Evaluating Changes in Farm Income, Other Monetary Benefits and Household Wealth from Tree Farming in the Markham Valley of Morobe Province, Papua New Guinea

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Abstract

Using household capital analysis, this study investigated the farm income, other monetary benefits and household wealth effects from participating in a tree farming project in the Markham Valley of Morobe Province, Papua New Guinea. The study employed both qualitative and quantitative research methods. From the total sampling population of 370 landowners and tree farmers, 10 per cent were selected to represent the participants in the project. Farm income and profitability gradually increased over the time involved in the project for contract work, annual land lease payment and intercropping practices. Farm income was influenced by the farm size and the number of years in the farming business. A rural household wealth analysis revealed that the highest ranked short-term recurrent need was clothing, followed by school fees. The main medium term recurrent needs were family events and cultural obligations, while the main long term recurrent need was better housing in order to improve living standards and wellbeing. The study also found that while tree farmers earn more income, they lack household income management abilities. The study recommended capacity building through training and education programs that improve farmers' knowledge of farm income management.

Keywords: farming business, farm income, capacity building, household capital analysis, recurrent needs

Introduction

'PNG Biomass' is a tree farming climate change resilience project that attracts carbon credits and reputational benefits to Papua New Guinea, as a partnership between the developer (PNG Biomass) and the customary landowners of Markham Valley. It is an entrepreneurship project whereby most labour requirements for farming activities involves the landowners within the participating family units and clan members. People from surrounding communities are engaged for farm activities depending on the urgency of work that needs to be done and also the monetary needs of the community, especially cash income to meet community social and cultural obligations. For example, a youth or church group in the community may ask tree farmers directly or PNG Biomass management if they can engage in contractual

work as part of fundraising activities for their organization in which the money generated from the contractual work would be contributed towards the operation of the organisation. The engagement of community groups for contractual work is facilitated by PNG Biomass management through close consultation with the farmers, the customary landowners. The range of farm activities in which the farmers were engaged as contractors included land clearing and preparation, tree planting, weeding, chemical spraying and fertilizing, and other farm maintenance work.

The objective of this study was to evaluate the changes in farm income, other monetary benefits and household expenditure patterns from participating in this tree farming project in the Markham Valley of Morobe Province. The significance of the study is to establish a data base for understanding the determinants of farm income and its effect on rural household units.

Research Methods

Research site

The study was conducted in the rural communities of Markham Valley in Morobe Province, Papua New Guinea. The primary field data were collected from the farmers who partnered with the PNG Biomass project to establish a tree farming business. Geographically, Markham Valley is located at longitude of 607'26.75" S and latitude of 14502'53.40" E as shown in Figure 1.

Figure 1. Map of the PNG Biomass project site and study area
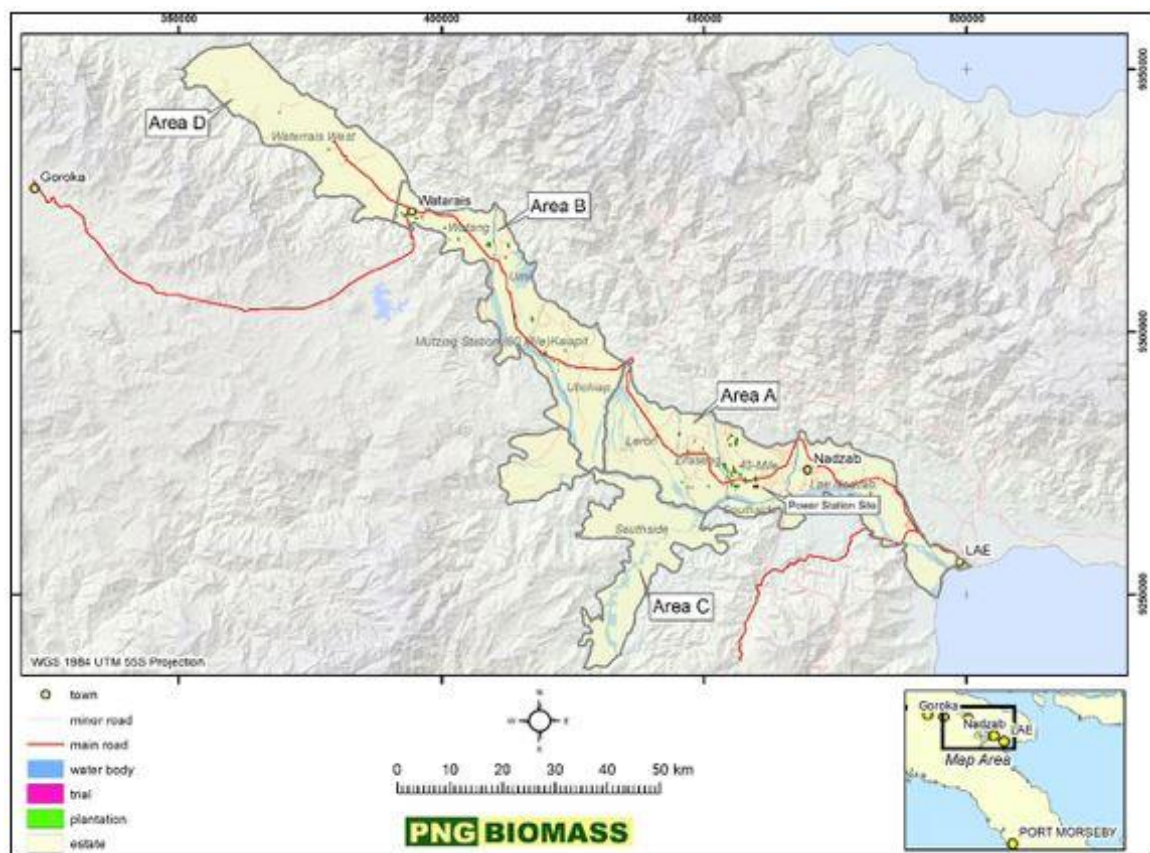
Source: PNG Biomass project profile map, December 2020

The Markham Valley is located in a strategic position where future commercial farming activities are conceivable due to the fertile land and the proximity to the coast. Lae City is the main northern industrial hub and shipping port for Papua New Guinea.

Research design

The study employed both qualitative and quantitative research design. The qualitative data was based on open-end questionnaires, observations, and discussions, which were represented by textual description about the behaviours', beliefs, opinions, emotions, and relationships of individuals (Ritchie & Lewis, 2003; Creswell, 2014; Gentles et al., 2015). The quantitative research method was based on closed-end questions that was represented by numerical figures and statistical analysis of data (Murtonen, 2005; Creswell, 2014). Ritchie and Lewis (2003) further elaborate that qualitative research helps to interpret and better understand the complex reality of a given situation and the implications of quantitative data. In other words, a mixed research design provided the primary data for the research.

Sampling strategy

The study involves purposeful sampling for gathering and evaluating field data. The two main purposeful sampling techniques applied were criterion, and random. The criterion purposeful sampling was used in order to capture the in-depth stories of respondents through asking personal questions and opinions about experiences by the person interviewed in related to the phenomenon of interest (Patton 2001, p.238). Benoot et al. (2016) pointed out that purposeful sampling is used to construct a comprehensive understanding of all studies that meet certain pre-determined criteria. The approach in this research for choosing criterion purposeful sampling was based on selected tree farmers from the PNG Biomass project host communities of Markham Valley in Morobe Province, Papua New Guinea.

The random purposeful sampling technique was another sampling strategy used in this research to gather quantitative data in a sample population of sampling. The random purposeful sampling technique provides best chances of selecting each and individual sample size in an identified population of interest by means of systematic ways of selecting cases which was not based on advance knowledge determined by the outcome of the cases (Suri, 2011; Kulshreshtha, 2013). Benoot et al. (2016) point out that random purposeful sampling adds credibility to sample when potential purposeful sample is larger than one can handle.

From a total sampling population of 370 landowners and tree farmers, 10 per cent were selected to represent the whole population. The choice of the 10 per cent sampling strategy was to collect valuable information with minimum cost but with sufficient variability that the findings represent the whole population.

Data collection instrument

Primary field data from the study area were collected using two instruments: interviews for qualitative data and a survey questionnaire for both qualitative and quantitative data. The interviews targeted both tree farmers and non-tree farmers of Markham Valley in Morobe Province, Papua New Guinea. The interviews were carried out to capture the in-depth stories of respondents through asking personal questions and opinions about the experience of the person interviewed in regard to the cause-effect relation of the PNG Biomass project and tree farming businesses.

The survey questionnaire was administered to collect specific data of interest in order to provide answers to the specific research questions. First, the survey questionnaires were distributed to the tree farmers whereby the farmers themselves filled in the blank questionnaire, and second, interviews were conducted with the tree farmers through face-to-face communication. This approach also allowed follow up about any discrepancies in the survey questionnaire.

Data processing procedure

The field data captured through the interviews and survey questionnaires were analysed and processed to provide solutions to the research objective and problem statement. The primary data were processed and analysed under two themes: farmers' income and household wealth.

Farmers income

The farm income in this research refers to income from the tree farming business. The farm income from tree farming included the land lease payment, contract work payment, on-farm income from inter-cropping activities and income from off-farm activities. In Table 1 is shown the form for collecting the various sources of income from tree farming including income from both on-farm and off-farm activities.

Table 1. Annual gross income (PGK) in 2017 & 2018

	Type of Income	Amount (PGK)	Remarks
A	Farm Income		
1	Land-Lease		
2	Farm maintenance Contract Payment		
B	On-Farm Income		
1	Intercropping: Watermelon & Cucumbers		
2	Fuel-wood		
C	Off-Farm Income		
1	Cash-crops		
2	Subsistence farming & rural economy		

Source. Authors' own study personal file, October 2018

Farmers household capital or wealth

The household capital analysis refers to investigation of the wealth of the people in the rural setting in terms of money or assets owned by the people in that particular area and how that capital was used. In this study, the farmers' household capital analysis is carried out to evaluate the farmers budgeting in terms of expenditure and their future planning. The farmers' household capital analysis applies two main approaches: rating and scoring expenditure categories, and then ranking of those scores.

Approach 1: Grading by rating and scoring. This involves the rating and then scoring of different budgeting and spending data from field assessments tabulated using Statistical Package for Social Sciences (SPSS) Software. The spending is graded under three categories; short-term needs, medium-term needs and long-terms needs. The rating and scoring were based on five dimensions represented by scoring as listed in Table 2.

Table 2. Grading household wealth by rating and scoring

Rating	Scoring
Not Important	0
Of some importance	1
Important	2
Very Important	3
Critically Important	4
Total Score (Out of 10 points)	

Source. Authors' own study personal file, October 2018

Approach 2: Ranking of Score. The scores were ranked from the highest to lowest for each category of spending and recurrent needs using SPSS software in order to tabulate the information.

Results and Discussion

Farmer's income and monetary benefits

The land lease payment was paid to the landlord (the tree farmers of Markham Valley) by the lessor (PNG Biomass Limited) at the rate of PGK200.00 per hectare on annual basis. The contractual payment analysis was based on cash income received by tree farmers from participating in farm activities. The payment was either as wages or a one-off payment after the completion of a given task or activity. The amount of income for the contract work was determined by the types of activities, the PNG Kina per hectare (K/Ha) rate and the total land area (Ha) of farmland worked on. The off-farm incomes were from intercropping of food crops within the tree farms, such as watermelon and cucumber. The income from intercropping varied from one farmer to another.

The income data during 2017 and 2018 are summarised in Table 3.

The results from Table 3 shows that total on-farm income from contract work and the annual land rental payment was K98,220 and K25,300, respectively over the two years 2017 and 2018, while the total off-farm income from inter-cropping was calculated to be K44,500.00. The average income for farmers per year during the period ranged between K9,198.00 and K14,805.00, and the income per hectare per year ranged between K572.00 and K921.00.

The farmers' income is determined by the number of farm activities allocated in a year. As the farmers are involved in more activities in the second year, they generate more income for their household. According to Brindal and Tey (2014), operation scale and efficiency as well as output prices have a positive impact on earnings. Further study was carried out through socio-economic statistical analysis based on key characteristics and indicators of farming and farmers' income respectively.

Table 3. Farmers' income during 2017 and 2018

Category	Total Income (K)	Year 2017	Year 2018	Total
On-farm Income	Contract work payment	22,785	75,435	98,220
On-Farm Income	Annual Rental Payment	22,500	2,800	25,300
Off-farm Income	Inter-cropping	19,100	25,400	44,500
	Average Income (K)	**64,385**	**103,635**	**168,020**
	Income per Year (K/Yr)	9,198	14,805	24,003
	Income per hectare per year	572	921	1,493

Source: Authors' own study personal file, October 2018. Note.1 PNG Kina (PGK) = 0.4321 AUD, October 2018

Farmer's socioeconomic characteristics for years 2017 and 2018

Socioeconomic characteristics are indicators of both social and economic conditions, status and the situation of people in the community. The social indicators chosen for tree farming in the Markham Valley comprised operational farm size, years of farming and the labour input into farming. The economic indicators of tree farming were the operational cost and the farm income from tree farming as well as income from intercropping of food crop and agro-forestry activities on farmland.

The socio-economic characteristics analysis was based on primary data from the field survey questionnaires. The two main independent variables were years of farming and farm size. The dependent variables were labour in Man-Days (MD), cost in PNG Kina (K) and annual gross income in PNG Kina (K). In Table 4 is shown the findings of the socio-economic analysis.

Labour (MD)

The labour variable is important in order to understand the co-relation between the labour input and the farmers' years of experience in farming, and also between the operational land holding. From Table 4, the mean of the labour input for farmers with farming experience of 0-2 years, 3-4 years, and more than 5 years, gradually increases with 1.00 μ, 2.00 μ and 2.33 μ, respectively. The labour input, total Man-Days (MD), used in farming under different categories of farm size, 0-5-hectare, 6-20 hectare and then more than 21 hectares, also gradually increases with 28 MD, 199 MD and 299 MD, respectively.

This result shows that as the farm size increases, more labour is being used to carry out field activities in order to effectively manage the farm. Further, the farmers increase their work force for farm activities over the years of farming as both farm size and the number of farm activities increase.

Cost (PGK)

Table 4. The socio-economic characteristics of the farmers for 2017 and 2018

Characteristics	Range	Categories											Year 2017 and 2018
			Labour (MD)				Cost (K)			AG Income (K)			
			%	Mean μ	SD	MD	%	Mean	SD	%	Mean	SD	Average Income (K)
Years of Farming	0 - 5	0-2 years (low)	43.00	1.00	.000	37.00	43.00	1.00	.000	43.00	42.90	.000	8,170.00
		3-4 years (medium)	14.00	2.00	1.155	161.00	14.00	2.00	.000	14.00	14.30	.000	19,255.00
		> 5 years (high)	43.00	2.33	.000	248.00	43.00	2.33	1.155	43.00	49.90	1.155	36,960.00
Farm Size	0 - 35	0-5 Ha (small)	14.00	1.00	.000	28.00	14.00	1.00	.000	14.00	14.30	.000	3,360.00
		6-20 Ha (medium)	57.00	2.00	1.155	199.00	57.00	2.00	.957	57.00	57.10	.000	28,125.00
(Ha)		> 21 Ha (large)	29.00	2.00	1.414	299.00	29.00	2.00	1.414	29.00	28.60	.000	32,900.00

Source. Authors' own study personal file, October 2018.Note.1 PNG Kina (PGK) = 0.4321 AUD, October 2018

Findings from the farm cost analysis show that the farming maintenance cost for farming experience of 0-2 years was K2,355.00, for farming experience of 3-4 years was K5,070.00, and for more than 5 years of farming was K15,360.00. This result indicates that farmers who venture into this type of farming business at an earlier stage of farm development tend to increase land area by leasing and this contributes to higher costs for farm management. As shown above, the main factor that contributed towards the tree farmers of Markham Valley increasing their farm size was due to the increase in income derived from farming. In addition, the extra land contributed to improved household food security and the larger farm size allowed more innovation and technology to be adopted.

The relationship between farm maintenance cost and farm size indicates that the average cost of farm activities for farm size between 0–5 ha was K1, 660.00, for farm size between 6-20 ha was K9, 400.00 and for farm size more than 21 ha was K11, 725.00. Cost increases with both years of farming and size of operational land holding. Farmers provide more land for farming over the years of farm entrepreneurship with PNG Biomass. The higher farm cost for the large farm size category was due to the larger labor force being used on this land.

Annual Gross Income (PGK)

The findings show that the annual gross income was K8,170.00 for between 0–2 years of farming, K19,255.00 for farmers with 3-4 years of farming and K36,960.00 for farmers with more than 5 years of farming experience. Farm incomes increase with farmers' years of farming. Early entrants tend to benefit from being involved in the tree farming business more that new farmers or recently joined farmers. The early farmers continue to provide more land for development over time and this contributed toward increased earnings.

The analysis of the relationship between Annual Gross Income and operational land holding shows that the average Annual Gross Income (K) for farm size between 0–5 ha was K3,360.00, for farm size between 6-20 ha was K28,125.00 and for farm size more than 21 ha was K32,900.00. Annual gross income increases with farm size. FAO (2014) argue that the share of income from farming increases with farm size.

Farmers' household wealth analysis

In this part of the study, the objective was to examine how the increased household wealth from participation in the tree farming scheme was spent, in terms of household recurrent needs. These are those factors which are required as necessary for living for the rural people and individual household units, recurring over different periods of time. These needs can be classified into short-term recurrent needs, from 0 –2 years; medium-term recurrent needs, from 2 – 4 years; and long-term recurrent needs of more than 5 years.

In Table 5 is shown indicators of short-term recurrent needs. The most highly ranked were clothing and school fees followed by health care. The mean for clothing was 3.3 μ and the mean for school fees was 3.1 μ and there was no significant difference between them. Most farmers' income was budgeted and spent on clothes and also invested in school fees for their children. Health care was the next most important short-term recurrent need, to maintain the health and wellbeing of their household units.

Mobile phone communication was ranked low as most of these farmers were not able to access or to purchase mobile phones. Farmers do not know how to use the modern technology and prefer verbal communication. Food purchase was also found to be a lowly ranked short term recurrent need with a

mean of 1.7 μ. Most farmers intercropped food crops in the tree farming system that supplemented the food supply for the household. According to Luo et al. (2013), intercropping food-crops with trees in a farming system increases productivity and income from the same land management unit on a sustainable basis.

Table 5. Short–term recurrent needs of 0- 2 years

Indicators	Mean (μ)	Sum	Ranking
Clothing	3.3	33	1
School fees	3.1	31	2
Health care	2.7	27	3
Transport	2.3	23	4
Communication (mobile phone)	1.8	18	5
Food	1.7	17	6

Source. Authors' own study personal file, October 2018

The three main medium-term recurrent needs for spending from farm income were family events, community activities and debt repayment, as shown on Table 6.

Family events and community cultural activities had means of 3.4 μ and 2.6 μ respectively. These indicators were priorities since they are both part of meeting social obligations in the community. This result suggests that participation in business development in the rural community is being influenced and based on cultural norms and values of the society, generating a commitment by a farmer and a business entrepreneur towards cultural obligation. It is also part of the courtesy and recognition process for local business entrepreneurs to meet these social obligations through donations and sponsorships towards community events.

The lowest ranked medium-term recurrent need was debt repayment with a mean of 1.6 μ. This was an outcome from the contractual relationship of the tree farming scheme, where PNG Biomass invests in farm development whereas the farmers provide the land and labour force, so there was no debt such as a loan from a commercial bank for repayment. Also, as farm income was relatively consistent throughout the years, the farmers do not owe money to other people or financial institutions.

Table 6. Medium-term recurrent needs of 2 – 4 years

Indicators	Mean (μ)	Sum	Ranking
Family events	3.4	34	1
Community activities	2.6	26	2
Debt repayment	1.6	16	3

Source. Authors' own study personal file, October 2018

Finally, the study assessed and evaluated budgeting of farm income for long–term recurrent needs (more than 5 years) as indicated in Table 7. The long-term recurrent needs in which farmers budgeted from farm income were bride price, housing, savings and investment. The bride price payment was ranked first with a mean of 2.9 because it was regarded as a major part of meeting cultural and social obligations in the community. The budgeting for housing was ranked second with a mean of 2.4 as most farmers viewed

that building a decent house would contribute towards improved household living standards and wellbeing.

Table 7. Long term recurrent needs of more than 5 years

Indicators	Mean (μ)	Sum	Ranking
Bride price payment	2.9	29	1
Housing	2.4	24	2
Savings	1.9	19	3
Investment	1.1	11	4

Source. Authors' own study personal file, October 2018

The least long-term recurrent needs were investment followed by savings, with means of 1.9 μ and 1.1 μ respectively. Farmers do not regard investment and saving as an important component of the farm income budgeting, and they do not invest or save money from farm income. The main reason was a lack of information and understanding about investment and saving as well as the long -term benefit from the investment.

Conclusions

This research into the farm income and other monetary benefits of partnerships in the planted forest industry in PNG found that farm income was influenced by both the farm size and the number of years in the farming business. The farmers who leased land to the PNG Biomass project over the years tended to benefit from both on-farm and off-farm incomes as their farm size under trees gradually increased over the same period of time. The study also revealed that the farmers' income was determined by the number of farm activities allocated in a year. As the farmers become involved in more activities, the farm generates more income for farmers. More income was generated during the initial stage of farm establishment and development because more activities were involved during that period of time.

Further research into farmers' household wealth and their recurrent needs shows that farmers earn more income from farming trees, but they lack household income management and accountability skills. This was influenced by low literacy and education levels as well as expectations of cultural obligations on farm income decision- making.

An implication from this study is that capacity building through proper training and education programs should be provided by PNG Biomass to improve farmers' knowledge of farm income management, use and control. Information about financial institutions with regard to loan and credit schemes as well as saving for the future should also be made available to the farmers.

Some areas for further research are that PNG Biomass should develop a proper value chain market strategy to assist the farmers for marketing their food products from intercropping within the planted trees and should investigate more closely the influence of social and cultural obligations on farm income and decision making.

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