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Full Length Research Paper

Economic viability of smallholder yoghurt production for a sustainable rural development scheme: The case of Bambui Cameroon

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Halving poverty by 2015 as per the Millennium Development Goals (MDGs) tuned African Development Agenda toward revamping the Agricultural Sector. This spurred the African Union to consider 2014 as "The Year of Agriculture" under the Comprehensive African Agricultural Development Programme (CAADP). With the strategic principle of partnership and alliance to include farmers, agribusinesses, and civil society communities, sustainable rural development can be achieved through the development of the Non-Farm Economy (NFE) such as smallholder yogurt producer's cooperatives. On this premise, a 3 months experimental survey was carried out at the Institute of Agricultural Research for Development (IRAD) Bambui, Cameroon to establish the economic viability of Yogurt production using the Return on Investment (ROI) approach. It was found that for every 1000XAF ≈ US$ 2 invested in yogurt production there is a 340 XAF ≈ 70 cents return. Returns are piece meal but will attract huge investment if operated in a cooperative as it will increase marketability and reduce production cost.

Key words: Sustainable rural development, non-farm economy, dairy products, yoghurt.

INTRODUCTION

Rural livelihoods the world over, have been enhanced through the effective participation of rural communities in the management of their own social, economic and environmental objectives. This has been achieved by empowering people living in these areas, particularly women and youth, through organizations such as local cooperatives, farmer organizations, community groups etc and by applying the bottom-up approach [1]. This situation has provoked the development of close economic integration of rural areas with neighbouring urban areas. In effect this has increased the creation of more rural off-farm employment hence narrowing rural-urban income and social disparities, expand opportunities for all, while encouraging the retention of skilled labour in these communities.

Contemporary Rural Developmental Strategies have been aimed at developing the Non-Farm Economy (NFE). In trying to fulfil the goals of the Millennium goals, efforts have been made in developing the NFE by creating decent, meaningful and challenging value chain agribusinesses established to boost youth and female participation as well as develop inclusive marketing approaches. Challenging and meaningful jobs here refers to transforming rudimentary agricultural practices into more sustainable activities that have attainable objectives with clearly defined route to achieve them. This includes themovingawayfromthe marketing of agriculture produce

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in underdeveloped market systems of spot markets to organised agricultural markets with efficient marketing functions and structures which includes food supermarket. This also requires the moving away from the underdeveloped value addition technologies (food processing technologies) to more scientific methods of value addition (food processing) with quality to satisfy a large market and reduce post-harvest losses greatly. With this, the major question has been what institutional arrangements or models would be appropriate for the effective establishment of agro-industrial activities that would maximize the contribution of the rural and small farmer in the development process (Gandhi et al., 2001). In this light rural poverty and food insecurity are seen to be born of unsustainable agricultural systems aimed at just intensification for increased yields with little or no post-harvest (value added) technologies. This only ends up in increase yields and increase post-harvest losses. Consequently sustainable rural development strategies are aimed at addressing both poverty and food insecurity in rural areas especially by increasing the physical access to food (economic viability) and quality food consumption (calories intake). As such, the problem of food insecurity in African economies owe its origin to unsustainable agricultural systems which ends up impoverishing rural communities more and more.

In Cameroon like other African countries, the advent of poverty, food insecurity and changing food production patterns encouraged the adoption of the agro-ecological zone approach of crop and animal production in an integrated approach for sustainability and the achievement of resilience in rural areas. To provide supportive institutions, part of the Cameroon government's strategy was the establishment of the Institute of Agricultural Research for Development (IRAD) with specialized centres in 5 different agro-ecological zones of Cameroon. These specialised research Centres conduct research on the agricultural potentials of crops and livestock in the 5 main agro-ecological zones so as to boost agricultural production within communities in these various ecological zones of Cameroon. This was the case especially in the mid 70's and early 80's when agriculture had the giant share of the GDP of over 60 percent. With the creation of the Institute of Agricultural Research for Development (IRAD), the Bambui Centre (IRAD Bambui) was established to serve the Western Highlands Ecological Zones. IRAD Bambui has been renowned for research in Maize and Beans variety development, hybrid cattle with high milking potentials and biotechnologies in diary productions. Some of these research findings and/or developed technologies have been feasible and sustainable methods to achieve resilience. Nevertheless, some of the technologies have not been fully adopted or taken over by the smallholder farmers. One of the most important of these technologies has been the processing of fresh cattle milk into Yoghurt, Butter and Cheese. Several studies have been carried out to understand why the low rates of adoption of this technology. Nchinda and Mendi (2008) in addressing this issue highlighted factors such as gender, education and capital as the major factors influencing the low rate of adoption of this technology. However, the problem still remains as the market of Yoghurt in this region is still highly under exploited as it is still operated by smallholder especially women with rudimentary technologies. On this basis this study is aimed at examining this phenomenon from the capital perspective by using the Return on Investment approach. This is in a bid to situate small scale animal farmers within the sustainable Rural Livelihood Development framework and advocate for the adoption of more sustainable models like the many cooperative models practiced in India and a small part of Cameroon - the TADU Dairy Cooperative Model in Jakari. Also, this study provides a ground for policy reconsideration or evaluation especially with the advent of the Commodity Value Chain Development Support Project (PADFA) which runs from 2010 – 2018 as one of the key national projects under the funding of the International Fund for Agricultural Development (IFAD).

The Study Area

The study area for this work is the Bambui community which falls within the Western Highlands agro-ecological zone located between latitudes 5° 20' and 7° North and longitude 9° 40' and 11° 10' East of the Equator. Bambui is situated in the Tubah Sub-division of Mezam Division of the North West Region of Cameroon. It is located at about 15km North East of Bamenda city (the NW regional headquarters) and 3km West of Bambili village from the Bambili three corners junction. The climate is generally characterized by an average minimum temperature of about 14^{o}C and reported average rainfall is about 2259.19 mm fairly distributed between the months of mid-March and mid-November. Furthermore, the soils are covered with pasture of savannah vegetation as well as it has an equatorial climate with two distinct seasons Rainy and Dry season. The rainy season runs from mid-March to mid-November while the dry season goes from mid-November to mid-March. Bambui has a population of over 50,000 people. It is popularly known by its inhabitants as "*abeh-mbeuh*". Agriculture dominates the area with potatoes, maize and beans being some of the most cultivated crops. The second popular agricultural activity in Bambui is cattle farming (rearing). By the distribution of the cattle population in Cameroon by regions, Bambui falls with the first four; the North West Region (Kameni et al, 1999). Situated in the Bambuicommunity is the Institute of Agricultural Research for Development (IRAD) Bambui centre, located at about 1600m above sea level.

The Institute of Agricultural Research for Development (IRAD)

is categorised under institutions within the Sustainable Rural Development Framework. This is the pivot of the development process, as it links livelihood resource usage to sustainable practices as an approach to poverty alleviation and making agricultural resources more sustainable through resource stewardship. This will increase the level of the resilience of rural communities. Considering the conditions and trends of the agro-ecological zone; the demographics, climate and history elements, they provides necessary conditions to improve on the macroeconomic conditions of employment of the community, prices of food through the market development, redressed social differentials so as to prescribe apt government policy for Agricultural Development. The establishment of IRAD Bambui was strategic given that, there were support institutions like the Regional College of Agriculture (RCA) and Technical School of Agriculture (TSA) in Bambili, the Community College of Arts Science and Technology (CCAST), the National Agricultural Research and Extension Program (PNVRA), Comprehensive High School (CHS), Heifer Project International (HPI) and today the University of Bamenda with a college of Technology with agriculture as part of her programs. All of these institutions have complemented each other by providing material, financial and human capital support to small scale farmers.

Paying particular attention to the local dairy industry in the Western Highland Agro-ecological zone one can conclude that it is underdeveloped despite the huge potential of the rural communities and supporting institutions. This is because most animal rearing is highly rudimentary, with nomadism as the major means of feeding as well as very limited dairy product enter into the local diet and culture of the people other thanmeat and milk. This emphasises the constraints highlighted by Bayemi et al (2005). Despite the fact that Yoghurt is one of most preferred of the dairy products within the Western Highlands of Cameroon her input supply or source is not from the fresh milk as supplies are pronounced limited (Bayemi et al, 2005). In 2000 the FAO estimated that the level of imports of milk and milk product was 11,480 tonnes representing about 50 percent of the adult per capita consumption as well as per capita consumption of milk and milk products was 15.3 kg (FAO, 2000). This is evidence of a growing need for dairy products yet underdeveloped domestic market for milk products such as yoghurt. Nchinda et al, (2008) asserted in the Western Highlands specifically in the Bamenda town in the North West Region, the most popularly consumed dairy product was Yoghurt. This explains why a policy for Sustainable Rural Livelihood Development of the NFE targeting the diary industry in this agro-ecological zone seems apt. This is because milk processing into yoghurt is technology that can be used to improve on rural and urban resilience given that the poverty index of the rural population of the North West and West was 29 and 24 percent respectively of the 2002 consensus MINAGRI/WFP (2001). This is because this will result in the trickledown resulting in the creation of the various marketing channels of dairy product which are efficient. This will initiate the development of an array of small agribusiness ventures that will harness the potentials of this sector. This will form the base of the Diary agro industry making efficient production strategy of artificial insemination for hybrid species with high milk production potential like the Holstein Friesian with an average of 11.5kg per day and a milk yield of 47,505kg (HPI, 1999). It will also make relevant the fresh milk processing technologies of Yoghurt, Butter and Cheese. Thus, the establishment of the Animal production units as well as the food processing unit in IRAD Bambui has been to bring sustain biotechnologies closer to the rural community and empower the industry from the grassroots.

However, these efforts have met difficulties such as low rate of adoption of the technologies of Artificial Insemination especially as farmers consider it capital intensive in maintaining the livestock in terms of feeding and health (Bayemi et al, 2005). The incorporation of the food processing units was aimed at empowering the farmer (women and youths) with skills for production of Basic or Minimal Processed Products (MPP) such as Yogurt, Butter and Cheese. These technologies happen to remain in the archives of the research centre as smallholders farming communities of Bambui and Western Highlands Agro-ecological zone have not taken ownership of this technology due to several factors. Some of the hypothesised factors to explain situation includes: lack of capital and limited knowledge of the market information. This is study is addressing the findings of Nchinda and Mendi (2008) by redirects the approach towards the question of low rate of adoption of postharvest technologies such as that of Yoghurt production. The major start point in the adoption of a technology is to assess the economic viability of the technology in terms of its costs and benefits. The next critical point is the relevance of the technology and ease of management ((Pingpoh 2007) and (Bayemi et al 2005)). Consequently, new technologies run the risk of rejection if they are not customised to the community in which they are to be established and if they do not show proof of improvement on the rural livelihood of the communities in a sustainable economic manner. It is therefore presumed that the food processing technologies of IRAD Bambui have been customised to the potentials and level of education of farmers of this area given that the methods of processing are basic. Furthermore, this technology can be effectively adopted within the Western Highland Agro-ecology zone as a strategy for poverty alleviation among smallholder farmers. However, smallholders have not adopted this milk processing technology in this area but it could be

made more attract and appealing if the technology is adopted as cooperative so as to overcome some of the major challenge of capital. An example of such setups that has been successful is the case of the TADU Dairy Cooperative in Jakiri. This cooperative is a grouping of cattle farmers especially the Mbororos in the Jakiri and Kumbo areas which collects fresh milk and processing into TADU Yoghurt with high quality. The TADU Dairy Cooperative model has been successful although still young compared to the Anand Milk Union Limited (AMUL) model in the Kaira District of India (Gandhi and Dinesh, 2011).

The lack of adequate political and institutional support may jeopardise cooperative models of this nature especially in the absence of a well-organised market system and policy. As such this study analysis the economic viability of the diary technology of Yoghurt production to underscore if it can kick-start the dairy industry in the form of an organised cooperatives. This study chooses the Plain Yoghurt of all the dairy products on the bases of its broader marketability given that it is a product that can be consumed by all age groups including lactose intolerant persons as asserted in the Dietary Approach to Stop Hypertension (DASH). It is interesting to know that in some countries there are dietary recommendations like the dietary guidelines for Americans which recommends that individuals aged 9 and older should consume 3 servings of milk, cheese or yoghurt each day and children 4-8 years should consume 2-1/2 servings of yoghurt (DASH Report). One serving of yoghurt is 8-ounce cup or container approximately 226.8grams which is approximately 0.227litre. This implies that every litre of Yoghurt is made up of approximately 4 servings of Yoghurt and each serving maybe valued at 250XAF ≈ 50 cents minimum in this case. This implies a litre of Yoghurt should sales at 1000XAF ≈ US$ 2 minimum as inferred from the DASH recommendations. It is worth noting that on average in most supermarkets in the world 0.5litre of yoghurt approximately 500grams sell at about £1≈ US$ 1.5. These monetary values are used to justify the dietary value that is placed on yoghurt in the world. This is the case with the yoghurt produced at IRAD Bambui. Based on the value chain system of agriculture, IRAD Bambui aims at building a forward integration model that harnesses the potentials of the rich livestock resources in this community especially as the area has more 34 percent of the nation's cattle population. However, a well-established market and marketing channel will help to develop the market better in the nation. This will result in a derived demand for high milking cow breeds in order to meet with the needs of the growing market for yoghurt from fresh milk. This will cause the farmers to fully embrace the artificial insemination technology even though at the expense of feeding cost especially as nomadism still remains a common grazing practices in this area.

The Sustainable Rural Development Framework is used in this study to illustrate the interdependence between the IRAD centre, the resources of the Western Highland Agro-ecological in terms of the history of cow livestock, the target of the government policy for instituting the centre in this area, the demographics and the agro ecological factors that favour the exploitation of Natural resources, Financial, Human and Social Capital in this area. The Natural Capital refers to the rainfall of 2259.19mm and average minimum temperature of about 14^{o}C which favours the growth of a Savannah Grassland field characterised by Elephant grass (*Pennisetumpurpureum*), Kikuyu grass (*Pennisetumclandestinum*), *Hyperrhenia*sp. and *Sporobolusafricanus*, which are common. *Leguminosae*include: *Trifolium*sp., *Sida*sp., *Stylosanthesguyanensis, Stylosanthesscabra*and *Desmodium*sp. Among exotic *Gramineae*species introduced are: *Brachiariaruziziensis, Setariasphaceolata, Panicum maximum* and Guatemala grass (*Trypsacumlaxum*). Major fodder trees are *Leucaenaleucocephala*and *Centosema*sp. for grazing and the low level of disease prevalence Djoko et al (2003). The villages are made of farmers (especially the Mbororo herders) who diversify or integrate crop and animal production which captures the cultural aspects. The Human capital is from the pool of graduates from the Cameroon College of Arts, Sciences and Technology (CCAST) in Bambili, Regional College of Agriculture (RCA) and Technical School of Agriculture (TSA) in Bambili, personnel from Heifer Project International (HPI) and the National Agricultural Research and Extension Program (PNVRA) who provide training, materials and financial support to smallholder farmers alongside the IRAD centre Bambui. Also, the social capital comes from the strong farmer groupings (Producer Organisations) and cooperatives such as the Bambui Cooperative and many other cooperative credit unions most of which have their headquarters in Bamenda - the regional capital of the North West Region which harbours part of the Western Highlands agro-ecological zone.

Building on the sustainable rural development framework, Agricultural integration was a productivity strategy aimed at harnessing all the natural, economic/financial resources, Human and social capital through extension programmes to build and diagnosis Farmer or Producer Organisation. It also ensured that all the technologies disseminated are relevant as well as adopted by the local farmers so as to increase productivity. However, Value Addition is now the most recent strategy for sustainable rural livelihood by improving on the marketability of agricultural produce through forward and backward inclusive market models in the concept of agribusiness and agripreneurship. It is in this vein that agricultural produce are seen as products which can feed all market demand as bundle of nutritive utility through processing and packaging that increases their shelf life. This is the

wheel on which western agricultural development has evolved over decades. Food crop is not just produced but value is added in terms of lines of products such as chocolate from cocoa, yoghurt from cow milk, wine from grapes, beer from corn and bread from wheat just to name a few. That is, a flock of cattle is not just raised for beef but also for steaks and other forms of canned processed beef. These processes of adding value to agricultural produces, have enhanced the agricultural sector through the establishment of an organised and sustainable food products markets which has led to the development of Non-Farm Economy. It is for this reason that small scale Yoghurt production projects are assessed for its viability to ensure that it is not just a technologically feasible project but that it is also an economically meaningful one in creating quality food products that have a profitable market. Such sustainable NFE projects if found economically viable will go a long way to alleviate poverty, make livelihood more resilient and natural resources use sustainable.

The Sustainable Rural Livelihood Development Framework is the theoretical base for an integrated approach to rural development with an emphasis on value addition for agricultural produces.

ANALYTICAL METHODS AND MATERIAL

The method adopted for this study is the survey research design. This design entails the observation of an on-station yoghurt production experiment and marketing in order to assess the economic viability of the project. In effectively assessing the economic viability of the on-station yoghurt production project, the analysis is divided into the Physical Relation Analysis (PRA) and the Economic Analysis (EA). The PRA is basically the input-output ratio which is a milk-yogurt ratio as well as the sales-production ratio. These physical ratios give some insight into the efficiency of fresh milk usage as well as the efficiency of the marketability of the produced yoghurt. For the Economic Analysis, the Return on Investment (ROI) technique is used. As such, to evaluate the economic viability of the smallholder yoghurt production units, the Return on Investment (ROI) method of analysis is employed given that it is a comparative efficient tool to assess economic viability for projects less than six months. This method of economic analysis satisfies the business shut down rule which states that, the selling price (P) must be greater than the Short Run Average Cost (SRAC): P > SRAC otherwise the business should be shutdown. This implies that, if a business cannot cover its short run average cost of production (operational cost) then it should be shutdown. The simplicity of this method in sourcing for data and computation makes it very handy as it may not be too cumbersome for most small scale farmers given their educational level or knowledge on agribusiness decisions. This is a measure of viability computed from the profit margin. It is very useful as a measure of evaluating the economic viability of small scale projects by size of capital and duration. Central to this method of analysis is the categorisation of costs into two elements: Fixed costs and Variable or Operational cost. In a critical manner, this method is limited in that it is not comprehensive in the costs and benefits elements as it makes use just of the tangible cost and benefits.

However, this method remains extremely relevant in this work especially as the objective is to evaluate the profitability of a smallholder yoghurt production unit, so as to build a case for an inclusive market approach towards sustainable rural development using the cooperative model. The cooperative model facilitates the rebuilding of the broken link between the Agricultural Research Centres and the farming communities for sustainable rural development through the efficient use of local resources alongside the customised technologies gained from agricultural research centres on-station experiments. This link has evolved since the 80s and 90s with the emphasis on agro-ecological farming and agricultural integration to inclusive market models in 2010 with an extension of sustainable agriculture strategy from increased productivity to value addition of agricultural produce for a sustainable rural livelihood.

It is on this element of value added that basic food processing is acclaimed by this work to be the route to achieve sustainable rural livelihood as well as boost youth and female participation in agriculture with meaningful agribusiness as part of the Cameroon 3 year emergence plan (2015 – 2017) . This may appear doubtful in the scenario analysis of the contemporary trends of Yoghurt consumption and production given that it is connoted to be baby food. Thus, this work also pushes through the whole rationale of food consumption and cultural preferences within the Cameroonian population. That is, food is consumed not for affinity but for calories and nutrients intake. The argument here is that Yoghurt is a necessary part of every good and healthy feeding plan for the required calories intake especially as calories intake is the measure of famine (Ray, 2007). There are good technologies for postharvest from IRAD Bambui such as Yoghurt, Butter and Cheese technologies which are necessary value addition technologies that can boost youths and female participation in this rural community. This emphasises the role of IRAD in developing sustainable production and marketing systems as well as skills and projects that will facilitate both backward and forward market integration approaches for dairy farmers. For these reasons, data for this study was obtained from a 3 months experimental survey of small scale production of Yoghurt at the Institute of Agricultural Research for Development Food Technology Unit. In order to utilise the Return on investment

(ROI) to assess the economic viability of small scale yoghurt production, the data requirements include both elements of Fixed and Variable Costs. However, given that the cost mostly considered for this study is the variable or operational cost data were collected on these items of the variable cost: Milk, Culture, Containers, Labels, Sugar, Gas, Labour and Gum. The data of Milk was measured using the International System of Measurement (SI) Units of Litres (L) of milk. The essence of laying emphasis on the variable cost is because, firstly, it accounts for more than 90 percent of the total cost and secondly, it is considered that the farmers do not individually own the fixed capital as they can run the agribusiness using a cooperative model approach. The Return on Investment (ROI) is a calculation of the tangible financial gain that can be expected from a business as against the cost of production (NSDI, 2009). It is an economic calculation that reveals the attractiveness of an investment. As a performance measure, the ROI evaluates the efficiency of an investment in pure economic terms. It is one way of considering profits in relation to capital invested. It gives a view of profitability gotten from the size of the investment assets tied up in the enterprise (Ferris et al., 2010). A 50 percent ROI represents a positive return in the business. However, the aprior expectation of ROI is that, it takes a ratio value greater than zero for a business to be attractive. Thus, a low ROI can be tolerated. The formula below is used for this analysis:

$ROI = \frac{R}{I}$ 1.1

Where

R = Return (Vales of yoghurt in XAF and US$)

I = Investment (cost of producing yogurt in XAF and US$))

Return is the actual net profit calculated as:

GM = GI – VC

R = GM –FC.....…… 1.2

Investment will be calculated as:

I = VC + FC..... 1.3

Where;

GI = *Gross Income from sales of Yogurt in XAF or US$*

VC = *Variable Cost or operational cost in XAF or US$*

GM = *Gross Margin in XAF or US$*

FC = *Fixed Cost (rental Cost of Fixed capital) in XAF or US$*

I = *Investment or Total Expenditure on capital goods in XAF or US$*

For the computation of equations 1.1, 1.2 and 1.3, the data presented in Table 1 is used. These data are collected for the months of March, April and May. These months are the first part of the rainy season when the sales of Yoghurt are slow due to the fact that most consumers like it fresh or cold as a coolant especially during the dry season. Thus, the ideal period of yoghurt consumption in Bambui and most parts of the Western Highland is the dry season. These figures show a three months (quarterly) supply of fresh milk in litres as well as produced and sold yoghurt within this same period. Table1 below is a quarterly input, output and sales record while Table 2 is a technological matrix or Input-output Ratio as presented below.

Table 1 shows that 55 litres of milk input for the month of March was used to produce 58 litres of Yoghurt as output for that month. Of the 58 litres of yoghurt produced, 42 litres were sold in March and 16 preserved and carried forward to the next month. In April, 40 litres of milk supplied from the diary unit were used to produce 42 litres of yoghurt as total output for that month. However, of the 16 litres preserved from March 10 more were sold alongside the 42 litres produced in April to make a total of 52 litres of yoghurt sold in April. In the month of May 67 litres of fresh milk were supplied from the Diary Unit and 79 litre of yoghurt were produced and sold. The variation in production can be explained to some extent by the technology of yoghurt production which includes the use of the following elements:

i. The addition of culture;
ii. The addition of sugar;
iii. Variation in the sizes of the containers used; and
iv. The manual measurement of milk and Yogurt.

The variation in the marketing can be explained by the market strategies of the pricing policy and branding. The pricing policy encourages the buying of more yoghurt at a relatively cheaper price. That is, the sales of 1 litre of yoghurt for 1000XAF ≈ US$ 2 which has approximately 4 servings of 0.25 litre or 250ml which is sold at 350 XAF ≈ 70 Cents. This implies that if one has more income it will be rationale to buy 1 litre at 1000XAF ≈ US$ 2 than buy 4 units of 250ml at 1,400XAF ≈ US$ 2.8. This policy induces high purchase of yoghurt but without neglecting the low income consumers.

The branding strategy is limited to just labelling of the bottles or packages with tags showing the manufacture plant of the Biotechnology Unit of IRAD Bambui. This label guarantees the quality of the yoghurt given that there is no well defined quality control body in Cameroon that certifies these products. These are just 2 of the 4 key marketing mix used in the marketing of yoghurt produced in IRAD. That is, Price, Product, Place and Publicity.

Analysing the production and sales trend from the survey data reveals that, the efficiency of input usage and sales improve over production time. This is because for the month of May, approximately 0.95 litre of milk was used to produce a litre of yoghurt. In April approximately 0.95 litre of milk was used to produce a litre of yoghurt. In May approximately 0.85litre of milk was used to produce a litre

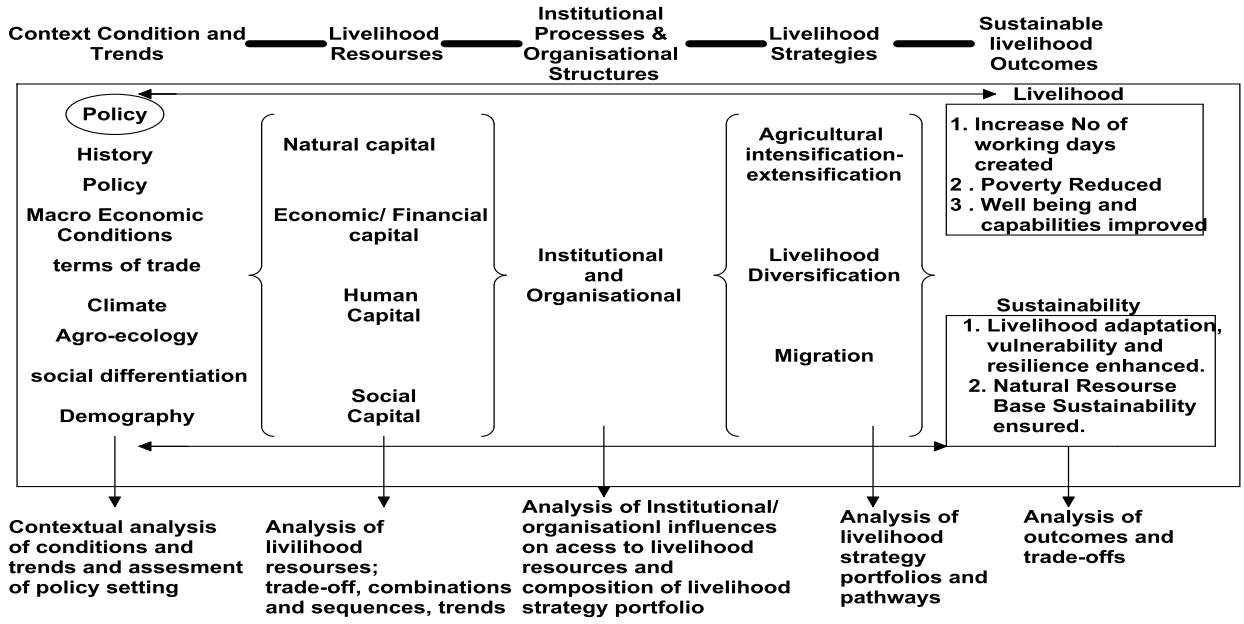

Figure 1. IDS Sustainable Rural Development Framework (Scoones, 1998).

Table 1. Quantity of Fresh milk supplied, Yogurt produced and sold over a peri od of 3 months.

Month	Quantity of milk suppli ed (litres)	Quantity of Yogurt prod uced (litres)	Sales (litr es)
March	55	58	42
April	40	42	52
May	67	79	79

Source: Recorded by authors at the Biotechnology Unit of IRAD, Bambui.

litre of yoghurt. The technology of milk processing to yoghurt definitely increases the shelf life of fresh milk. Looking at the May and April month 16 litre of yoghurt was deferred from March to April and of the 16 litres, 10 litres was sold in the month of April which justifies the fact that yoghurt increases the shelf life of milk by 21 days. (Bayemi et al, 2005). Processing milk into these products will help extend shelf life without modifying the nutrient content. This is true as Yoghurt can last for 21days before getting rancid and it is rich in vitamin C, A and B. So if milk is being processed into yoghurt, it will contain vitamin A, B and C (as seen in the vitamin contain for fresh milk) and still be able to go for 21days before getting rancid. For the sales, the sale production ratio increases from approximately 72 percent of production to approximately 89 percent and lastly 100 percent of production. This reveals to some extent that the market is expanding as many come to know of the product. This further implies that marketing strategies such as branding like the MIDENO Robusta Coffee and pricing result in increases in sales as the market is still to be fully developed.

Profitability Analysis of Yoghurt Production

Fresh Milk is processed by the Biotechnology Unit of IRAD Bambui into several dairy products amongst which is Yoghurt is one of them. The economic analysis of yoghurt is the main interest of this work. Yoghurt is produced and sold for 1000XAF ≈ US$ 2 and 350XAF ≈ 70 Cents for 1litre and 1/4 litre respectively. The profitability analysis of small scale yoghurt projects is aimed at assessing the viability of small scale projects using the Return on Investment (ROI). This is to build a case for the cooperative model of yoghurt production within the Bambui community and her environs. In order to carry out the Return on Investment Analysis the Cost elements are classified into Fixed and Variable or operati-

onal cost as presented on Table 3 below. During this 3 months period, the factors of production included some fixed cost elements which were computed on a daily base using the depreciation rate approach presented on Table3 below.

Table 3.shows that the daily fixed cost of yoghurt production was 583XAF ≈ US$ 1.2. This implies that if the services were to be hired the rental fee was going to be at least 583XAF ≈ US$ 1.2 which is affordable for small-scale yoghurt producers. However, the interest of the study is the variable cost. In the yoghurt production for this period the variable cost was computed as presented below on Table 4.

Table 4 shows the variable cost of production of 175 litres of yoghurt. This cost amounted to 130,005 XAF (US$ 260). That is, for a total input of fresh milk of 162 litres and a total yoghurt production of 179 litres the variable cost of production was 130,005XAF (US$ 260). This implies that the Average Variable cost of production or the per unit cost of production is 726.3XAF ≈ US$ 1.45 at 500XAF per US$ exchange rate. Using the Shut down Rule of Theory of the firm;

P = AVC..... 1.4

Where

P is the selling Price of a litre of yoghurt in XAF or US$

AVC is the Average Variable Cost or Per Unit Cost of Total Physical Production

That is

1000XAF > 726.3XAF or US$ 2 > US$ 1.45

ROI = Return/Investment..... 1.5

GM = GI – VC

R = GM – FC..... 1.6

Investment = VC + FC..... 1.7

Where;

GI is the Gross Income (Total value of Production or Sold Output * Price) in XAF or US$

VC is the Variable Cost (cost that vary according to the level of production)

GM is the Gross Margin in XAF or US$

FC is the Fixed Cost in XAF or US$

R is the Return in XAF or US$

Thus,

GI = 175 * 1000 = 175,000XAF ≈ US$ 350

GM = GI – VC

175,000 – 130,004.05XAF = 44,995.95 ≈ US$ 89.99

R = GM – FC

R = 44,995.95XAF - 582.7 = 44,413.25XAF ≈ US$ 88.82

Investment = FC + VC

= 582.7 + 130,004.05

= 130,586.75XAF ≈ US$ 261.17

To get the profitability rate in monetary terms, the calculation will be done as seen below

Profit = GI - I

= 175,000XAF -130,586.75XAF

= 44,413.25XAF ≈ US$ 88.82

As for the ratio of profitability, the Return is divided by Investment as shown below.

ROI = R/I

R = 44,995.95 ≈ US$ 89.99

I = 130,586.75 ≈ US$ 261.2

ROI = (44,413.25/ 130,586.75) *100

= 0.34 * 100

= 34 Percent

The ROI above computed indicates that to every 1 XAF investments there is a 0.34 percent return. That is, to every 100XAF investment on the Variable cost results in a 34 XAF return on that investment. Furthermore, a 1000 XAF investment on the variable cost will results in a 340 XAF return on that investment.

DISCUSSION OF RESULTS

The Return from producing 175 litres of Yoghurt and selling at 1000 XAF or US$ 2 a litre computed using the Return on Investment Ratio was 44,413.25XAF ≈ US$ 88.83 and yielded a 34 percent or 340 XAF ≈ 70 Cents return to every 1000 XAF ≈ US$ 2 invested in the production and sales of a litre of yogurt. Also in the Total Cost ratio between the Fixed and Variable Costs, the variable cost was 130,005XAF ≈ US$ 260.05 and made up over 99 percent of the total cost of production compared to 1% for Fixed Cost of a total cost of 130,586.75XAF during the 3 months.

This result is similar to the findings of Nchinda et al. (2008) that asserted that the Variable Costs account for 96% of the cost of production for yoghurt producers of the Western Highland Agro-ecological zone of Cameroon as compared to 4% for fixed cost. This result shows that per unit profit is 253.79XAF which is greater than the cost of a litre of milk which was procured at 250XAF. This implies

Table 2. Milk/Yogurt Ratio and Production/ Sales Ratio (Physical Relationship Analysis).

Month	Milk/Yogurt Ratio	Production/ Sales Ratio
March	0.9482	0.7241
April	0.9523	0.8966
May	0.8481	1.000

Source: Computed by authors.

Table 3. Economic Analysis; Fixed factors and Depreciation cost.

Item	Original unit cost (XAF)	Useful life (in years)	Amount of annual depreciation (XAF)	Amount of monthly depreciation (XAF)	Amount of daily depreciation (XAF)
Refrigerator	264,285	15	1,7619	1,468.25	47.4
Cooker	25,000	15	1,666.7	138.9	4.5
Incubator	3,861,000	20	193,050	16,087	518.9
Pots	16,000	10	1,600	133.3	4.3
Table	15,000	20	750	62.5	2.0
Thermometer	15,000	10	1,500	125	4.0
Water baths	6,000	10	600	50	1.6
Total	**4,186,285**		**216,786**	**18,065**	**583**

Source: Survey data (March – May, 2014).

Table 4. Variable Cost of yoghurt production.

Item	**Amount used (March-May)**	**Cost (XAF)**
Milk	162	40,500
Culture	4,050	6,075
Containers	175	26,250
Sugar (cubes)	2,437	8,529.5
Labels	175	2,625
Gas	-	2,320.5
Labor	-	43,680
Gum	-	24.05
Total	**-**	**130,005**

Source: Survey data (March – May, 2014)

there is a 101.516 percent Return on Investment in milk procurement for each litre of yoghurt produced. The ROI in yoghurt production shows that the product is undervalued because it is an on-station experimental project. However, by virtue of its value, plain yoghurt should sell between 1200-1500 XAF ≈ US$ 2.4 – 3 a litre. Despite the low price, it is still a profitable venture for small scale dairy farmers and it also permits consumers to save money rather than spending on expensive imported yoghurt with serving of 0.65ml selling at 250 XAF ≈ 50 Cents. This is therefore the base for advocating for a Cooperative Model approach to sustainable rural livelihood in the Bambui community. In this case, there are a lot of favourable factors such as the Institute of Agricultural Research for Development (IRAD) with Animal Sector with key technologies like the artificial inse-

mination to produce high milk yielding species, Heifer Project International, the Food Technology Unit with the milk processing technologies. All of these along the many financial cooperative societies, a cooperative model for yoghurt production like the TADU Cooperative Model will result in more sustainable rural livelihood better that the long hours of grazing and little milk production and no processing which ends up just as subsistence production. The essence of the economic analysis was to build the argument on the economic viability of the small scale production units that have a joint ownership and management under the cooperative model. In this case each small scale farmer can successfully investment in the venture and be sure it will be a profitable venture that he has invested in especially with a ready market in the urban Centres of the Western Highland.

From a broader perspective and as guided by the principle of economics of scale agro-processing projects at large scale such as a cooperative will be more profitable and cost effective. This is very feasible method process highly perishable agricultural produce like fresh milk and vegetables and increase farmer resilience. This is on the bases of the institution of research centre close to the rural population which help reduces their vulnerability to price fluctuation by handing down customised technology to increase their resilience through basic or Ultra Processed Products.

In the Sustainable Rural Livelihood Framework the institutions are pivotal in the transforming of rural livelihood. Given that this technology is from the Institute of Research for Agricultural Development, it can be patented or certified to play a key role to guarantee quality by certifying the Products after quality control like the Hazard Analysis Critical Control Point (HACCP). This will increase the marketability of the products and develop the diary product sector in Cameroon by breaking the Monopoly or Duopoly enjoyed a few giant firms (Camlait, Fresh Co and Top Lait) that occupy over 70 percent of the diary industry in Cameroon.

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