview household members together and not only focusing on one respondent (usually the male active head of household) was emphasized. Therefore each survey unit consisted of a household and not a farmer.

Data analysis

The objective of data collection was to provide reliable material for DAFEP impact assessment in relation with specific indicators. The data analysis component was aimed at processing this data in order to perform this impact assessment. Since what matters is whether DAFEP had an impact, the key indicator in fact was the significance of a difference observed between the DAFEP and the Reference sample, difference being expressed for each indicator presented above, as the variation between the changes that occurred in the DAFEP sample and the changes that occurred in the Reference sample. This can be represented with formula (1) below as:

$$(1) \quad I_X = F\left(Sig.\Delta\left(\Delta\left(\overline{X_{\substack{Dafep\\After}}} - \overline{X_{\substack{Dafep\\Before}}}\right) - \Delta\left(\overline{X_{\substack{Reference\\After}}} - \overline{X_{\substack{Reference\\Before}}}\right)\right)\right)$$

where:

I x is the impact of the project in relation with the indicator X (I x can be true or false)

Sig. is the result of the significance test

I_X is the difference in the terms expressed in the parentheses

$\overline{X}_{\substack{Dafep \\ After}}^{\Delta(\ )}$ is the mean or median of the indicator X for the Dafep Sample in the EoP survey (and according to the indices, for Reference sample; the Benchmark survey is referred to as After)

Statistical treatment of data thus differed according to the type of indicator and whether the samples were considered as independent (for comparison of means and averages and dispersion, and for Before and After comparison) or as dependent (for comparison of individual longitudinal data and for regression analysis).

The process of analysis included two steps. The first step consisted in conducting statistical work on each indicator in order to assess the impact of the project. This step had two subcomponents: i) analysis of quantitative indicators (see Figure 1), and ii) analysis of ordered (ordinal) and non-ordered (nominal) qualitative indicators (see Figure 2). The output of this step was the identification of the indicators for which it could be concluded that the project had a significant impact according to formula (1). The second step consisted of multivariate analyses such as principal component and factorial analysis, applied to these indicators in order to provide, whenever possible, a more complete understanding of how this impact took place and to what extend it was due to the project.

Statistical treatment of individual indicators

Quantitative data (income, assets, yields, costs)

In the preparation of the data sets corresponding to each indicator, outlier[25] identification was conducted to eliminate unreliable data. Two methods were used. First, unreliable data was eliminated (for instance yields that were impossible to obtain, or a share that is more than 100%). Alternatively percentile limits set at 95% or 99% were used to identify and eliminate extreme data that could influence or bias the results .

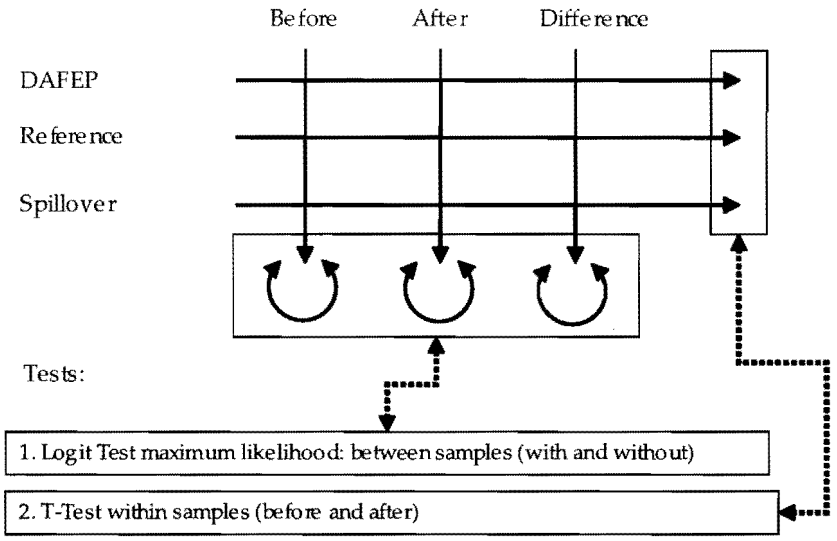
SAS software was used to conduct two different tests on the data sets. A T-test was used (with adjustment to the error degree of freedom using Satterthwaite's formula) within each sample to assess whether the situation *After* was significantly different from the situation *Before*. This test was selected since the *After* samples are not independent form the *Before* samples due to the selected method of conducting the second survey with the same households.

Then, Binary Logistic Regression Model (logit) was applied to test the significance of the means' difference between DAFEP and Reference. For each model, the dependent variable was the membership of the respondent household to the different samples and the independent variable was the indicator. Each indicator was analysed separately. This method uses the significance of the regression coefficient, estimated with the maximum likelihood method, as a significance test of the differences observed between samples in the initial situation, in the final situation and of the difference as indicated in formula (1). Significant changes in the latter indicate that the observed difference was related to the existence of the project; in other words

[25] According to Iglewicz and Hoaglin (1993) outliers can be defined as observations that represent a discrepancy with the rest of the collected data according to the investigator. Several methods can be used for identifying and eliminating outliers in normally distributed data sets (Fallon and Spada). The Box plot method (Tukey 1977) is a graphic method that does not include the extreme outliners in calculating the dispersion because it is based on median and inter-quartile range calculation from which error limits are set at 5% and 95% confidence intervals.

We had for instance the case of one household whose total non farm income represented 26% of the DAFEP sample total non farm income. It turned out that the respondent household had borrowed and invested a huge amount of money for developing a cocoa trading business that year.

Analysis of Quantitative Data (Mean and Median)



the project had an impact[27].

In addition, tests were also carried out on the distribution of the quantitative variables using classic indicators such as skewness, kurtosis, and Gini coefficients. As there is no formal test to check whether the difference between *Before* and *After* conditions are significant, the Bootstrap method was used.[28] The steps of the simulation were:

1. Re-sampling the data for each sample (Monte Carlo method)
2. Compute the skewness and kurtosis of the variable at *before* and *after* condition for each sample
3. Compare the skewness and the kurtosis of before and after condition
4. Repeat 10.000 times steps 1- 3
5. Count the situation where *'after'* is less than *'before'*, and calculate the percentage. If the percentage is less than 0.05 or greater than 0.95 we conclude that they are significantly different.

Figure 1. Statistical approach for quantitative data

[27] Note that although the figures in the tables are sometimes presented with a large number of significant figures, this is not a reflection of the precision of the estimates, merely the nature of the output of the software.
[28] See for example Efron and Tibshirani 1993.

Coping with missing production data
At the time of the EoP field survey, more than 400 parcels, a non negligible share of the total number of parcels, were cultivated but not yet harvested. The majority of these parcels are mainly cropped with rice and to a lesser extent with maize and soybeans. As a result, cost data were collected but not production data. This affected the value of several indicators, in particular agricultural net income per capita, yields, total production value per ha, input use efficiency, trade income per capita.

This situation influenced the results in particular when comparing the Before and After results, since at Benchmark data collection period those cases were almost non-existent. The following adjustments were made in order to minimize the effect of the missing production data when comparing the results. According to the type of indicator, the adjustment process took different forms.

Adjustments for yield calculation. Three crops were concerned: rice, maize and soybeans. For coconut, there was no missing data. The method for adjustment consisted in calculating a proxy for the expected yields with the following procedure:

1. Split DAFEP and Reference samples into two sub-samples, one without the missing parcels (SS1) and one with only the missing parcels (SS2).
1. Calculate the new average yield in SS1 for each of the three crops
2. Calculate the input cost per ha (IC1) in SSI and input cost per ha (IC2) in SS2.
3. If IC1 differs from IC2 by more than 10%, calculate the average yield for a subset of parcels in SS1 centred on the value of IC2. This calculation was made using a 10% range from the centre value of IC2.[29]
4. Use this yield to calculate the harvest for each parcel multiplying it by the cultivated area (this makes a new SS2 sub-sample)
5. Use the new data to complete the sample by merging SS1 and the new SS2 and recalculate the new proxy yield.
6. Do the impact analysis with the recalculated yields.

Adjustment for agricultural income calculation. The agricultural income per capita cannot be recalculated because the period of analysis is a one year period. Including an expected but virtual income would have altered the consistency of the whole data set. Thus, this indicator is not used to assess the project impact on this specific point. An alternative indicator, the crop net income per hectare, was thus established as a proxy of project impact on income. The crop net income per hectare is calculated from crops for SS1, followed by running comparisons of Before /After, and DAFEP/Reference. The same procedure was applied to recalculate the trade net income per hectare. Another consequence was that the total net income per capita was also to some extent affected by this situation. However, given that both Reference and DAFEP samples were similarly affected, the difference in total net income indicator per capita was not expected to be significantly affected. Furthermore, another indicator, the net yearly expenses per capita is also a proxy of the total income and therefore analysis on income and welfare could be performed.

Adjustment for input use efficiency indicator. The input/output ratio (IOR) was calculated for rice maize and soybeans after proceeding as for yield calculation adjustment. In addition the value of production using the average price in the sample was calculated without missing data. For rice this approach is particularly acceptable, since farm gate price of rice is determined by GoI floor price.[30]

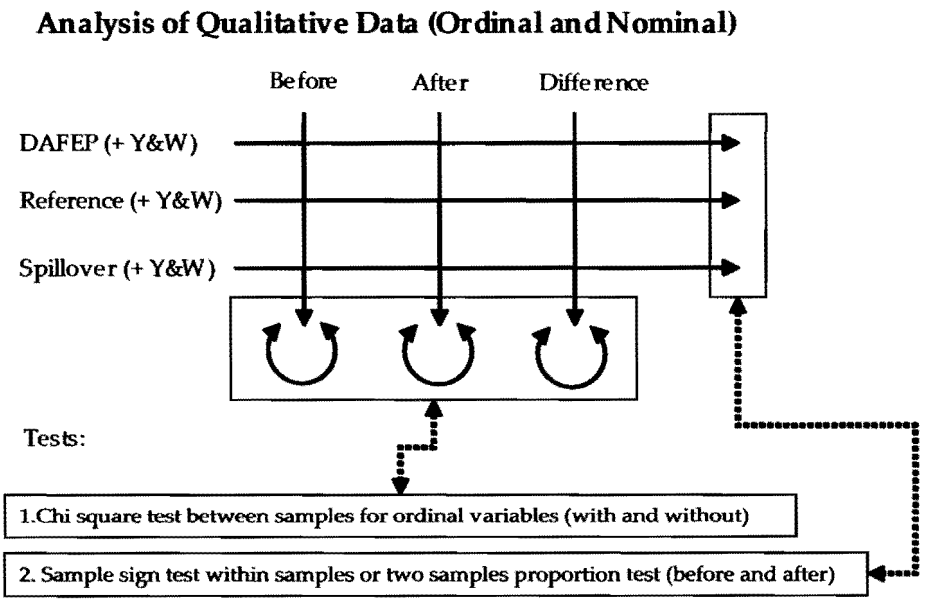
[29] This method was based on the hypothesis of a positive correlation between input use and output volume. The coefficient of correlation between input cost/ha in rupiah and the yield in Kg/ha for the EoP survey, without the parcels not yet harvested is 0,89 for rice, 0,76 for maize and 0,40 for soybeans. This indicates that the hypothesis was verified for rice and maize.

[30] The HPP Inpres No. 13/2005 sets the floor price of paddy (*Gabah Kering Panen*) at Rp 1,730/kg. The median price of paddy in the three EoP samples is Rp1500/kg. Similarly, the price for maize was Rp1,200/kg and for soybean Rp2,700/kg.

Qualitative data

Data is sorted into two categories, ordinal (numbered) and nominal data. For each ordinal indicator, the difference in the value *Before* and *After* was processed for each respondent. This difference is classified into three categories: improvement (positive), stable (neutral) and worsening (negative). The testing of ordinal indicators consisted of measuring the difference between *Before* and *After* for each sample using a related sample sign test. Then, the difference in the change rate between samples was measured based on the different values of the indicators over the time period and using a chi-square homogenised proportion test. For nominal indicators, a representation of the variation in the distribution of respondents' answers was used. The estimates between *Before* and *After* conditions were based on two-samples proportion test. For some clusters a new synthetic indicator (composite indicator) was also used with a weighted combination of ordinal indicators. Then, change and significance tests were conducted as indicated above for ordinal variables.

Figure 2. Statistical approach for qualitative data



Sample erosion

At the start of the project, DAFEP was planned to be implemented in 10 provinces. On this basis, the sample was design to cover and represent the target group of 30 000 households. However, activities were cancelled in one province because the extension services were "re-structured" and disappeared as such. This reduced also the size of the sample. There was also a "natural" erosion due to the impossibility in the EoP survey to find all the households interviewed in the Benchmark survey. This case had been foreseen in the project survey design and an erosion rate of 20% had been anticipated. The real erosion rate is more or less 10%, mainly due to households that have moved and/or that the enumerators were unable to locate. Thanks to the overestimation of the erosion rate, the size of each sample in the EoP survey was large enough to carry out the statistical analysis with the expected confidence level.

Data quality and reliability: How reliable is the data ? There are clear limitations of the data. The first limit is inherent to the type of work and to the collection of socioeconomic and agronomic data from farm households. Collected data is not similar to data used in laboratory experiences or in field trials. Most information comes from the recounting by respondents of facts that have occurred in a more or less recent past, without the possibility to check its accuracy. In addition, many indicators proposed for the assessment of the project were qualitative and some of them based on perceptions of fact, not even factual ones with no way to measure their accuracy. Thus, accuracy and data inconsistency were the main problems in this survey. Several methods were used to counter these.

4.36 As income was a central issue in the evaluation (the sampling rate was based on household income distribution), particular attention was paid to income data accuracy and inconsistency. For this purpose a household budget approach was used with on one hand the income flow and on the other hand the expenses flow. Data was collected independently for the two flows and a ± 10% match considered as acceptable over a one year period. The requested presence of all household members at the time of the interview was also a means to increase the reliability of data and in many cases proved to be necessary. Enumerators were requested to check consistency in income flows at the end of the interview and built-in queries were added in the database so as to automatically detect these.

4.37 Thus, it is considered that data is reliable with a ± 10% range and this although was true for the calculation of significant differences. In fact, since what mattered in the evaluation was the significance of the differences and not the absolute values taken by each indicator, reliability of data was more a function of using similar methods and tools in the DAFEP and Reference sample than which method and which tools were used. As enumerators were assigned to perform both DAFEP and Reference sample survey, possible biases due to different teams assigned to different samples were eliminated.

The second limit was linked to two classic problems: outliers and missing data. For outliers, a median based approach was used rather than a mean based approach. It is acknowledged that alternative methods and approaches may be used – the aim is to provide transparency on the methods used so that it can be replicated and checked and alternative methods can be tested.

The third source of uncertainty is the respect of data collection protocol by the teams of enumerators and supervisors. Feedback from the EoP survey team related to how data collection was performed during the Benchmark indicates that there were some possible breaches in the data collection protocol. Cases were mentioned where apparently respondents were not interviewed in their house and in per households, but regrouped in one place. The selection of respondents in some place was not fully random and respondents belonged to one farmer group (reference sample).

Annex 2: Multivariate Analysis

This annex presents multivariate analysis applied to the indicators that have been identified as significant in the main report. The objective is to provide further arguments to discuss the significance of the changes earlier observed. It intends also to find out whether specific features of the DAFEP sample are related with these changes in a causal way, in which case the impact of the project would be considered as even more likely. This work is firstly conducted with factorial analysis for the whole set of significant performance indicators, distinguishing qualitative and quantitative indicators. Then specific correlation analysis is conducted between significant indicators. It is not the purpose of this report to perform systematic multivariate analysis of changes that have occurred between the Before and After situations if the latter are not significant in the comparison across the DAFEP and Reference samples.[31]

Section A2.1 presents the results of the analysis conducted on the whole set of significant indicators and section A2.2 has the results of the analysis for the specific indicators for which significance tests were positive.

A2.1. Factorial Analysis

Quantitative indicators

Methodology

In this part of multivariate analysis, principal component analysis (PCA) and Biplot are applied to samples from which multi-dimension outliers have been eliminated. Outliers were detected and removed using the Mahalanobis distance method. For independent variables this is a measure of how much a case values differ from the average of all cases. A large distance points out a case having extreme values for one or more of the independent variables. The numbers of outliers detected with this method are displayed below:

Table A2.1. Outliers identified with Mahalanobis distance method for multivariate analysis

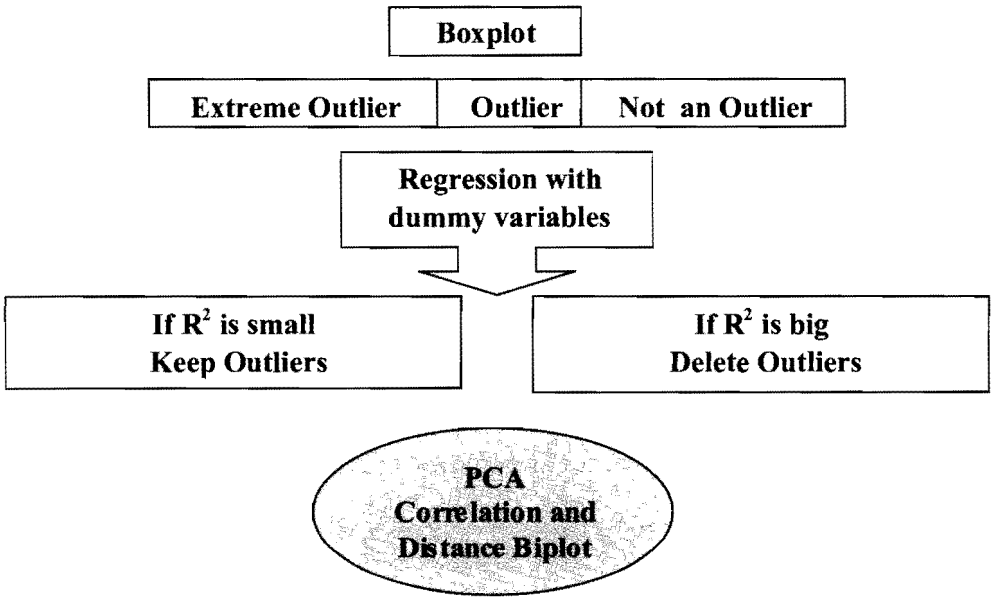
Type of Outlier	Before			After		
	DAFEP	Spillover	Reference	DAFEP	Spillover	Reference
Extreme Outlier	18	21	20	28	22	32
"Usual" Outlier	14	14	15	17	10	23

After detecting the outliers, they were classified into three categories: not an outlier, usual outlier, and extreme outlier. These categories were used as dummy variables in a regression analysis to see how much they affected the variables used in the multivariate analyses. A low R-square value indicated that the outlier's effect was not significant. The results pointed out that the extreme outliers have a more significant effect (R-sq = 34% for Before and R-sq = 40% for After) compared with the usual outliers (R-sq = 27% for Before and R-sq = 35% for After). Then, dummy variables were regressed excluding the extreme outliers. The results are R-sq = 6% for Before and R-sq = 15% for After, showing that after excluding the extreme outliers, usual outliers presence was non-significant. Among the extreme outliers, seven were common to the Benchmark and EoP surveys.

[31] However, the authors in collaboration with the World Bank plan to conduct further analysis on this data set and to present the results in other media.

After elimination of extreme outliers, the data set was ready for a principal component analysis. This analysis is used to understand the covariance structure in the original variables and/or to create a smaller number of variables using this structure. Results of the PCA are displayed with Biplot, a way to present information on the characteristics of many objects in a 2D graph. With Biplot, it is possible to display the similarity of characteristics among objects (here each sample in each survey, so that there are six objects), the variance of variables (see the list of variable below), relations/ correlations among variables/ characteristics and the main characteristics of each object. Two scaling methods were combined - the correlation method and the distance method, in on columns centered and standardized correlation biplot representation. Figure 1 below synthesises this process.

Figure 1. Process of multi-dimension outlier identification and removal



Results

The results of PCA applied to a selected list of quantitative variables and indicators in each sample are presented in the Biplot figures 2 and 2 bis below. Variables are Type of sample (1=DAFEP; 2=Spillover; 3=Reference); Age of the household head; Education level of the household head; Family size; Land area in ownership; Cultivated area; Number of crop grown; YEC; AVC; SFE; NFIC; ABNIC; ARNIC; TIHA; TVIHA; CNIHA; ARNIC ; RiceYld; MaizeYld; SoybeanYld; IORrice; IORmz; IORsbn. The objects are the different types of sample while the vectors represent the variables.

Figure 2. Correlation biplot representation (columns centered and standardized) for selected quantitative variables

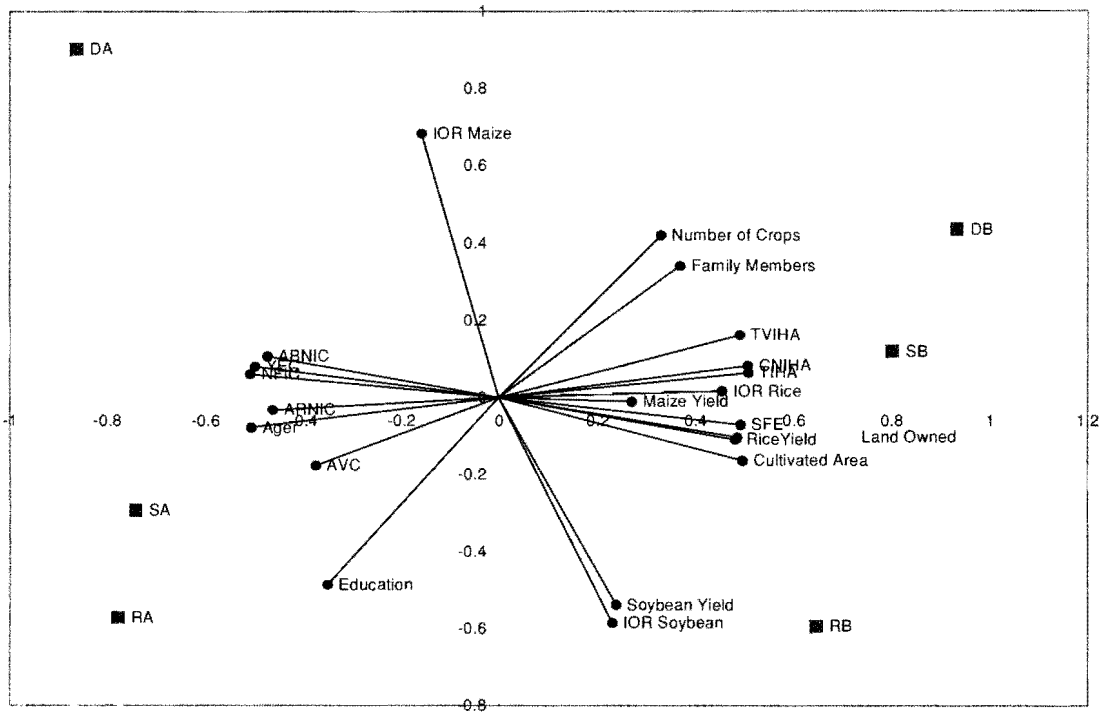
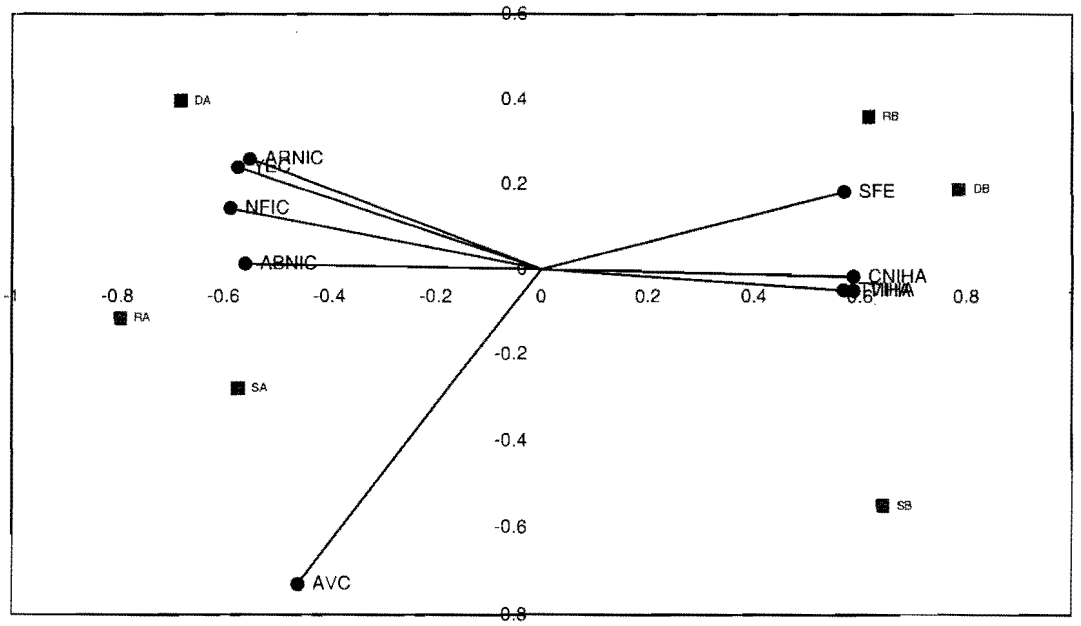


Figure 2bis. Extracted from Figure2.



The characteristics of a correlation Biplot are as follows:

- Correlation between variables is represented by the cosinus angle of two factors. If the correlation is positive, the two vectors form an angle that is <90°, i f negative it is >90° and if the correlation is 0 the angle is ~90°
- The variance is equivalent to the length of the vector; the longer the length, the higher the variance.
- Object Characteristics: two objects with similar characteristics will be shown as two dots close to each other; if an object and variable vector are in the same space (close to each other) the closest vectors indicates the characteristic of the object.
- The distance between objects (samples) is a proxy of their Mahalanobis distance in the multidimensional space.

Most correlations are positive and some are very strong (the more acute the angle the stronger the correlation). Most income and welfare variables are strongly correlated except ANIC with ABNIC and NFIC. The proximity of YEC and TNIC confirms that YEC is a good proxy for the total net household income per capita. As the length of the line that links a variable point to the graph's origin represents its contribution in this space, we can see that most of the characteristics of the sample are explained by welfare and income indicators. However, the projection of the objects coordinates to these vectors indicates a rather large homogeneity among the samples in the Benchmark survey and among samples in the EoP survey. This result confirms the trend in the statistical analysis. Samples were very close in their characteristics before the project and remain so after. It confirms also the importance of the change (positive) in relation with NFIC for both DAFEP and Reference samples between Before and After and the relative decline of ANIC and other variables that are related to agriculture (number of crops harvested, TVIHA, CNIHA, TIHA, Rice, Soybean and Maize Yield, and cultivated area) have relatively decreased.

Qualitative indicators

Methodology

Factor analysis is used to identify underlying variables, or factors, that explain the pattern of correlations within the set of observed variables. As indicated in table A2.2 eight components explain more than 75% of the total variance. A rotated component matrix highlights which indicators mostly contribute to each of these components as displayed in table A2.3 where, for example, factor 1 represents ind-19 (Accessibility to extension workers), factor 2 represents ind-14 (Interest in group activities)

Table A2.2. Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	2.449	18.840	18.840
2	1.407	10.822	29.662
3	1.184	9.107	38.769
4	1.098	8.446	47.215
5	1.046	8.046	55.261
6	.966	7.430	62.690
7	.928	7.139	69.830
8	.866	6.665	76.494
9	.842	6.474	82.969
10	.780	6.003	88.971
11	.738	5.677	94.648
12	.380	2.919	97.567
13	.316	2.433	100.000

Extraction Method: Principal Component Analysis.

Table A2.3. Rotated Component Matrix (a)

	Component							
	1	2	3	4	5	6	7	8
ind-19	**.942**	-.067	-.030	-.097	-.018	.009	-.077	-.042
ind-14	-.071	**.926**	.087	.012	.082	.033	.039	.056
ind-8	-.029	.076	**.985**	.000	.070	.073	.031	.028
Ind-23	-.086	.010	.000	**.991**	-.027	-.044	.028	.028
ind-16	-.018	.071	.070	-.027	**.984**	.035	.040	.070
ind-11	.006	.029	.071	-.044	.035	**.991**	-.050	.036
Ind-27	-.066	.031	.030	.028	.039	-.050	**.993**	.041
ind-18	-.038	.047	.028	.028	.068	.036	.042	**.990**
Ind-24	-.031	.023	.024	.017	.065	.009	.014	.068
Ind-26	-.008	.004	.008	-.003	-.025	.010	-.017	.002
ind-41	-.010	.009	.007	-.024	.030	.022	-.012	.000
ind-13	-.065	.351	.095	.001	.070	.050	-.001	.042
ind-20	-.329	.090	.084	.096	.069	.054	.011	.034

The variables selected for further correspondence analysis are thus:
ind-19 : Accessibility to extension workers
ind-14 : Interest in group activities
ind-8 : Participation in Village Decision Making
ind-23 : Barriers of access to input markets
ind-16 : Accessibility of agriculture information
ind-11 : People's desire to participate in decision making process at a village level
Ind-27 : Joint marketing of outputs/agriculture commodities
ind-18 : Willingness to pay for agriculture information

The next step was to conduct a multiple correspondence analysis and represent the results on a graph. In Figure 4, the square dots represent the values taken by the selected indicators and triangular dots represent the various samples (12 samples in this case after separating household respondents from Y&W respondents).

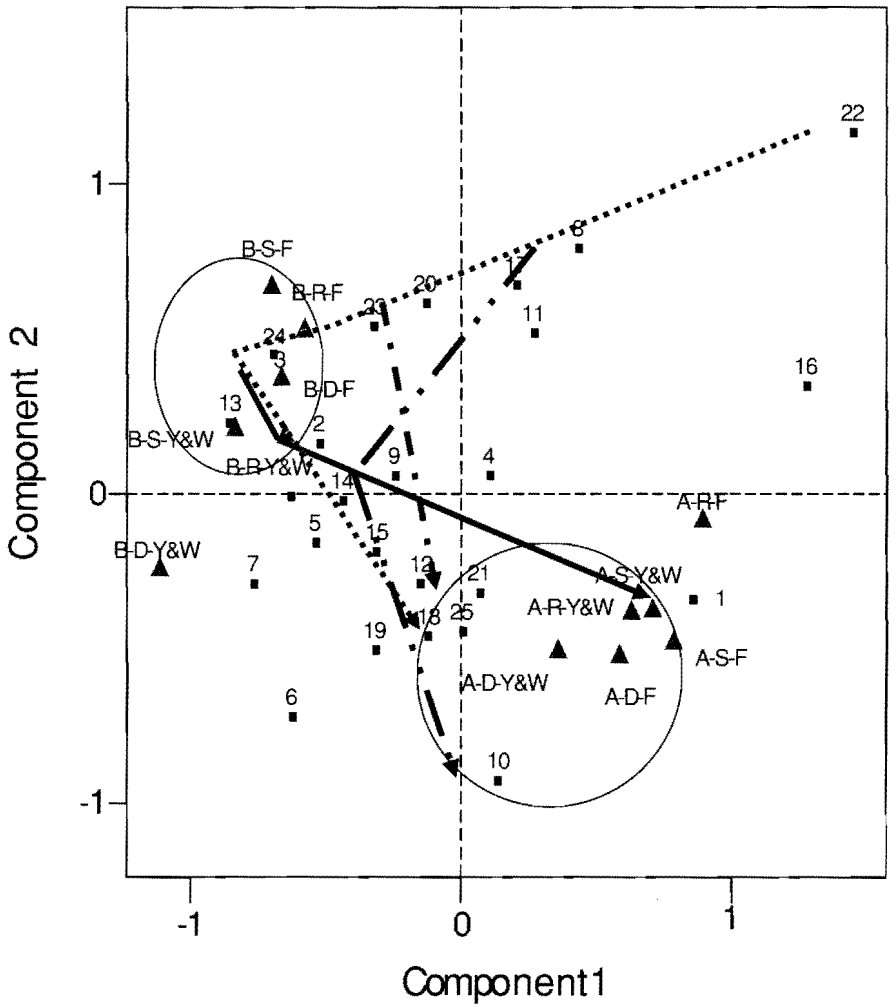
Interpretation

When samples and indicators values are close it means that these values are associated with the sample. Based on this, in the multiple correspondence analysis graph displayed in figure 3, we can differentiate two main clusters: the Benchmark cluster and the EoP cluster. This confirms that there is generally a significant difference for many of the key qualitative indicators between the Before and After situation. The Benchmark (Before) cluster is characterized by the following respondents' perception: having easily access to extension workers, often having barriers to input market, participating in group activities for between 1 and 5 years, and having no desire to join in village decision making.

The EoP (After)cluster is characterized by the following respondents' perception: having no barriers to input market, having sufficient access to agriculture information, being a member of group activity for more than five (a logical result since this survey was conducted five years later) and having the desire to join in village decision making.

As indicated by the arrows, the direction of the evolution (the After cluster has moved to a position closer to improved values for many variables) is rather positive with the exception of access to extension workers but it is compensated by improved access to agriculture information. However, these changes occur again between the Before and After surveys, not across sample (Reference versus DAFEP).

Figure 3. Representation of multiple correspondence analysis results



Note :

B-D-F is Before DAFEP farmer (household)
B-R-F is Before Reference farmer (household)
B-S-F is Before Spillover farmer (household)
A-D-F is After DAFEP farmer (household)
A-R-F is After Reference farmer (household)
A-S-F is After Spillover farmer (household)

B-D-Y&W is Before DAFEP youth and women sample
B-R-Y&W is Before Reference youth and women sample
A-S-Y&W is Before Spillover youth and women sample
A-D-Y&W is After DAFEP youth and women sample
A-R-Y&W is After Reference youth and women sample
A-S-Y&W is After Spillover youth and women sample

1 No barriers to input market
2 Sometimes barriers to input market
3 Often have barriers to input market
4 No joint marketing
5 Joint marketing (0-2 years)
6 Joint marketing (3-5 years)
7 Joint marketing (>5 years)
8 No access to agriculture information
9 Lack of access to agriculture information
10 Sufficient access to agriculture information
11 Not willing to pay for agriculture information
12 Willing to pay for agriculture information
13 Easy access to extension worker
14 Accessibility to extension worker is average
15 Hard to access to extension worker
16 No respond to accessibility to extension worker
17 No participation in village decision making
18 Not to Active in village decision making
19 Active in village decision making
20 No desire to join in village decision making
21 Desire to join in village decision making
22 Not a member of group activity
23 Member of group activity (0-2 years)
24 Member of group activity (3-5 years)
25 Member of group activity (>5 years)

A2.2 Correlation analysis of significant indicators

The results of the significance tests applied to the performance indicators are summarized below cluster by cluster, and corresponding hypothesis and multivariate analysis method are indicated.

The income and welfare cluster

The significance analysis shows that Reference households have performed better than DAFEP households with respects to agriculture related net income per capita (ARNIC) and within this category agribusiness net income per capita (ABNIC). Conversely, positive changes in non farm net income per capita (NFIC), yearly expenses per capita (YEC) and asset value per capita (AVC) are significantly higher for the DAFEP sample compared to the Reference sample.

We firstly examined whether a change in the number of household members could explain the differences observed, since all these indicators are calculated per capita. The results are presented in table A2.4.

Table A2.4. Value and significance of correlations between family size and selected per capita indicators

Sample	YEC	AVC	NFIC	ARNIC
Dafep Before	-0.3*	-0.2*	-0.2*	-0.1
Dafep After	-0.2*	-0.3*	-0.2*	0.0
Reference Before	-0.3*	-0.3*	-0.1*	-0.1*
Reference After	-0.3*	-0.3*	-0.2*	-0.1
Spillover Before	-0.3*	-0.3*	-0.2*	-0.1*
Spillover After	-0.3*	-0.2*	-0.2*	-0.1*

*Significant (2-tailed)

Interpretation

There is a correlation between the size of the family and TEC, AVC and NFIC for all samples in both Benchmark and EoP surveys. For ARNIC the correlations are not always significant. However, since the values of the correlation coefficient are all very low (<0,3), it is likely that other factors explain the observations.

Decomposition of significant income and welfare indicators

Agriculture-related net income per capita (ARNIC)

In table A2.5 is displayed the share of households earning an income from agriculture related activities and then the share of its three components, respectively agro processing (ABNIC), renting of production factors (RPFC) and selling labour force (LF).

Table A2.5. Decomposition of ARNIC and correlations with its constituents

Decomposition	ABNIC		RPFC		LF	
	Before	After	Before	After	Before	After
DAFEP	27%	45%	24%	21%	49%	34%
Spillover	19%	38%	26%	23%	55%	39%
Reference	18%	41%	29%	25%	53%	34%
Correlation	**ABNIC**		**RPFC**		**LF**	
	Before	After	Before	After	Before	After
DAFEP	0.6*	0.9*	0.3*	0.3*	0.6*	0.4*
Spillover	0.8*	0.9*	0.4*	0.3*	0.4*	0.1
Reference	0.7*	0.9*	0.5	0.3*	0.3*	0.1

*Significant (2-tailed)

Interpretation

The results indicate that in all samples the percentage of households with income from agriculture related activities has increased. This increase is characterised by a drop in the relative weight of selling labour force as source of income and the surge in agro processing. This is particularly true for the Reference sample where the earlier analysis had highlighted the weight of this source of income in agriculture related income.

The correlations between ARNIC and its components confirms that ABNIC is the main factor explaining the observed trend and that the two other factors get less correlated with ARNIC in the EoP sample.

Analysis of Non Farm Net Income per Capita

In table A2.6 is displayed the share of households with a non farm income and then its four different sources, respectively non farm jobs (NFJC), sale of assets (SOAC), financial transactions (FTC) and remittances (RMC).

Table A2.6. Decomposition of NFIC and correlations with its constituents

Sample	NFIC		NFJC		SOAC		FTC		RMC	
	Before	After	Before	After	Before	After	Before	After	Before	After
DAFEP	77%	94%	61%	49%	11%	12%	23%	21%	4%	18%
Spillover	74%	95%	61%	52%	9%	9%	23%	20%	7%	19%
Reference	75%	94%	59%	48%	9%	11%	22%	22%	8%	18%
Sample			**NFJC**		**SOAC**		**FTC**		**RMC**	
			Before	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
DAFEP			0.6*	0.1*	0.5*	0.1	0.6*	0.98*	0.1	0.04
Spillover			0.5*	0.8*	0.6*	0.2*	0.6*	0.5*	0.1	0.2*
Reference			0.8*	0.7*	0.1*	0.4*	0.8*	0.6*	0.3*	0.2*

*Significant (2-tailed)

Interpretation

In all samples the percentage of households with non farm income has drastically increased reaching 95% (NFIC column represent the share of households with NFIC income). The structure of non farm income remains stable as far as cash flow aspects (little change in SOAC) and financial transactions within the households (little changes in FTC) are concerned. However, the relative share of remittances and other subsidies have gained importance. These results indicate that these households become more dependent from external sources of income while the share of purely non-farm household activities has decreased. This trend is similar for all sample but more accentuated in the case of the DAFEP sample since the Before situation of RMC was lower. The correlations are more difficult to explain. Non farm jobs income is strongly correlated with all samples before but very loosely with DAFEP after, while there is a stronger correlation with financial transactions in the EoP samples. Remittances are not strongly correlated with NFIC.

Analysis of Asset Value per Capita

In table A2.7 the structure and evolution of assets using five main categories whose share is represented through the estimates of their monetary value with regards to total asset value is presented. These are respectively animal assets (AA), AgriEquipment (AE), House&Furniture (HF), Transportation Means (TM), and Capital Savings (CS).

Table A2.7. Decomposition of AVC and correlations with its constituents

Decomposition	AA		AE		HF		TM		CS	
	Before	After	Before	After	Before	After	Before	After	Before	After
DAFEP	18%	9%	5%	4%	70%	76%	7%	10%	0,0%	0,1%
Spillover	13%	10%	6%	5%	74%	76%	7%	9%	0,0%	0,3%
Reference	16%	10%	5%	5%	72%	75%	8%	9%	0,2%	0,2%
Correlation	**AA**		**AE**		**HF**		**TM**		**CS**	
	Before	After	Before	After	Before	After	Before	After	Before	After
DAFEP	0.37*	0.23*	0.42*	0.61*	0.91*	0.92*	0.43*	0.66*	-0.04	0.13
Spillover	0.23*	0.12*	0.09	0.07	0.99*	0.99*	0.60*	0.17*	-0.03	-0
Reference	0.92*	0.24*	0.09	0.17*	0.84*	0.96*	0.88*	0.41*	-0.02	0.04

*Significant (2-tailed)

Interpretation

In all samples house and furniture represent more than 70% of the assets both Before and After conditions. The weight of animal assets has rather strongly dropped in the DAFEP and Reference. This may be interpreted as a change in the consumption patterns of the household and in their accumulation strategy. With higher income the needs for savings through animals has decreased and households acquire more consumption goods. The correlations confirm this trend with a decline in the association between assets and animals in the After samples while the correlation get stronger with house and furniture.

Analysis of Yearly Expenses per Capita (YEC)

In table A2.8 we present the structure and evolution of yearly expenses per capita using six main categories whose share is represented through the estimates of their monetary value with regards with total expenses value. These are respectively, food consumption (FC), non food routine consumption (NFR), education costs (EC), social expenses and transfers, asset acquisition (AA) and financial transactions (FT).

Table A2.8. Decomposition of YEC and correlations with its constituents

Decomposition	FC		NFR		EC		SC		AA		FT	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
DAFEP	36%	31%	31%	34%	5%	6%	7%	8%	11%	12%	10%	9%
Spillover	36%	32%	33%	35%	5%	6%	7%	8%	9%	11%	10%	9%
Reference	36%	32%	31%	33%	5%	6%	7%	8%	11%	11%	10%	10%
Correlation	**FC**		**NFR**		**EC**		**SC**		**AA**		**FT**	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
DAFEP	0.49*	0.18*	0.59*	0.22*	0.29*	0.03*	0.53*	0.11*	0.80*	0.37*	0.55*	0.94*
Spillover	0.46*	0.48*	0.64*	0.58*	0.27*	0.41*	0.37*	0.42*	0.78*	0.73*	0.59*	0.67*
Reference	0.53*	0.63*	0.51*	0.66*	0.18*	0.26*	0.30*	0.41*	0.77*	0.72*	0.68*	0.57*

Interpretation

In all samples the trend is that monetary non food routine expenses are progressively taking over monetary food expenses. This indicates some improvement in general welfare level; however, as education expenses

and assets acquisition remain stable, this improvement does not translate into an accumulation process or a long term strategy. Transfers from the households are limited and confirm that the net flow of transfer is positive towards the rural households.

Deepening the analysis of welfare distribution

As indicated earlier, while AVC in the DAFEP sample is significantly higher than in the reference sample, AVC distribution in the EoP survey is significantly different than in the reference sample, showing a higher level of inequality. In order to better understand this situation, we split the DAFEP sample into two subsamples of the same size using the median value of AVC in the EoP sample. A correlation analysis was run for the variables displayed in Table A2.9. Figure 4 plots the variations in asset value per capita between the Benchmark sample and the EoP sample against the variation in non farm net income per capita for the two subsamples (called "Upper Stata" and "Lower Strata").

Table A2.9. Correlation coefficients between AVC and NFIC for DAFEP upper and lower strata

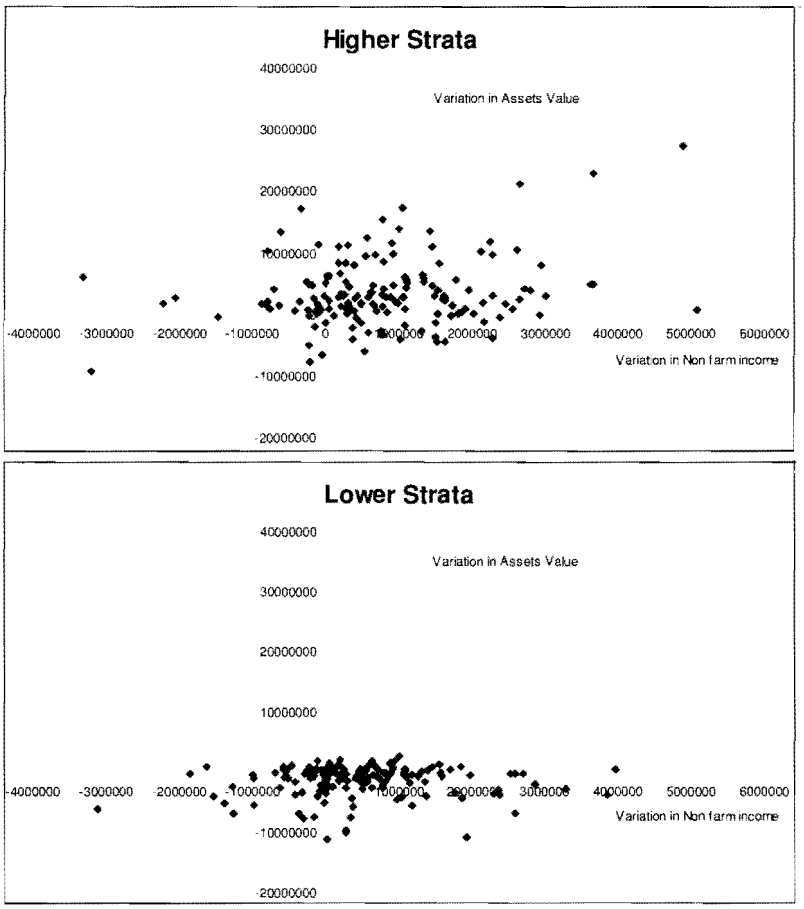
UPPER	*AVC-1*	*AVC-2*	*Dif AVC*	*NFIC-1*	*NFIC-2*	*Dif NFIC*
AVC-1	1,00					
AVC-2	0,14	1,00				
Dif AVC	-0,21	0,94	1,00			
NFIC-1	0,29	0,07	-0,03	1,00		
NFIC-2	0,20	0,23	0,16	0,28	1,00	
Dif NFIC	-0,05	0,16	0,17	-0,52	0,68	1,00
LOWER	*AVC-1*	*AVC-2*	*Dif AVC*	*NFIC-1*	*NFIC-2*	*Dif NFIC*
AVC-1	1					
AVC-2	0,19	1,00				
Dif AVC	-0,95	0,14	1,00			
NFIC-1	0,18	-0,06	-0,21	1,00		
NFIC-2	0,16	0,17	-0,10	0,16	1,00	
Dif NFIC	0,03	0,19	0,03	-0,45	0,81	1,00

Note: 1 and 2 refer respectively to Benchmark and EoP surveys.

The results show that there is no significant correlation between the variation in asset value per capita and the variation in non farm income (0,17 and 0,03 respectively for Upper and Lower Strata). The difference in AVC is strongly positively correlated (0,95) with the level of asset in the 2006 for the Upper strata while it is strongly negatively correlated (-0,94) with the level of assets in 2001 in asset value per capita for the lower strata.

Figure 11 shows that in the higher strata, an increase in non farm in come is more often linked with an increase in asset value, while in the lower strata the two elements are almost completely de-linked. Furthermore, the trend in the lower strata is a de-capitalization of assets in value (deflated) while there is a capitalization in the upper strata. Lower strata households do not use their additional non farm income for accumulation, but for direct consumption purpose. This in turn leads to a depreciation of their asset values. As a result inequality in AVC distribution has increased as earlier indicated.

Figure 4. Difference in AVC against difference in NFIC for higher and lower strata



The Productivity and technology cluster

The only significant differences observed are for soybean yield and in input efficiency for rice where DAFEP sample households improved much more than in the Reference sample.

Analysis of Soybean Yield in the DAFEP sample

Given that soybean is very sensitive to local conditions, hypotheses related to the following points were tested for the corresponding households: location of the respondent households, level of input use, type of variety, cultivated area, type of land, and tenure status

Correlation analysis was used for the numeric and ordinal variables and association analysis for nominal and ordinal data. For association analysis a 4-category variable was created based on quartile distribution. There were no outliers found before conducting this analysis; the sample consist of 57 parcels owned by 26 respondents in the Benchmark sample and 12 respondents in the EoP sample.

The correlation for yield with cultivated area is negative (-0.74) but not significant while the correlation between yield and total input is positive but weak (+0.22) and significant only at 10% level. The results of association analysis show only a significant association between yield and the type of variety but this association is weak.

Analysis of input efficiency for paddy in DAFEP Sample

For rice input efficiency (measured by the input/output ratio), included in the analysis are the following variables: variety, cost of physical inputs, gross harvest, type of land, tenure status, JPAI and JMAO.

The method is similar to the analysis of soybean. There were 4 outliers found and the sample consists of 1060 parcels owned by 569 respondents in the Benchmark sample and 491 respondents in the EoP sample.

The correlation between IOR and yield and total cost of input/ha is weakly negative though significant (-0.07 and -0.11). This result is logical for the yield (higher yield means higher output, thus lowering the IOR ratio) but more surprising for input use. This indicates either that there is no response to higher input use or that another variable (such as the price of inputs) plays also a role. Ideally, input use should be represented by the physical quantities, but since there is a large range of various input used by farmers this is not included in this analysis in the report. In the association analysis, there is a weak association between the type of variety with IOR and only at 10% level.

Significant Income and welfare indicators and extension indicators

Finally, a correlation analysis was included between the two indicators found significant in the extension cluster (JPAI and JMAO) and the significant income and welfare indicators (YEC, AVC, NFIC, ABNIC, and ARNIC) so as to clarify whether there was a possible interaction within the DAFEP sample that could help understand why these indicators differ. The results are in Table Using Mahalanobis distance method we eliminated extreme outliers and found the results as indicated in table A2.10.

Table A2.10. Correlation coefficients between JMAO, JPAI and income/welfare indicators

	YEC	AVC	NFIC	ABNIC	ARNIC	JMAO	JPAI
JMAO	-0.04	0.01	-0.05*	-0.01	0.00	1	
JPAI	-0.07*	-0.01	-0.09*	-0.04	0.01	0.54*	1

Interpretation

The only significant and somehow strong correlation is between JMAO and JPAI (0.54). Other correlations are either non significant or weak. There is no related effect between the changes that occurred in the significant extension variables and with the income and welfare variable in the DAFEP sample.

Annex 3: Farmer Managed Activity Interventions

The project provided the opportunity for bottom-up participatory planning and implementation of FMA activities, which provided 'learning by doing' opportunities to groups of farmers in the participating villages. The ICR mission during field visits to Bantul, Kulon Progo, Magelang, Gowa and Kupong districts has documented several successful interventions which have provided significant financial returns to the farmers (Table 1). There is a large variation in financial returns and investment costs showing wide variation in adoption rates and equity considerations (numbers of poorer benefiting households and gender).

There were a number of high income generating high cost activities like orchids, gurmi fish and coconut jelly, to which large proportions of the FMA budgets have been allocated and which benefited very few farm families in the participating villages. High investment/operating cost and/or gestation period of these activities restricted their adoption to only few better-off households who actually received the training. On the other-hand there were other low cost key interventions with as little as 3 to 7% of the village FMA budget being allocated to them for improving the skills of farmers which have benefited many families particularly the poorer ones. Examples include duck raising, catfish, bitter gourd, citrus, cattle fattening and local chicken improvement which proved to be popular and financially viable as seen by their spread from 16 to over 50% of the farmers in the villages concerned..

Case study examples of FMA interventions

Financial analysis was carried out by the FAO ICR mission of a number of interventions adopted by farm households that participated in FMA activities through DAFEP (Table 1). The analysis is based on data obtained in focus discussions with farmers during village visits by the mission.

Targeting villages is just as critical as targeting resource poor farmers for achieving significant impact on poverty reduction. Most of the villages visited by the mission, with the exception of Kupang, are endowed with better resources. Within the village also, FMA interventions could have been better targeted to maximize the beneficial impact per unit of budget spent. One good example observed during the ICR mission's field visit to an interior location, Pallantikang Village (UPKG) in the sub-district of Pattallassang in Gowa district. This village is far away from the district headquarters with poor roads. The farmers here identified a training activity for building up a partnership with the help of an outside expert and utilized an FMA grant of Rp 2.3m (3% of the FMA budget). A total of 30 men and 20 women/youth attended this training, which led to the development of several partnerships between 2003-2005. Each of the seven farmer groups entered in to an MOU with entrepreneurs located in Makassar for marketing corn, tapioca and paddy directly instead of going through middlemen as was the case before DAFEP. Price realized net of transport charges, for paddy and cassava are 33 to 80% more than before, while the price advantage for maize has been between 10-40%. As of now, around 800 farmers from this and neighboring non-DAFEP villages are estimated to have been benefited through these partnerships, each getting Rp 0.5 to 0.8 million incremental net benefits per year. More importantly, these groups are now looking for developing new partnerships for getting access to credit linked input supply for improving their farm business opportunities.

Technology transfer for better rearing of local chicken in Sendangsari UPKG in Bantul is a good example of how even with a modest budget, cost effective extension related farmers' capacity building activities could lead to significant improvement in individual as well as societal welfare.. Just by training farmers to carry out a very simple and easy management practice of separating a hen from its chicken, each farm family who adopted this technique is earning an additional income of Rp 1.35m per year and the technology has spread to more than 50% of the farmers in the village. On the other hand, another FMA activity in the same village for the processing of spices, despite being highly profitable by getting additional income of

Rp 0.027m for every kg of spices processed, the spread of this technology was limited to the group of 26 women who received training during two consecutive years. Such monopolization of skills acquired by the FMA training was also observed in the case of orchids with respect to another group in Magelang district where the benefits from almost 30% of the total FMA grant allocated to a village with 727 farm households was captured by a group of 25 better-off women who received training over three consecutive years contributing themselves 29% of their training and setup costs to start their group operation and there has been no spread to any other households in their village. These varied experiences observed in the project villages highlights the need for strengthening farmer groups and FETs (i) in identifying low cost highly profitable interventions and (ii) to ensure equitable distribution of benefits from FMA interventions for reaching more farmers, including the poorer households within and across villages.

Aside from equity concerns, clearly financial returns from typical interventions that families have been able to implement following training received through DAFEP have been very attractive and have substantially raised family incomes. The mission analyzed a variety of 16 such interventions – these are presented in the following Table. FMA activities were classified into (i) those requiring capital investment and (ii) those requiring only additional operating expenses. For the type (i) activities net benefit to incremental costs (investment plus operating costs) range from 1.4 to 33.1 indicating that for every additional Rp1 spent Rp2.4 to Rp34.1 are returned. For type (ii) activities net benefit to incremental operating costs range from 1.3 to 15.7 so that for every additional Rp1 spent Rp2.3 to Rp16.7 are generated. Expressed as a percentage return to additional cost, these range for type (i) from 40% to 3210% and for type (ii) from 30% to 1470%.

Table 1: Financial Analysis of sample FMA interventions in DAFEP villages

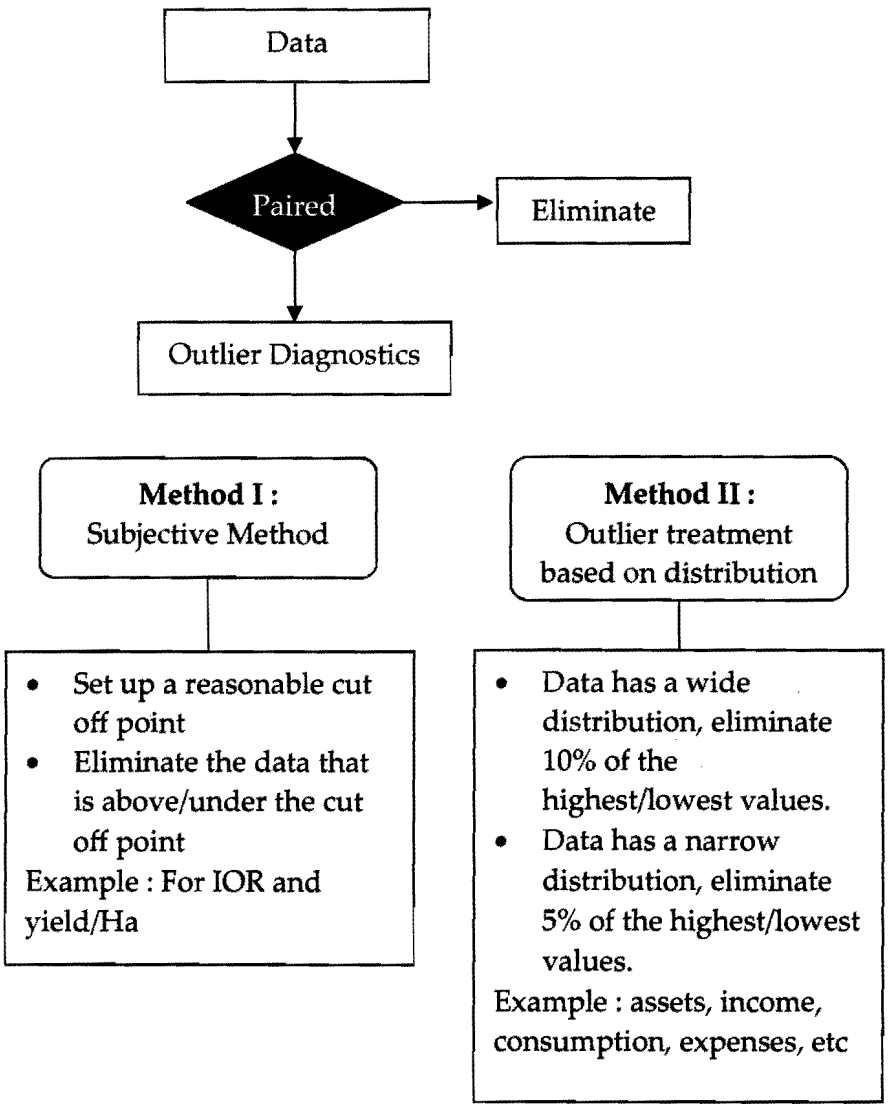
Name of the activity	Benefits provided under FMA	Farmers benefited as % of village farmers	Training budget for activity as % of FMA budget	Net benefit to operating cost ratio	Net benefit to annualized investment ratio [1]
Cat fish raising	Technology transfer; Farmer trainings for nursery raising and cat fish raising	17%	3.5%	0.73	2.5
Gurmi fish raising	Technology transfer; Apprenticeship; Potential assessment; Business meeting, and tour	12%	24%	2.1	8.6
Duck raising	Technology transfer; Study tour; Networking for duck raising & golden snail pest as feed	16%	7%	2.9	4.2
Orchid cultivation	Technology transfer; Apprenticeship; Tour; Comparative study; Field school meeting	3.4%	28.5%	1.0	7.7
Cultivation of Bittergourd	Field school and technology transfer	27%	4.7%	3.0	7.5
Coconut Jelly processing	Technology transfer; Apprenticeship and Study tour	0.4%	6.4%	1.3	12.5
Citrus cultivation	Technology transfer; and training organized in collaboration with pest management school	31%	3.1%	6.8	33.1
Paddy Threshers	Apprenticeship program for technology transfer to make indigenous wooden thrasher	9.2%	4.1%	15.0	1.4
Partnership building	External expertise provided training on partnership activities	100%	3.1%	NA	NA
Cattle fattening	Training for technology transfer-faster growth and weight gain-enabling two cycles in 2 years	27%	4.7%	2.2	NA
Improved paddy technology	Rainfed paddy field school	8%	3.1%	2.2	NA
Bamboo handcraft for youth	Demonstration and supervision by invited artisan.	15%	NA	15.7	NA
Improved cattle by breeding/ ration formulation	Technology transfer and training	100%	NA	2.8	1.9
Local Chicken	Technology transfer for better rearing - increased stocking and production	More than 50%	4 %	9.0	9.0
Processing of Spices for value addition	Technology transfer for spices processing in 2002 and field meeting for spice crops cultivation in 2003	Less than 1%	14.5%	2.1	NA
Rambutan selection, budding and production	Technology transfer and training	75%	13%	NA	NA

[1] Annualized investment cost is estimated based on 10% interest rate and 3 to 5 years of repayment period wherever appropriate; NA for Not available/applicable

Annex 4. Statistical treatment of univariate outliers

Statistical treatment done for the outliers in this report for the univariate indicators are shown in the figure below. The first step is to build a database of respondents who are in the before and after survey and eliminate those who don't match. After getting a paired data set we start detecting outliers for each individual indicator. For indicators that can be judged as rational or irrational value, such as yield of paddy it is unlikely to get a harvest of 10 tons from 1 Ha or for IOR it is unlikely to have a value above 1, we eliminate the irrational values. The second method is used when we have indicators which might have a long range of values, such as income, consumption, assets, etc it varies from 0 to 1.000.000.000 for assets, and then we use a 5% or 10% distribution method. This method depends on the distribution of each indicator, if the indicator has a wide distribution then we use a 10% limit and when we have a narrow distribution we use a 5% limit.

Graph of univariate outliers treatment algorithm



Annex 5. Analysis of Soybean Yield in DAFEP Sample

1. Correlation

o Correlations between Yield and Cultivated area

Correlations

		Cultivated	
Cultivated Area	Pearson Correlation	1	-.074
	Sig. (2-tailed)		.585
	N	57	57
Yield/Ha	Pearson Correlation	-.074	1
	Sig. (2-tailed)	.585	
	N	57	57

The correlation reported in the table is negative, although it is not significantly different from 0 because the p-value of 0.585 is greater than 0.05.

o Correlations between Yield and Total input

Correlations

		Yield/Ha	Total input/ha
Yield/Ha	Pearson Correlation	1	.221
	Sig. (2-tailed)		.098
	N	57	57
Total input/ha	Pearson Correlation	.221	1
	Sig. (2-tailed)	.098	
	N	57	57

The correlation is positive and the p-value of 0.098. It indicates that the correlation is not significantly different from 0 at level 5% but it is significantly significant at level 10%.

2. Association

o Relationship between Yield and Location

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.937[a]	15	.607
Likelihood Ratio	12.655	15	.629
N of Valid Cases	57		

a. 20 cells (83.3%) have expected count less than 5. The minimum expected count is .21.

The significant value of the Chi-square statistic is greater than 0.05. It means that there is no relationship between yield and location. The chi-square test is useful for determining whether there is a relationship.

- **Relationship between Yield and Type of variety**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.412[a]	21	.067
Likelihood Ratio	31.983	21	.059
N of Valid Cases	57		

a. 28 cells (87.5%) have expected count less than 5. The minimum expected count is .21.

The significant value of the Chi-square statistic is 0.067. It means that there is no relationship between yield and location at level 5%. At level 10%, there is relationship between Yield and Type of variety. The Chi-square test doesn't tell you the strength of the relationship. Symmetric measures attempt to quantify this strength. These measures are based on the chi-square statistic.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.742	.067
	Cramer's V	.429	.067
	Contingency Coefficient	.596	.067
N of Valid Cases		57	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

The significance values of all three measures are 0.067, indicating a statistically significant relationship at level 10%. The values of all three measures are around 0.5; it subjectively indicates the association yield and type of variety is not strong enough.

- **Relationship between Yield and Type of land**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.051[a]	21	.245
Likelihood Ratio	25.247	21	.237
N of Valid Cases	57		

a. 28 cells (87.5%) have expected count less than 5. The minimum expected count is .21.

The significant value of the Chi-square statistic is greater than 0.05. It means that there is no relationship between yield and type of land.

- **Relationship between Yield and Tenancy**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.893[a]	6	.558
Likelihood Ratio	5.935	6	.430
N of Valid Cases	57		

a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is .63.

The significant value of the Chi-square statistic is greater than 0.05. It means that there is no relationship between yield and tenancy.

Annex 6. Analysis of Input Efficiency for Paddy in DAFEP Sample

1. Correlation between IOR and variables:

Correlations

		IOR	Total Input/Ha	Yield/ha
IOR	Pearson Correlation	1	-.108**	-.070*
	Sig. (2-tailed)		.000	.022
	N	1060	1060	1060
Total Input/Ha	Pearson Correlation	-.108**	1	.697**
	Sig. (2-tailed)	.000		.000
	N	1060	1060	1060
Yield/ha	Pearson Correlation	-.070*	.697**	1
	Sig. (2-tailed)	.022	.000	
	N	1060	1060	1060

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The correlation reported in the table for Total input/Ha and Yield/Ha towards IOR paddy is negative, and it is significantly different from 0 because the p-value is smaller than 0.05.

2. Association

- **Relationship between IOR and Type of Variety:**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.358[a]	12	.061
Likelihood Ratio	21.163	12	.048
N of Valid Cases	1064		

a. 4 cells (20.0%) have expected count less than 5. The minimum expected count is .17.

The significant value of the Chi-square statistic is greater than 0.05. It means that there is no relationship between IOR paddy and type of variety at a 5% significance level, but the relationship is significant at 10%.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.138	.061
	Cramer's V	.080	.061
	Contingency Coefficient	.137	.061
N of Valid Cases		1064	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

The significance values of all three measures are 0.061, indicating a statistically significant relationship at level 10%. The values of all three measures are around 0.1; it subjectively indicates the association IOR and type of variety is not strong enough.

- Relationship between IOR and Type of Land:

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.447[a]	28	.298
Likelihood Ratio	25.202	28	.617
N of Valid Cases	1064		

a. 16 cells (40.0%) have expected count less than 5. The minimum expected count is .02.

The significant value of the Chi-square statistic is greater than 0.05. It means that there is no relationship between IOR paddy and type of land is not significant at 5% and 10%.

- Relationship between IOR and JPAI:

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	-.018	.027	-.668	.504
	Kendall's tau-c	-.014	.021	-.668	.504
	Gamma	-.031	.046	-.668	.504
N of Valid Cases		1064			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

The significant value of the all three measures of ordinal association is greater than 0.05. It means that there is no relationship between IOR paddy and JPAI is at 5% and 10%.

- Relationship between IOR and JMAO:

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	-.018	.027	-.668	.504
	Kendall's tau-c	-.014	.021	-.668	.504
	Gamma	-.031	.046	-.668	.504
N of Valid Cases		1064			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

The significant value of the all three measures of ordinal association is greater than 0.05. It means that there is no relationship between IOR paddy and JMAO at 5% and 10%.

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