FEATURES AND PROFITABILITY OF DOMESTIC GRASSCUTTER PRODUCTION IN THE BRONG AHAFO REGION

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Ghana's national economic surveys of the 1960s and even now, repeatedly, report that the country's main sources of meat consumption, like previous years, is the slaughter of mostly imported livestock supplemented by wild animal hunting (bush meat i.e. all types of meat obtained from the wild), particularly in the rural areas (Ntiamoa-Baidu, 1998).

Ghana's main sources of animal protein are fish, livestock and bush meat. However, livestock production is not sufficient to meet the national meat requirement. Ghana produces only 40,000 tons of meat annually, representing 20% of an estimated national requirement of 200,000 tons per year (Obimpeh, 1987). It is evident that the national herd of livestock is not adequate to meet the country's demand for meat. Therefore there is the need to develop other sources of acceptable meat in addition to conventional livestock.

The grasscutter (*Thryonomys swinderianus*) is an important source of meat and is acknowledged to be the preferred meat virtually throughout Ghana and the West African Sub-Region (Martin, 1985; Asibey, 1969; 1978; Falconer, 1992; Ntiamoa-Baidu, 1998; Vos, 1978; Baptist and Mensah, 1986). The meat is appreciated because of its culinary properties (Ajayi, 1971; Hartog and Vos, 1973; National Research Council, 1991; Anon., 1993) with demand consistently outstripping supply (National Research Council, 1991). The National Research Council (USA) includes the grasscutter in its list of "Micro-

livestock: Little-Known Small Animals with a Promising Economic Future" (Addo, 1998).

The potentials of grasscutter farming as a means of poverty alleviation, as well as its contribution to keeping environmental health has long been recognized in Ghana (Yeboah and Adamu, 1995; Adu, 2002). However, the impact of grasscutter farming is yet to be felt in the national development agenda. And though grasscutter farming has been practiced in Ghana for some decades now, the enterprise still remains in the hands of smallholder farmers who are generally poor and have neither the institutional nor economic power to ensure that their technology needs are met by public sector research (Anandajayasekeram, 1999).

According to an FAO Document Repository on Wildlife utilization and food security in Africa, there is no doubt at all that domestication and farming of favourite "wild animal species" could provide viable complementary or alternative sources of animal protein. However, the key to its acceptance on a wide scale depends on the development of technical know-how and cheap methods of production (http://www.fao.org/docrep).

The demand for grasscutter meat in Ghana is high with its accompanying price hikes, making the prospect of grasscutter rearing very bright and encouraging either as a full-time or part-time job. Asibey (1987) estimated that about 80% of the rural population in Ghana depends on game meat for their dietary protein supply, and that the most

commonly consumed species of game meat by those living in rural areas is the grasscutter. Grasscutter meat is also a delicacy in big towns and cities in Ghana.

In the late 1960s the need to diversify Ghana's sources of animal protein was reviewed. During that process, Ghana's Department of Game and Wildlife singled out the grasscutter for scientific investigation as a potential source of meat. The popularity of the grasscutter meat among other reasons led to several studies on the animal during that period with the primary aim of domesticating the species for large-scale farming and production of the meat for human consumption (Ajayi, 1971).

Grasscutters or cane rats (Thryonomys spp.) are widely-distributed and valuable animals in West and Central Africa. Within the West African sub-region, grasscutter is the favourite bushmeat species and accounts for the greater proportion of bushmeat sold in markets (Falconer, 1992; Ntiamoa-Baidu, 1998). The grasscutter is available throughout the country. Its savannah habitat has expanded as a result of encroachment on forest lands by crop farmers. Studies by Baptist and Mensah (1986); Schrage and Yewadan (1999) showed that most of hitherto setbacks to its captive breeding can be overcome. Therefore, as part of resources to provide food security, job opportunities and income generation, (particularly for both rural and urban poor), early surveys (Asibey, 1965, 1966, 1969, 1971) as well as recent surveys (Ntiamoa-Baidu, 1998) have shown that most Ghanaians, irrespective of their educational, economic or social status, would eat 'bushmeat' (the common term for game animals in Ghana) as and when it is available.

Research has been carried out over the past 15 years in Benin under the Project Benino - Allemand d'Aulacodiculture (PBAA) to select and improve stock in order to enhance their adaptability to a restricted life in captivity and to develop rearing programmes in rural and peri-urban areas of Africa.

More recently, intensive production of grasscutters has been undertaken in countries such as Benin and Togo and agricultural extension services in Cameroon, Côte d'Ivoire, Gabon, Ghana, Nigeria, Senegal and Zaire have also encouraged farmers to rear these rodents in rural and peri-urban areas (Asibey, 1971; Baptist and Mensah, 1986; Mensah, 1991).

Grasscutter production in Ghana was started by Asibey and also the Game and Wildlife (now Wildlife Department) in the 1970s. Asibey worked directly with farmers and interested farmers were given cages and initial breeding stock (mostly captured from the wild). However, the initial interest and efforts put into the project did not result in the establishment of any large scale, grasscutter farms and only a few people continued with the idea of back-yard grasscutter farming.

Organized formal grasscutter production, however, was started in the Brong Ahafo Region of Ghana by the German Technical Co-operation Sedentary Farming Systems Project (GTZ/SFSP) in collaboration with the Animal Production Unit of the Ministry of Food and Agriculture (MoFA) in 2000. The start of the grasscutter project in the Brong Ahafo region was inspired and motivated partly by the success of the GTZ-PAAB project

in Benin; where the animal had undergone over two decades of domestication and selective breeding, and partly by the fact that grass, the major feed of the animal abounds in the region.

1.2 PROBLEM STATEMENT

Over the years, the demand for grasscutter meat has been met through hunting from the wild. This has been done by the use of chase dogs, baiting with chemicals with harmful effects on consumers and other untargeted species, or by bush burning which mainly results in bushfires (Yeboah and Adamu, 1995; Oduro and Kankam, 2002). In the wild, the grasscutters multiply by themselves, but high demand for the meat has resulted in a decline in their numbers. Evidently, the future availability of grasscutter meat through these above-mentioned conventional means as well as its sustainability is in question.

In recent times a lot of research work has been done on domestic grasscutter production because the meat is known to be popular among majority of the population and thus producing them under domesticated conditions in higher numbers would be a good source of supplementing the country's inadequate protein needs which is dependent on conventional livestock (cattle, sheep, goats, pigs and poultry).

Several studies have confirmed the feasibility of rearing the grasscutter in captivity and also demonstrated that its litter size could be increased with good feeding (Schrage and Yewadan, 1999; Adu, 2000). However, this initial interest and efforts did not result in the establishment of grasscutter farms and only a few people continued with the idea of back-

yard grasscutter farming. The waning support could be attributed mainly to the relatively large initial capital investment required, the lack of readily available breeding stock, and problems of feed during the dry season and the many unresolved and poorly understood issues associated with diseases in captive grasscutters.

Furthermore, most of the recent studies tend to focus primarily on addressing the challenges of appropriate housing and feeding for the domestic grasscutter production albeit little seem to have been done regarding the profitability of the venture, as is evident by some researchers. Much of current small ruminant research is dominated by descriptions of production systems and traits (ILCA, 1979; Gatenby and Trail, 1982; Wilson and Bourzat, 1985; Sumberg and Cassaday, 1986). Little economic analysis of the frequently reported constraints has been done.

1.3 MAIN OBJECTIVE

The main objective of this study is to examine the profitability of domestic grasscutter production as an economic venture among farmers in the Brong Ahafo Region.

1.3.1 Specific Objectives

The main objective would be achieved through the following specific objectives:

- To describe the features of domestic grasscutter farming in the Brong Ahafo Region
- To determine the costs and returns associated with domestic grasscutter production

- To ascertain the profitability and viability of domestic grasscutter production
- To identify and measure the socio-economic determinants of profitability in domestic grasscutter production
- To ascertain the problems and externalities of domestic grasscutter production

1.4 JUSTIFICATION OF THE STUDY

Majority of farmers in developing countries are poor and avoid taking risk in adopting new technology until they are sure about its benefits. For more than 30 years it has been clearly evident that harnessing the production of bush meat could be part of the solution to the country's animal protein shortage. With the majority of the Ghanaian population living in rural areas, grasscutter farming will create employment avenues for the unemployed. Again, people living in these areas with their main source of income from farming can use grasscutter farming to supplement their income especially during the periods when there are no farming activities. Moreover, since grasscutter rearing does not require much labour, time and space, it will be an important means of supplementing household income for people living in the cities and other urban areas of the country.

One of the main causes of bush fires in the country is search for game and out of which grasscutter forms the majority, if people can keep grasscutters close to them, it would in the long run help curb the rampant destruction of the forest through bush fires thereby conserving the biodiversity.

The grasscutter feeds mainly on green plants especially those with succulent stems such as elephant grass (*Pennisetum puerperium*), guinea grass (*Panicum maxima*), and foliage of certain leguminous plants, maize husk, tubers of yam, cassava and other root crops. These materials are readily available and can be obtained at little or no direct cost. The animal also requires little space under captivity as compared to others like cattle, sheep and goats.

Again, these animals are non grazers, since their feed requirement is mainly dependent on cut grass supplied by the farmer; environmental degradation as a result of overgrazing, which is a problem in ruminant production is eliminated.

There is the need to develop the grasscutter industry to the status of a viable commercial venture, capable of meeting both local and foreign demands without depending largely on hunting from the wild. But before grasscutter production can fully be embraced by farmers, the level of profit from undertaking such an economic venture should be remunerative enough to provide an economic incentive for undertaking such a venture.

Since the objective of any economic venture is to make profit, there is the need to examine the profitability of grasscutter production by identifying the factors that influence the level of profitability and determining their respective percentage contributions, as a first step in any attempt towards undertaking commercial grasscutter production under domestic conditions.

1.5 LIMITATIONS OF THE STUDY

Some farmers targeted for interview based on their stock size from the monitoring sheets were found not to have that number of animals (two-starter family production unit) or were no longer in production. This resulted in covering fewer respondents than anticipated.

There was no properly kept record on farm operations, expenses and sales. It is presumed that the responses of the farmers, used in this study, are thus approximations of what could have been the most accurate information

In spite of the shortcomings spelt out, all possible means were explored in order to present more accurate information upon which sound decision can be made.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 GRASSCUTTER PRODUCTION AS A SOURCE OF LIVELIHOOD

Animals are known to make important contribution to livelihoods in smallholder farming systems throughout the developing world (Arriaga-Jordan and Pearson, 2004). For example, the sheep enterprise in the Ethiopian highland crop and livestock system were found to be the most important form of investment and cash income, and provided social security in bad crop years (Getachew, 1988). In Yatenga, Burkina Faso, livestock cash income was 33% to 99% of total farm cash income, with goat and sheep sales providing 52% of livestock cash income (Bourzat, 1985).

In most developing countries, the living conditions of local people are severely affected from time to time, by a number of basic needs such as; lack of food, poor income generation (poverty), droughts, desertification (in the sahelian part), diseases, and poor education. This implies resource use namely subsistence hunting (bushmeat), medical and customary use of some wildlife species, etc. (Zeba, 1998).

According to an ECOWAS report on desertification in 1993, for more than 50% of West Africans, subsistence farming supports the families for up to 9 months in the year. In the absence of appropriate technologies, funds for mechanisation and a sustained supply of adequate quantities of inputs, good productions remain a dream as shifting cultivation prevails. The farmers are very aware of the declining yields and even blame it on the

disappearing forests. This situation seems caused by demographic pressures on lands, and market economy that pushes people to produce more crops for trade (wool, coffee, cocoa, etc). However, the revenues of such trade are not enough for their needs (health, habitat, children's education, social obligations, etc). As a consequence, people are obliged to over-utilize other land resources like wildlife, in order to bridge the food gap (Zeba, 1998).

Domestication of some wildlife species can provide sound solutions through income generation, bushmeat production, and conservation of forests. Wildlife domestication can help combat poverty by creating more revenues for local people. It is clear that any success in combating poverty through such a concept would help discourage local people from becoming involved in poaching activities.

According to Adu (2002) the captive rearing of grasscutter is simple and easy to implement by local people. It's also an efficient tool for combating poverty, particularly in the wooded savannah zones, in most coastal countries.

Mwangi and Omore (2004) noted that though livestock help poor farmers in Africa to accumulate capital and to have an inflation free form of banking, the start-up capital is too high for poor farmers. Among the problems enumerated as facing the livestock sector in African economies are: low quality of breeds currently kept, low quality feeds, diseases, poor management, lack of or inadequate support services to livestock keepers, inappropriate policies and low access to input and output markets.

Yasmin *et al* (2003) concluded the goat industry is one of the most important industries for meat production and for alleviating poverty. They indicated that although the goat industry is profitable, it is in no better condition due to factors such as high rearing cost, lack of proper management, insufficient health care and marketing facilities.

Different factors affect the animal production industry, and Sarmin (1998) developed an econometric model for analyzing the important factors and their linkages relating to beef animal development, the supply of beef animals for slaughter and the demand for beef. It was found that beef price rated high among the important determinants of beef production in Malaysia.

2.2 BUSHMEAT PATRONAGE IN WEST AFRICAN COMMUNITIES

In the whole of West Africa, there is a considerable demand for bushmeat because people do prefer it to domestic meat. In most cases, demands for bushmeat exceed regenerative capacity; and this could probably be reduced by developing new and appropriate sources of protein. In other words, excessive bushmeat demand could be reduced by domesticating some wild species but any innovation promoted needs to be accepted by the prevailing social and cultural environment. For instance, with respect to taboos, snails and pork are not consumed in certain societies owing to cultural or religious belief (Ocloo, 1993).

However, unlike some animals which may not be killed or touched because of formal religious dictates, traditional taboos or prejudices (Ocloo, 1993; Vos, 1978), the

grasscutter meat transcends religious prohibitions and Muslims who do not consume rabbit or guinea pig are known to consume grasscutter (Anon., 1993). Since the grasscutter meat has such wide acceptance, its demand is very high and cannot be met from hunting wild populations alone (National Research Council, 1991).

Nevertheless, it should be recognized that there is currently very little domestication of wild animals, because it is culturally unusual in the whole region to breed wild species. It is quite the opposite in Eastern Africa, where Massaï people don't mind mixing their cattle with antelopes. According to Lungren Clark, a Canadian wildlife manager at the Nazinga game ranch, the presence of domestic animals in West African forests means the absence of wild animals. Nowadays, wild animals breeding would be really profitable, given the considerable demand for bushmeat. For example Dilys Roe (IIED) reported that dignitaries from Abidjan who were visiting a project in Serebou (Côte d'Ivoire), asked for bushmeat, in place of the chicken they were offered (Zeba, 1998).

In Cote d'Ivoire for example, bushmeat surveys in the region of Toumodi and Comoé have shown that the commercial value of traded bushmeat reached 50 billion CFA per annum (US$ 100 million/year). Through extrapolations from the whole country, the coordinator of the national planning program for the management of protected areas PCGAP concluded that the annual contribution of bushmeat to Ivorian economy is around US$ 400 million (Zeba, 1998).

It is reported that, 5 tons of bushmeat have been recorded during a market day by the PCGAP survey. Other bushmeat surveys in Ghana (Ntiamoa-Baidu, 1998), in Mali and Burkina Faso (Zeba, 1998) do confirm the special interest of West Africans in bushmeat.

2.3 BUSHMEAT PREFERENCE AND AVAILABILITY IN GHANA

A survey by Ntiamoa-Baidu (1998) has revealed that chicken is the most preferred animal protein followed by bushmeat, then fish and livestock. In terms of availability, fish is the most available, followed by beef, then chicken and bushmeat. It is therefore not surprising that bushmeat, the second most preferred meat which is not readily available tends to be the most expensive (Ntiamoa-Baidu,1998b) and thus no longer within the economic reach of the rural poor. Hence their willingness to sell the bushmeat for cash income to be able to buy the cheaper fish which is also more readily available both fresh (frozen) and smoked. This situation creates heavy hunting pressure on the wild animals thus making hunting (both communal and individuals) intensive and extensive.

The creation of a Wildlife Department in Ghana in 1965 (unlike other parts of Africa), was necessitated by the then heavy hunting to feed an insatiable bushmeat market in the country. It was feared that in the absence of specified breeding areas, where there should be no hunting, the wild animal resource of the country would be hunted to extinction. The policy was, and still is that; representative samples of the country's ecological zones should be set aside for wildlife (wild animals and their habitat) preservation. It was anticipated that with such approach, bushmeat production would be sustainable, at least, in the lands surrounding the protected areas.

This was a period when in other parts of Africa, wildlife preservation was closely linked to tourism and the protection of life and property against wild animals. It was generally felt that wildlife conservation in Ghana could not (and it still cannot) be justified on grounds of its role as tourist attraction in comparison with other parts of Africa such as

East and Southern Africa (Mills-Odoi *et al*, 1967). Therefore there was no justification for a wildlife program in the country. Donors were interested in supporting the livestock but not the wildlife initiatives of the country.

Nonetheless the Department was allowed to remain to develop a system of wildlife protected areas for the country. Hunting for bushmeat was considered as the knell of wild animals in the country. The Wildlife Department therefore undertook bushmeat surveys to find out animals that frequently entered the hunter's bag while at the same time finding out appropriate lands to be set aside to create the country's system of wildlife protected lands. There was serious resistance against the abolition of hunting in such reserves and compulsory acquisition laws had to be use d to establish the system of wildlife reserved lands, palliated with the assurance that hunting outside the protected lands could continue. It was also generally accepted that, with time, these areas might be the main sources of wild animals in the country that would restock their surrounding lands. It is now clear that in view of the ever growing hunting pressures and the demand for bushmeat, the sustainability of bushmeat supply is in question (Ntiamoa-Baidu, 1998). Decline in wildlife population is evidenced by the fact that hunters have to travel long distances and invest a lot of time before obtaining a decent bag of bushmeat.

Due to its widespread acceptance in Ghana, a bushmeat trade network is well developed: involving hunters, wholesalers, retail traders, butchers and chop bar owners as well as the general public (Falconer, 1992). Women dominate the trade while men are mainly involved as hunters (Ntiamoa-Baidu, 1998).

The bushmeat trade has been a remunerative business for several years therefore fourth generation bushmeat traders can be found (Falconer, 1992). The bushmeat trade is very lucrative, as an annual bushmeat harvest by a survey tagged the income at US$350 million (Ntiamoa-Baidu, 1998). The income generated is estimated to be actually more than half a billion dollars a year.

Bushmeat trade, heavily dominated by the grasscutter, provides economic justification for sustainable production and use of wild animals in Ghana (Ntiamoa-Baidu, 1998), and thus one of the main economic bedrocks of wildlife conservation in the country. There is a call for captive breeding and ranching of wild animals as part of steps to be taken to assure sustainable use of bushmeat.

2.4 SOURCES OF BUSHMEAT SUPPLY

Surveys have revealed that bushmeat dealers in Ghana received their supplies from all the regions of Ghana indicating that all the regions are involved in the Bushmeat trade even during the closed season (Ntiamoa-Baidu, 1998). Bushmeat is sent to the major markets either smoked or fresh. Those using bushmeat for medicinal purposes cut the meat into various parts (bones, skull, skin, hair, tails, jaws, intestines, limbs) and dry them for their clientele.

Standards for bushmeat processing and marketing vary from one area to the other. There seems to be absolutely no rules or standards for the bushmeat trade in Ghana and the quality of bushmeat offered for sale on the markets varies widely. While there may be

standards set to ensure domestic meat hygiene, these either do not seem to apply to bushmeat or are totally ignored when it comes to bushmeat marketing and processing (Ntiamoa-Baidu, 1998).

The bushmeat trade has evolved over a long period of time and developed into an intricate network of hunters, wholesalers/middlemen (mostly females, popularly referred to as "queen mothers"), retailers (restaurant /chop bar operators) and consumers. Hunters kill the animals and either transport them long distances to the marketing centres for sale to middlemen or the queen mothers travel to the farm gates to buy the bulk of bushmeat killed. It is common for animals killed on night hunting trips to be kept till day break before they are sold. Animals caught in traps may stay in the traps for up to three days if trappers do not visit their traps regularly for one reason or another. Sometimes such carcasses are almost beginning to decompose, but they will be collected and either sold as 'fresh' bushmeat or smoked for sale (Ntiamoa-Baidu, 1998). There also seem to be no standards for smoked bushmeat and it is common to find improperly smoked bushmeat offered for sale on the markets. The "queen mothers" sell the bushmeat to the retailer in the state in which they bought them. The retailers, mostly restaurant/chop bar operators, process the bushmeat for sale to consumers.

2.5 DOMESTICATION OF THE GRASSCUTTER

The idea of domesticating wild animal species for meat production to improve protein supply in Africa is not new. As far back as 1848, the domestication of the eland and buffalo was mooted in South Africa (de Vos, 1978). However, despite these early

intentions, the only African wild animal species which have been successfully domesticated completely are the ostrich and the camel. A number of species, e.g., the crocodile, are farmed on large scale under semi-domesticated conditions. Domestication of wild species has been particularly popular in the West African sub-region where bushmeat is a most important dietary item.

Adaptable and prolific, many rodent species have been and continue to be a delicacy in a number of countries. Not restricted to the tropics, dormice were favoured by the Romans and they are still eaten in parts of Europe, while squirrels are a choice game animal in the United States. However, it is in Latin America, Africa and Asia where markets offer a particularly wide variety of rodent species for consumption and are often preferred over other meat sources (Jori *et al*., 1995). The vast majority of these animals are still gathered from the wild and several species have been hunted so extensively that they are now extinct or endangered. However, even with species that are plentiful in supply, the increasing demand for bush meat offers small-scale farmers an economic incentive for raising these species in captivity.

Grasscutters, otherwise known as cane rats, (*Thryonomys spp*.) are widely distributed and valued in West and Central Africa. Like guinea pig, the meat is of a higher protein but lower fat content than domesticated farm meat and it is also appreciated for its tenderness and taste (Jori *et al*., 1995). In the past and even present this animal has been hunted extensively, although, in the savanna area of West Africa, people have traditionally captured wild grasscutters and fattened them in captivity (Jori *et al*, 1995; Asibey, 1974b). More recently, intensive production of grasscutters has been undertaken in countries such as Benin and Togo and agricultural extension services in Cameroon, Côte

d'Ivoire, Gabon, Ghana, Nigeria, Senegal and Zaire have also encouraged farmers to rear these rodents in rural and peri-urban areas. This in most part could be attributable to research carried out in Benin under the Project Benino – Allemand d'Aulacodiculture (PBAA) over the last two decades, which aimed to select and improve grasscutter stocks genetically adapted to life, and to promote the rearing of the animal in rural and peri-urban environments for small and large scale farming (Baptist and Mensah, 1986; Schrage and Yewadan, 1999). Much knowledge and techniques for grasscutter production has been determined from the work carried out at this Benin-Germany cane rat breeding station, which was established in the mid-1980s. And practical information is now more readily available for farmers interested in grasscutter production but training is still advised (Schrage and Yewadan, 1999).

Studies in Ghana in the 1970s demonstrated that the animal could be kept in captivity (Asibey, 1966). Work was followed by studies on several aspects of the biology and ecology of the animal in Ghana (Asibey, 1974b; Ntiamoa-Baidu, 1980) and in Nigeria (Ajayi, 1971). In addition to the field studies on feeding and reproductive ecology, Asibey also worked directly with farmers. Interested farmers were provided with a starting stock of a male and a female grasscutters (mostly captured from the wild) and a cage. The performance of the animals was monitored by trained extension workers. The idea was that the research findings could be applied directly by farmers and that both rural and urban household could rear grasscutters in their back-yard to provide meat to feed the family. These studies confirmed the feasibility of rearing the grasscutter in captivity and demonstrated that its litter size could be increased with good feeding.

Unlike other rodent species, the high exploitation of grasscutters in the wild has not had serious effects on its numbers. They have adapted easily to deforested areas and occur in close proximity to farmlands and people. However, there are areas where the species has been over hunted and savanna habitat is often at risk during the dry season from bushfires, which are lit during bush meat hunting expeditions. Grasscutters are not the most prolific of rodent species but the high demand, and the more attractive per unit market price than that of beef (Baptist and Mensah, 1986; Mensah, 1991), and the fact that it accounts for the greater proportion of bush meat sold in the markets makes grasscutters a suitable micro-livestock activity for income generation in many parts of West and Central Africa.

2.6 REASONS FOR DOMESTICATION

It is worthy to note that in terms of bushmeat preference in Ghana, the grasscutter (*Thryonomys swinderainus*) is the most preferred among eleven (11) preferred wild animals, accounting for 65.1 % of the total preference. This is confirmed by the fact that it is the most sought after consumed bushmeat in the restaurants and chop bars throughout the country. According to Ntiamoa-Baidu (1997) grasscutter remains the most important Bushmeat species throughout West Africa in terms of volume of trade and preference. There is also an indication of over-dependence of consumers on this single species, culminating in over exploitation, as she observed, according to some of the traders, who reported that smaller sizes are now being hunted and sold, as compared to previous years. Even though the species breeds prolifically, the current rate of

exploitation could be more than what the reproductive capacity of the populations in the wild could sustain.

The high dependence of consumers on this single species provides justification for the promotion of the grasscutter (*Thryonomys swinderianus*) domestication programme. This is because there is currently, adequate demand for the meat of this species and any investment is most likely to readily pay off and contribute enormously to reducing the high market demand on other wild animal species.

Caspary (1999) observed that most exploited species were those considered to cause damage to agricultural areas.

2.7 FARMING WILDLIFE VERSUS DOMESTIC LIVESTOCK

To be economically attractive, wildlife farming would have to offer returns per unit investment equivalent to rearing domestic species. This is generally not the case, due to the low productivity of many wildlife species compared to domesticated ones. The general lack of experience in raising wild species also makes these farms riskier than raising domestic animals. Production for cane rats is more complicated than that of domesticated livestock (Jori *et al*., 1995). Asking marginalized farmers in developing countries to expend considerable amounts of time, energy, and capital on untried systems is unlikely to succeed. Finally, slaughter and processing requirements of wildlife species are less likely than domestic species to meet national health and hygiene regulations in many countries (Jori *et al*., 1995).

2.8 HABITAT AND DISTRIBUTION OF THE GRASSCUTTER

The grasscutter is a wild herbivorous rodent erroneously regarded by some people as a larger version of the rat. It is rather related to the African porcupine, the brush-tailed porcupine as well as the guinea pig, chinchilla and the capybara of South America (Wood, 1955; Asibey, 1974a; Baptist and Mensah, 1986; National Research Council, 1991). The grasscutter is found only in Africa (Rosevear, 1969; Baptist and Mensah, 1986; Adoun, 1993). In West Africa where grass provides its main habitat and food, it is commonly known as the "grasscutter" or the "cutting grass" while in other parts of Africa, particularly Southern Africa, where it is closely associated with cane fields, it is called the "cane rat."

The grasscutter is found in grasslands and wooded savanna throughout the humid and sub-humid areas south of the Sahara (National Research Council, 1991), specifically from Senegal to parts of the Cape Province in South Africa (Rosevear, 1969). It can also be found in any area where there is dense grass, especially reedy grass growing in damp or wet places. They do not inhabit rainforest, dry scrub or deserts, but they have colonized road borders in forest regions (Asibey, 1974(a); National Research Council, 1991). Its distribution is determined basically by the availability of adequate or preferred grass species for food (National Research Council, 1991).

In the context of West Africa, the grasscutter cannot be considered a threatened or disappearing species of wildlife (Baptist and Mensah, 1986). On the contrary, forest clearance in the Guinean zone has expanded its ecological habitat from the savanna regions into cropped areas and secondary forest, following agricultural encroachment on

forests (Baptist and Mensah, 1986). Similarly in Ghana, the grasscutter has penetrated the high forest where there is intensive maize, cassava, sugar cane, young cocoa, coconut, oil-palm, pineapple and egg plant cultivation (Asibey, 1974a). The farms offer the grasscutter food all year round and the animal is now considered agricultural pest of cereals and other crops (Jones, 1966; Yeboah and Adamu, 1995).

2.9 HOUSING SYSTEMS FOR GRASSCUTTER PRODUCTION

The animal is easy to house though its handling requires skills. Among rural communities and even some urban people without adequate space, the animal has been bred and kept in rooms or farm-houses strewed with a choice of some pieces of pipes, lorry tyres, hollow wood, or hollow palm trunks to provide escape shelter. The hollow wood and palm trunks can be gnawed and they require replacement from time to time. Wooden-cages with or without a wire net lining is in frequent use though. Such cages require frequent repairs. Ideally, the animal should rather be housed in strong metal cages, particularly, where space is limited (in apartment buildings, crowded compound houses, etc) and in laboratory animal houses. The recommended mode of housing is the three-tier cage system (Adu *et al.*, 1999).

2.10 POTENTIAL BENEFITS OF GRASSCUTTER DOMESTICATION

The demand for bushmeat is high. Although certain types of species have reduced or become extinct (Falconer, 1992; Ntiamoa-Baidu, 1998), the grasscutter species continues to be harvested in large quantities. It is not classified among species presently considered

to be rare or threatened in Ghana (Ntiamoa-Baidu, 1998). It is the only wild animal allowed to be hunted in the closed hunting season.

In addition to breeding throughout the year, one of the reasons for the grasscutter's survival (despite heavy hunting pressure that it is subjected to) is the advantage afforded it by its size. It is known that rodents do not decrease easily because of their small size which makes room for them where large animals are scarce (Vos, 1978). Besides its size, the grasscutter has the ability of freezing and hiding in under growths without being detected when it is being hunted. Hence the heavy use of fire and dogs to flush it out during hunting.

It is contended that in some countries individual populations are below carrying capacity due to over-exploitation (National Research Council, 1991). It is only in areas where human population densities reach 20-30 people/km^2 that the grasscutter is thought of as being over exploited (Baptist and Mensah, 1986). Thus the main threat to the survival of the grasscutter in its natural environment is human population explosion with negative impact on its habitat and heavy demand for its meat.

Continued dependence on hunted wild populations for grasscutter meat does not lend itself to quality control of the meat, nor does it enhance planned production, availability and use as and when required for any reasonable purpose. Domestication or captive breeding is a necessity if a grasscutter meat industry is to be developed.

Other benefits for its domestication relate to the nutritional, economic, conservational, environmental, microlivestock, efficient resource-use, and scientific potentials.

2.10.1 Nutritional Potential

The grasscutter is an important source of animal protein in Ghana (Asibey, 1969; 1978; Falconer, 1992; Ntiamoa-Baidu, 1998) and the rest of West Africa (Vos, 1978; Baptist and Mensah, 1986). Bushmeat, as previously stated, is eaten not only by the rural but also by the urban folks: including people from all classes of the Ghanaian economy. The situation from all indications, as presented by Table 1 below, has remained unchanged (Ntiamoah- Baidu, 1998). The surveys of the 90s confirmed the findings of the 70s that with some people, the grasscutter is their preferred source of animal protein and that among the various bushmeat species, it is consistently the consumers' first choice (Ntiamoah- Baidu, 1998).

Table 2.1: Bushmeat Consumption in Different Localities and Ecological Zones of Ghana

Category	No. of respondents	Mean no. of times eaten/month	Mean quantity per sitting (g)	Quantity per person per week
Villages	568	3.9	235.5	230.6
Towns	346	5.3	243.9	328.8
Cities	278	4.5	281.4	318.1
Forest zone	831	4.6	248.4	284.7
Transition zone	184	6.5	230.1	372.7
Savanna zone	177	2.0	323.1	158.3
All sites	**1192**	**4.5**	**249.2**	**279.5**

Source: Ntiamoa-Baidu, 1998

The meat is appreciated because of its culinary properties (Ajayi, 1971; Hartog and Vos, 1973; National Research Council, 1991; Anon., 1993). It resembles venison in flavour but dark like the meat of wild-duck (National Research Council, 1991). Most visitors to Ghana make it a point to try it and they are not disappointed. Apart from its excellent taste, like most bushmeat, it is nutritionally superior to some domestic meat (Table 2) because of its higher protein to fat ratio (Asibey 1974a; Asibey and Eyeson, 1975), and higher mineral content (Asibey, 1974b). Unlike some bushmeat which may not be killed or touched because of formal religious dictates, traditional taboos or prejudices (Vos, 1978), the grasscutter meat transcends religious prohibitions and Muslims who do not consume rabbit or guinea pig are known to consume grasscutter (Anon, 1993). Since the grasscutter meat has such wide acceptance, its demand is very high and cannot be met from hunting wild populations alone (National Research Council, 1991).

Table 2.2: Approximate Composition (%) and Mineral Content (Mg/100g) of Grasscutter in Relation to that of other Domestic Meats

Meat	Moisture	Ash	Fat	Protein	Iron	Calcium	Phosphorus
Beef	73.8	1.0	6.6	19.6	5.1	3.9	57
Mutton	78.5	1.0	2.9	17.2	3.1	9.0	80
Pork	64.8	0.8	13.4	19.4	3.1	3.0	73
Grasscutter	72.3	0.9	4.2	22.7	2.8	83.0	111

Source: Asibey, 1974a

2.10.2 Economic Potential

Grasscutter contributes to both the local and export earnings of the country (Asibey, 1974d). At the local market level for example, approximately 73 tons of grasscutter meat representing more than 15,000 animals can be sold in a year (National Research Council, 1991). According to recent surveys, the grasscutter continues to dominate the bushmeat trade (Falconer, 1992; Ntiamoa-Baidu, 1998).

Preliminary survey by the Animal Research Institute found that some rural folks, using grass and household waste from cassava, were able to raise grasscutter stocks which they sold at a price of ¢50,000 ($23) per animal of about 4 kg-weight. They also sold 3-month old animals for breeding at ¢20,000 ($9) per animal, irrespective of sex (Adu, 1998). Compared to other traditional livestock production, grasscutter production offers a relatively lower variable cost of production. For instance, feeding constitutes 82% of total variable cost of production in poultry enterprises (Farooq *et al.*, 2001), but this is considerably low in grasscutter production.

In a recent survey, in terms of numbers, the grasscutter was one of five species found to dominate the bulk of the bushmeat trade (Asibey and Addo, undated). The five species accounted for over 90% of the total carcass numbers. The Ghana Export Promotion Council (1995) includes the grascutter in the non-traditional export trade of the country. Smoked grasscutter meat is exported to Europe and to the United States of America (Yeboah and Adamu, 1995).

The production of the animal has so far been done to supplement income. Even hunting, which produces the bulk of bushmeat of the country, is done as a supplementary income activity. There is evidence that such income can be higher than the regular monthly income of the hunters (Ntiamoa-Baidu, 1998). The grasscutter meat is a popular food item. It has high market demand and it commands high price. Therefore all classes of people, especially the poor could undertake grasscutter breeding for both income generation and food security.

International trade as well as regional and continental interest in the grasscutter meat provides economic basis for the development of the grasscutter industry. The industry will be greatly enhanced through the establishment of breeding centres to provide stocks for farmers and other out-growers who will multiply its production. This approach will also be an avenue to involve rural communities. It would provide additional source of income desperately required in the quest to help the rural poor to meet their basic necessities and sustain their food security (Asibey, 1986).

2.10.3 Conservational Potential

Over 90% of grasscutter farmers depend on the wild stock for their breeding animals (Yeboah and Adamu, 1995). Yet initial high mortality resulting from trauma on their capture from the wild is frustrating and expensive to the breeder. Consequently there is great demand for captive-bred breeding stock for starters. There is the need to develop the grasscutter industry to the status of a viable commercial venture, capable of meeting both local and foreign demands without depending largely on hunting from the wild.

Domestication of the species will ensure that breeding stocks for the expansion of the industry is readily available; reduce dependence on wild stock; and reduce bush fire threats, which grasscutter hunting poses to the environment and to other resources.

2.10.4 Environmental Implications of Grasscutter domestication

Communal hunting with dogs and fire has negative environmental and economic implications in the locality where the hunting goes on. Although it is illegal, fire is frequently used in hunting the grasscutter (Martin, 1983).

There have been complaints by farmers that their crops get damaged by communal hunters through trampling and fire that get out of hand. Besides the destruction of farms and other properties, the bush fires adversely affect other animals and plants, creating immediate and long term ecological problems. There is no doubt that captive breeding of the animal will reduce risks associated with the hunting of the grasscutter.

2.10.5 Grasscutter Domestication as Micro-livestock

Conventional livestock such as cattle, sheep and goats are usually kept extensively, requiring substantial areas of land. Most of Africa's livestock graze over rangelands and fallow fields after crops have been harvested. However, continued availability of grazing lands is threatened by human population growth, poverty, increasing urbanization, and increasing pressures on land for other uses with higher economic benefits.

The grasscutter does not require much land and can even be raised in backyards and on flat roof tops by the landless. They also do not produce great quantities of body wastes, which in addition to being barely odorous, can easily be disposed of. Therefore in situations where agricultural land is scarce or unavailable, small sized animals such as the grasscutter whose meat is generally preferred to conventional meat could be developed along with livestock.

2.10.6 Grasscutter Production and Energy Requirements (Resource Use)

Suitable food must be readily and economically available to meet a species' energy requirements if the species' production is to warrant investment, especially by the less endowed or marginalized farmers of the developing world. Frugivores (e.g., some civets, flying foxes) are relatively costly to rear in captivity because they need to be fed either purchased or collected fruits, requiring considerable cost or time to procure. Secondary consumers (e.g., some species of turtles) must be fed animal protein, and may consume more animal protein than they produce, which is rarely cost effective. In contrast, herbivorous species that eat or browse grasses can more readily be fed economically.

Hence, most species which have been domesticated for human consumption require food that can be produced cheaply and easily. Most of such foods are not directly consumed by humans since our digestive systems are not adapted for digesting such plant foods (Emmons, 1987), so we are not competing for food with these species. The grasscutter, a herbivorous species, thus provides economic use for plant species like grasses that are usually considered weeds in most regions of Ghana.

2.10.7 Scientific Potential

Africa's advent into scientific research in general and biomedical research in particular, has come along with the need to import research animals for that purpose. These research animals are maintained in facilities whose environment is controlled with electricity, an unreliable utility service in many parts of Africa and Ghana in particular. Failure to maintain the animals in the special facilities results in their destruction besides the generation of incorrect research data, which become a waste of research resources and time. The development of an indigenous research animal that does not need to be placed in rigidly controlled facilities, such as the grasscutter would help eliminate these problems.

2.11 CHALLENGES IN DOMESTIC GRASSCUTTER PRODUCTION

The grasscutter is a recent introduction in captivity and have often been kept under less intensive conditions. With the drive towards increased economic returns from grasscutter farming, there is the need to increase stock levels and intensify production practices. Accompanying the intensification of livestock management practices is increased

incidence of diseases. Among the health challenges to grasscutter farming in Ghana are: sudden deaths, worm infestation and respiratory diseases (Adu *et al*., 2000, 2005b). Every death or loss from the stock is cost to the farmer, reduction in revenue and consequently a decline in profit.

The number of young born alive, and at weaning in a polytocous species such as the grasscutter represent a major source of variation of profitability in the industry. The gestation length of the grasscutter is 152 days (Stier *et al*., 1991), which culminates in an average litter size of four (Schrage and Yewadan, 1999). This means the grasscutter has a breeding potential of only two litters per year for a female (Asibey, 1974, Baptist and Mensah, 1986, Adu, *et al*., 1999) compared with a breeding potential of seven litters per year for a female rabbit (Adu *et al.*, 2005a).

Labour is required for cutting grass, cleaning and feeding the animals. With fewer animals, the farmer relies on family labour. Increasing numbers would mean the employment of additional labour to do the above tasks. The availability and the cost of labour would be an important factor in determining the level of profit.

Among the major materials used for house construction are concrete or brick, mud or clay and wood and mesh. Though the dimensions for housing the grasscutter and housing design are no longer issues in grasscutter farming (Adu *et al*, 1999, Awotwi *et al.*, 2005), housing issues still remain a problem for most farmers in the grasscutter industry.

Currently the cost of housing the animal is beyond the reach of most farmers due to the high cost of inputs.

The nutrition of the grasscutter still remains one of the major constraints to the industry. Grasscutters are fed mainly on forages with variable nutritional concentration. Adu and Wallace (2003) reported that the major forage fed to the grasscutter in Ghana, *Panicum maximum,* does not support efficient growth and reproductive performance. Attempts have thus been made to supplement the diet of the animal in captivity. However most of the supplements currently being used are based on rabbit standards (Schrage and Yewadan, 1999). Feeding the grasscutter during the dry season therefore poses a major problem to most farmers when forages are dry and usually of low nutritive value (Adu *et al*., 1999). Though farmers have become innovative in feeding the animal during this period by feeding more cassava (*Manihot utilissima*) compared to the feeding of Guinea grass (*Panicum maximum*) and Elephant grass (*Pennisetum purpureum*) during the wet season, dry season feeding still remains a major constraint to the grasscutter industry (Awotwi *et al*., 2005).

All other things being equal, the impact of grasscutter farming would only be felt when the meat from domesticated animals is readily available on the market at competitive price. This means the farmer has to sell at the price as is being offered for the counterpart from the bush. But since the hunter places a premium only on the effort spent in hunting for the animal it would make the price quite cheaper than that of the domesticated grasscutter.

Another constraint to large scale production was and still is the unavailability of breeding stock. According to Asibey and Addo (2000), the mass of accumulated information on housing, handling, feeding and other useful knowledge remain unwritten and generally not available to would-be breeders. As at now, the situation is different since a lot of the information that were unavailable can be obtained from GTZ-Sedentary Farming Systems Project in the Brong Ahafo Region.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 THE STUDY AREA

The study was conducted in the Brong Ahafo Region of Ghana. Brong Ahafo Region is located in the central to the lower northern part of the country. It is bordered to the north by the Northern Region, eastwards by the Volta Region, to the south by the Ashanti Region, southwest by the Western Region and westwards by the Cote d'Ivoire. The Region is currently made up of 15 districts which can be divided into three agro-ecological zones namely; forest zone, transitional zone, and the guinea savannah zones.

3.2 SOURCES AND TYPE OF DATA

Primary data was mainly used for the study, and these were obtained from owners of grasscutter enterprises, drawn from 7 out the 15 districts of the Brong Ahafo Region. In some cases, farm hands were also interviewed for specific information relating to feeding and farm management. Primary qualitative data were collected via observation.

3.3 SAMPLING METHOD

In all, a total of 7 out of the 15 districts in the Region were purposively selected for the study. This was to ensure a fair representation of all three agro-ecological zones in the Region. The selected districts for the study comprised; Sunyani Municipality, Techiman Municipality, Jaman, Kintampo, Nkoranza, Berekum and Dormaa Districts.

Sunyani Municipality, Techiman Municipality, and Berekum District fall under the transitional zone. Jaman and Dormaa Districts belong to the forest zone, with the Nkoranza and Kintampo Districts being part of the guinea savanna zone.

In each of the districts, a list of grasscutter farmers who had been in production for at least one year was obtained from GTZ-MOAP. All the farmers on these lists were covered with a semi-structured questionnaire. In all, 46 producers were from the Sunyani Municipality, 15 from the Nkoranza District, 10 each from the Techiman Municipality, the Dormaa District, and the Berekum District, 6 and 3 were from the Jaman and the Kintampo Districts respectively, culminating in a total of one hundred (100) producers.

3.4 SURVEY METHOD

The data were collected through personal interviews with the use of a semi-structured questionnaire, alongside discussions and direct observations. The survey was carried out between March and May 2006. The interviews were conducted with the help of trained field assistants who used local language to ensure smooth interaction. The student researcher was responsible for training and supervision of field assistants during the survey.

3.5 METHOD OF DATA ANALYSIS

Descriptive Analysis of data was done with frequency tables, matrix ranking, percentages and simple descriptive statistics like; the means and modes.

Inferential Analysis of data was done in two stages. The first stage had to do with the analysis of Net Present Value (NPV) and other investment parameters like Benefit-Cost analysis as well as the Internal Rate of Return (IRR). In the second stage the NPV obtained in the first stage was considered as a proxy for profit and used as dependent variable in a multiple regression analysis to identify the factors that are critical in determining the level of profit in grasscutter production.

3.5.1 Net Present Value (NPV) Analysis

Gittinger (1982) provides the theoretical framework for NPV Analysis. The NPV of an enterprise is the present worth of the net incremental benefit or incremental cash flow stream. Incremental net benefit is the increase in net benefit with the project as against without the project. The NPV simply describes the present worth of the income stream from an investment. In NPV analysis, a discount rate is required. Usually the opportunity cost of capital is used as the discount rate. This is the rate that results after the utilization of all capital in the economy if all possible investments undertaken in the economy generate that much or more. In other words the opportunity cost of capital is the return on the last or marginal investment made that exhausts the last available capital.

There exists a problem in the practical application of the opportunity cost of capital. The exact value is usually unknown. It is usually assumed to be equivalent to lending rates of commercial banks within the project's locality (Gittinger, 1998).

Mathematically, the NPV is expressed as:

$$NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t}$$

Where B_t = Benefit in each project year

C_t = Cost in each project year

n = Number of years

r = Interest (discount) rate.

That is, the NPV is computed by subtracting the total discounted present worth of the cost stream from the discounted present worth of the benefits.

The selection criterion is to accept all independent projects with NPV of zero or greater, at a specified discount rate. A negative NPV implies that at the assumed opportunity cost of capital, the present worth of the benefit stream is less than the present worth of the cost stream, rendering the enterprise unable to recover its investments.

One problem of the NPV is that it cannot be calculated without a satisfactory estimate of the opportunity cost of capital. It cannot also be used to rank independent projects since the NPV is an absolute value and not a ratio. The NPV is, however preferred in choosing among mutually exclusive projects.

3.5.2 Benefit - Cost Ratio

Benefit-Cost ratio is the ratio obtained when the present worth of the benefit stream is divided by the present worth of the cost stream. As in the case of the NPV, an appropriate opportunity cost of capital is required. The larger the value of the opportunity cost of capital (discount rate), the smaller the value of the ratio.

Mathematically, the B/C ratio is generally written as:

$$B/C = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}$$

Where B_t = Benefit in each project year

C_t = Cost in each project year

n = Number of years

r = Interest (discount) rate.

The selection criterion is to accept all independent projects with B/C ratio of one or greater, after discounting costs and benefits at the appropriate opportunity cost of capital.

One convenience of the B/C ratio is that it can be used to determine how much costs will rise without making the project economically unattractive. The B/C ratio is however not appropriate for evaluating mutually exclusive projects since it can lead to the wrong investment choice. Also, though projects with high B/C ratios are often preferred, rankings based on the ratio can lead to the wrong investment choice. B/C ratio has the

disadvantage of discriminating against projects with relatively large gross returns and operating costs, even though these may prove to have high capacity for wealth generation.

3.5.3 Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) refers to the rate of return that is being earned on invested after allowing for recoupment of the initial capital. It is also called the yield of an investment.

Mathematically, it is given as:

$$\sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t} = 0$$

Where B_t = Benefit in each project year

C_t = Cost in each project year

n = Number of years

r = Interest (discount) rate.

The guiding principle is that; a project should be undertaken if the IRR is above the interest rate charged by the lending bank or prevailing in the open market.

Calculating the IRR is quite involving, as it is usually done via trial and error. Different discount factors are tried until one obtains a value that renders the net present value almost zero. The general rule when estimating the IRR by trial and error is that; if at a given discount rate the net present value is positive, the discount factor is increased, and

if at a given discount rate the net present value is negative, the discount factor is reduced. The true discount factor, however, will usually lie between these two discount factors. The formula below is used to estimate the Internal Rate of Return (IRR):

$$IRR = Lower\ discount\ rate + Ddf\ \left(\frac{NPV\ at\ lower\ discount\ factor}{absolute\ difference\ between\ the\ two\ NPVs}\right)$$

Where Ddf = Difference between the discount rates.

3.5.4 Sensitivity Analysis

The computation of the NPV, B/C ratio, and the IRR was done by using a single price to estimate the cost and revenues. It is however, usually better to assume and use a range of prices, between 5% and 50% to recalculate these measures and compare them with the cost of capital for enhanced decision making. This exercise of varying prices and other coefficients of a venture in order to recalculate the measures of viability is referred to as *Sensitivity Analysis*.

Sensitivity Analysis makes it possible to determine the most sensitive and less sensitive variables of a production or venture. As a precautionary measure, prospective investors are then alerted on those sensitive variables which may render profitable projects unprofitable.

3.5.5 Profitability Analysis

According to Yasmin *et al* (2003), the goat industry is one of the most important industries for meat production and for alleviating poverty. They enumerated that although the goat industry is profitable, it is in no better condition due to factors among which are

higher rearing cost, lack of proper management, insufficient health care and marketing facilities. Different factors affect the animal production industry and Sarmin (1998) developed an econometric model for analyzing the important factors and their linkages relating to beef animal development, the supply of beef animals for slaughter and the demand for beef. He found that the important determinants for beef production in Malaysia were the previous number of females less than 3 years old, males more than 3 years old, and beef price.

In a study, Farooq *et al* (2001) observed that numerous factors such as market age, mortality, flock size, shed utilization and hygienic conditions of the farm were critical on the cost of production and net profit per broiler, and thus determined the fate of broiler productivity in Pakistan.

3.5.6 Choice of Functional Form for the Regression Analysis

In the theory of econometrics, there are a number of mathematical forms that a regression function can take. Common functional forms include the simple linear specification of a regression model, quadratic form, power form, semi-logarithmic form, double logarithmic form and exponential form. Most empirical studies tended to use nonlinear specifications in regression analysis.

Economic theory provides little guide concerning the mathematical form of the regression model that suits a particular study (Adesini, 1978). Adesini revealed that in practice researchers have tended to follow either of two approaches. First, a strong

assumption may be made concerning the particular mathematical form that would best characterize the problem being investigated. Second, if the researcher is not able to make such an assumption, *ex-post* criteria are relied upon by fitting different mathematical functions to the data and selecting the best on the basis of R^2, t-values, and the "reasonableness" of the estimated parameters.

In the light of the foregoing, different functional forms were fitted to the data collected, with NPV as proxy for profit level, being the dependent variable. The most appropriate functional form was then selected for discussion.

The implicit form of the multiple regression model for the study was specified as:

$\pi i = f(X_1, X_2, X_3, X_4, X_5) + \mu i;$

Where:

πi = Annual profit (NPV) from *i*th grasscutter enterprise

X_1 = Age of farmer,

X_2 = Educational level of farmer,

X_3 = Sex of farmer,

X_4 = Housing cost,

X_5 = Years of experience in animal rearing prior to grasscutter farming

μi = Random Variable/Disturbance term.

3.6 ASSUMPTIONS FOR THE STUDY

- The sex ratio at litter for males and females is 1:1.
- Breeding animals are sold in the ratio of 1:4 (i.e. 1 male to 4 females) and the remaining males fattened and sold for meat.

- Breeding animals are sold after three months of being littered, and table ones (fattened males) are sold after one-and-half years.
- The project terminates at the end of the sixth year of operation.
- Salvage value of fixed assets at the end of their useful life is zero (0).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter discusses the results of the study in relation to the objectives. It covers the characteristics of grasscutter farmers obtained in the study, costs and returns associated with grasscutter production, investment analysis parameters like Benefit- Cost ratio and examination of regression parameters on factors that are critical in determining the level of profit in grasscutter production.

4.1 SEX DISTRIBUTION OF RESPONDENTS

Table 4.1 shows that 84 out of the 100 grasscutter farmers interviewed, representing 84% were males. The reason for such a great disparity in gender distribution could be attributed to the fact that since grasscutter production is capital intensive and the male population has more money than their female counterparts, they are able to acquire the necessary assets and then enter into production although the GTZ-SFSP was training females for free.

Again, it could also be due to the fact that that in our society women are supposed to take care of the household chores such as cooking, cleaning and general upkeep of their homes, and this busy schedule does not afford them the time to go into grasscutter production which is also time demanding.

Table 4.1: Gender of Respondents

Sex	Frequency	Percentage (%)
Male	84	84.00
Female	16	16.00
Total	**100**	**100.00**

Source: Field Survey, 2006

4.2 MARITAL STATUS OF RESPONDENTS

From Table 4.2 below, 94% of the respondents are married. These respondents, assisted by their children, are able to minimize direct cost of production by performing most of the production activities by means of readily available family labour, which is employed in cutting grass, feeding and cleaning the housing units. This explains why most respondents do not depend much on hired labour in their grasscutter production.

Table 4.2: Distribution of Respondents by Marital Status

Marital Status	No. of Respondents	Proportion of Respondents (%)
Married	94	94.00
Single	5	5.00
Widowed	1	1.00
Total	**100**	**100.00**

Source: Field Survey, 2006

4.3 EDUCATIONAL BACKGROUND

As evident from Table 4.3, people with education up to the Middle/JSS, form the majority with a corresponding percentage of forty-five (45). Only 11% of the grasscutter farmers interviewed had no formal education. This shows that majority of the respondents (89%) had obtained some level of formal education.

Table 4.3: Educational Level of Respondents

Level of education	No. of Respondents	Proportion of Respondents (%)
Non-literate	11	11.00
Basic	1	1.00
Middle/JSS	45	45.00
Sec./Comm./Voc.	24	24.00
Post-Sec./Tertiary	19	19.00
Total	**100**	**100.00**

Source: Field Survey, 2006

4.4 RELIGIOUS AFFILIATION OF RESPONDENTS

Religious affiliation of the respondents is displayed by Table 4.4. Though majority of the respondents (89%) are Christians, the fact that 7% and 4% of respondents are Muslims and Traditionalists/pagans respectively, shows that grasscutter production transcends beyond religious boundaries. This confirms findings from various studies. Vos (1978), and Anon (1993) all indicated that, unlike some animals which may not be killed or touched because of formal religious dictates, traditional taboos or prejudices, the grasscutter transcends religious prohibitions and Muslims who do not consume rabbit or guinea pig are known to consume grasscutter.

Table 4.4 Distribution of Respondents by Religion

Religion	No. of Respondents	Proportion of Respondents (%)
Christianity	89	89.00
Islam	7	7.00
Traditionalist/Pagan	4	4.00
Total	100	100.00

Source: Field Survey, 2006

4.5 SYSTEM OF GRASSCUTTER PRODUCTION

It is evident from Table 4.5 that, the majority (72%) of the grasscutter farmers are into the production of both breeding and meat (table) animals. Twenty-eight out of the 100 farmers, corresponding to 28% claimed to produce solely for breeding purpose and not for table (meat) purpose. This is however not the case, as there is always excess male animals by virtue of the recommended stocking rate. At the time of the study none of the farmers is engaged in exclusive meat production. Those who are into the production of meat and breeding animals do not buy animals from the breeders to fatten them for sale. It can however, be said that those who call themselves breeders are actually not breeders but rather outgrowers or multipliers since they do not have any selection criteria as would have been for the production of breeding animals. Since there are only few farmers in grasscutter production, all the animals produced by the farmers are sold as breeding animals. Only excess males and unproductive or over-aged females are fattened and sold as meat. It was gathered that the main motive of domestic grasscutter production at the moment is the sale of animals for breeding, with the production for meat being seen as a by-product.

Table 4.5 System of Grasscutter Production

Production System	No. of Respondents	Proportion of Respondents (%)
'Breeding'	28	28.00
'Breeding' and Meat Production	72	72.00
Meat Production	-	-
Total	**100**	**100.00**

Source: Field Survey, 2006

4.6 FEATURES OF GRASSCUTTER PRODUCTION IN THE STUDY AREA

The distribution of grasscutter farmers according to stock sizes (number of grasscutters reared) presented in the table, reveals that 22% of the farmers had animals between 51 and 100. However, majority (72%) had animals not exceeding 50 with only 6% having animals more than 100. This revealed that majority of the farmers operated with fewer breeding stock. Further analysis shows that all the respondents had other major occupations and grasscutter production was an additional venture.

The distribution of the farmers based on sources of foundation stock (start up stock) also presented in the table, showed that majority (90%) of them purchased their start up animals from GTZ for breeding. It should, however, be mentioned that some farmers were keeping both animals bought from GTZ, and offsprings of animals captured from the wild. Although, this is not quite advisable due to the aggressive nature of wild animals and again from the fact that wild animals may be infested with ecto-parasites, some farmers still practiced this due to lack of breeding stock.

The major type of cage used by the farmers in grasscutter production was wood and mesh cage. This was practiced among 80% of the farmers, with 18% using concrete cages. Only 2% used other forms of cages like only wood or bamboo.

The type of housing system common among the farmers was the Indoor unit, constituting 90%. This unit consists of the cages either wood and mesh, concrete or wood being kept in a housing facility. This form of housing unit ensured that animals are protected from adverse weather conditions like cold, escape of animals during accidental opening of individual cages and a better protection from theft. Outdoor housing system is the situation where cages are left in the open, and only 10% of the farmers practiced this.

Table 4.6 Features of Domestic Grasscutter Production in the Study Area

Item	Frequency	Percentage (%)
Stock size		
1-50	72	72.00
51-100	22	22.00
>100	6	6.00
Source of foundation stock**		
GTZ	100	90.09
Wild	11	9.91
Type cage used		
Wood and mesh	80	80.00
Concrete	18	18.00
Others	2	2.00
Housing systems		
Indoor	90	90.00
Outdoor	10	10.00
Type of labour employed		
Family	91	91.00
Hired	9	9.0
Primary occupation		
Farming	65	65.00
Civil Service	19	19.00
Trading	5	5.00
Artisanship/Others	11	11.00
Ecological zones		
Forest	21	21.00
Transitional	59	59.00
Guinea savanna	20	20.00
Major production motive**		
Income	80	62.50
Employment	27	21.09
Environmental conservation	12	9.38
Others	9	7.03
Previous Experience in Animal Rearing		
N=100 in all cases However ** indicates cases of Multiple Responses		

Source: Field Survey, 2006

The dominant occupational group among the grasscutter producers is livestock, poultry, and crop farmers constituting 65% of the total respondents. These view grasscutter production as a supplementary venture.

4.7 PREVIOUS EXPERIENCE IN ANIMAL REARING

Eighty-three percent (83%) of the farmers interviewed already had experience in animal rearing. Thus explaining the reason why the number of years in production did not have any effect on productivity. Again before farmers get the opportunity to get breeders to start up production, they are taken through training in grasscutter production by the Sedentary Farming Systems Project of GTZ. So before the individual starts the grasscutter production, there is already some amount of knowledge.

Table 4.7: Previous Experience in Animal Rearing

Response	Frequency	Percentage (%)
Yes	83	83.00
No	17	17.00
Total	**100**	**100.00**

Source: Field Survey, 2006

Majority of the farmers (83%) testified that even though they had knowledge about keeping other type of animals the training they received in grasscutter production was very relevant. This, they acknowledged, had gone a long way in helping them reduce the incidence of diseases in their production. According to the farmers, they initially perceived grasscutters as wild animals that could not be kept in cages. They however, conceded that the training by GTZ has helped to broaden their understanding of husbandry aspects of the grasscutters namely feeding, handling, general sanitation and crossing. This is perhaps the reason why a greater percentage (73%) of the farmers in Table 4.8 had not yet encountered any disease or health related problems among their animals.

Table 4.8: Incidence of Health-Related Problems

Response	Frequency	Percentage (%)
Yes	27	27.00
No	73	73.00
Total	**100**	**100.00**

Source: Field Survey, 2006

4.8 BASIC INPUTS OF DOMESTIC GRASSCUTTER PRODUCTION

Table 4.9 displays the basic inputs utilized in domestic grasscutter production and their respective sources. Among the basic inputs common to all 100 respondents are, three-tier cages and their housing units, starter stock, labour for daily routine operations, supplementary feed, and miscellaneous items, comprising feeding bowls and cleaning materials.

Table 4.9 Inputs of Grasscutter Production and their Sources

Input	Source
Starter stock	GTZ/Grasscutter Farmers' co-operative
Three-tier cage	GTZ
Labour	Family/Hired
Supplementary feed	Open market
Miscellaneous items	Open market

Source: Field Survey, 2006

4.9 AVERAGE PRODUCTION COSTS AND RETURNS

The annual production costs and returns streams for domestic grasscutter production project of two (2) family start-up stock, comprising eight females and two males obtained at three months old from a recommended breeding source was estimated for all 100 respondents. Table 4.10 shows the estimated average annual costs and returns streams. Appendix 1, however, reveals the estimation of incremental benefits for a two-family start-up stock project.

Table 4.10 Expected Costs and Returns for a Two-Family Start-Up Stock

Year (1)	Cost- GH¢ (2)	Revenue- GH¢ (3)	Incremental Benefit- GH¢ (4)
1	1520.70	665	-855.70
2	627.63	1330	702.37
3	837.25	1770	932.75
4	837.25	1770	932.75
5	837.25	1770	932.75
6	389.65	440	50.35

Source: Field Survey, 2006

4.9.1 Profitability of Domestic Grasscutter Production

To estimate the Net Present Value (NPV) and the Benefit-Cost ratio, however, a discount rate must be taken into consideration. This is usually related to the interest rate operating in the open market, which in this case happened to be 24% at the time of study. Discount factors at 24% interest rate for six years are presented in Column 3 of Table 4.11 below.

Table 4.11 Discounted Cash Flow Analysis for the Two-Family Start-Up Stock

Year (1)	Incremental Benefit- GH¢ (2)	Discount Factor @ 24% (3)	NPV @ 24% GH¢ (4)	Discounted Cost- GH¢ (5)	Discounted Revenue- GH¢ (6)
1	-855.70	0.806	-689.6942	1225.684	535.99
2	702.37	0.65	456.5405	407.9595	864.50
3	932.75	0.524	488.761	438.719	927.48
4	932.75	0.423	394.55325	354.1568	748.71
5	932.75	0.341	318.06775	285.5023	603.57
6	50.35	0.275	13.84625	107.1538	121.00
Totals			**982.075**	***2819.175***	***3801.25***

Source: Field Survey, 2006

The discounted costs and revenues are obtained by multiplying the discount factors in column 3 of Table 4.11 by costs and revenues in columns 2 and 3 of Table 4.10 respectively. From these calculations, the NPV is computed as the summation of the discounted incremental benefits (column 4 of Table 4.11). Thus the NPV obtained is ***GH¢ 982.075 ≈ GH¢ 982.08***, which is a positive value, and an indicator of financial viability of the domestic grasscutter production venture. The huge jump in incremental benefits between year 1 and 2 is as a result of increase in the level of output (i.e., two litters in the second year), as compared to one litter in year 1. That is, the young female is mated for the first time when it is at a minimum weight of 1.5kg which is at the average age of six months (Schrage and Yewadan, 1999). Also, the high overhead cost, which does not recur in subsequent years, is partly responsible for the reduced incremental benefit in the first year.

Likewise, the Benefit-Cost ratio, which is the ratio of discounted revenue to discounted cost is obtained as: $\boldsymbol{B/C = \frac{3801.250}{2819.175} = 1.3484 \approx 1.35}$. And again, a greater than unity Benefit-Cost ratio signifies a financially viable project or investment.

Lastly, the Internal Rate of Return (IRR) for the two-family start-up stock at 24% rate of interest was estimated to be ***87.884% ≈ 88%***. This simply means, even when interest rate is increased by a 100%, financial viability of the domestic grasscutter production is not affected. In other words, for every cedi borrowed at a 24% interest rate and invested into the domestic grasscutter production, an extra eighty-eight pesewas could be gained in addition to recouping the initially invested cedi. This means the cost of borrowing at 24%

p.a. interest rate (i.e. 24 pesewas for the hypothetically borrowed one cedi) could be settled leaving the project owner with a margin of 64 pesewas on the one cedi investment.

4.10 SENSITIVITY ANALYSIS

The project's financial viability (profitability) has been sensitized with regard to the following assumptions:

1. The cost of borrowing (interest rate) more than doubles, increasing from 24% to 50% p.a., with all other things remaining unchanged.
2. The cost of inputs of production rises by 25% while all other things remain equal.
3. The revenue from the production decreases by 25% while all other things remain constant.
4. The cost of inputs of production rises by 25%, and the revenue from the production decreases by 25% while all other things remain constant.

These sensitivities are applied separately and the results are summarized in tables 4.12, 4.13, 4.14 and 4.15.

4.10.1 Increase in Interest Rate from 24% p.a. to 50% p.a.

When this is done, the project's profitability is reduced by as much as ***GH¢ 652.642*** from ***GH¢ 982.075*** to ***GH¢ 329.433***. That notwithstanding, the project achieves a positive NPV, a greater than unity Benefit-Cost ratio of ***1.177***, and of course, still an IRR of ***88%***, which is still an indication that the venture is profitable or financially viable. Table 4.12 summarizes the sensitivity results:

Table 4.12 Results of an Increase in Interest Rate from 24% p.a. to 50% p.a.

Year (1)	Incremental Benefit- GH¢ (2)	Discount Factor @ 50% (3)	NPV @ 50% GH¢ (4)	Discounted Cost- GH¢ (5)	Discounted Revenue- GH¢ (6)
1	-855.70	0.667	-570.752	1014.307	443.56
2	702.37	0.444	311.853	278.668	590.52
3	932.75	0.296	276.094	247.826	523.92
4	932.75	0.198	184.685	165.776	350.46
5	932.75	0.132	123.123	110.517	233.64
6	50.35	0.088	4.431	34.289	38.72
Totals			**329.433**	**1851.382**	**2180.815**

Source: Field Survey, 2006

4.10.2 Increase in Cost of Production by 25%

When this is done, the project's profitability is reduced by as much as ***GH¢ 704.794*** from ***GH¢ 982.075*** to ***GH¢ 277.281***. Again, the project achieves a positive NPV, a greater than unity Benefit-Cost ratio of ***1.079***, and an IRR of ***38%***, which is an indication that the venture would still be profitable or financially viable. Table 4.13 summarizes the sensitivity results:

Table 4.13 Results of an Increase in Cost of Production by 25%

Year (1)	Incremental Benefit- GH¢ (2)	Discount Factor @ 24% (3)	NPV @ 24% GH¢ (4)	Discounted Cost- GH¢ (5)	Discounted Revenue- GH¢ (6)
1	-1235.88	0.806	-996.115	1532.105	535.99
2	545.4625	0.650	354.551	509.949	864.50
3	723.4375	0.524	379.081	548.399	927.48
4	723.4375	0.423	306.014	442.696	748.71
5	723.4375	0.341	246.692	356.878	603.57
6	-47.0625	0.275	-12.942	133.942	121.00
Totals			**277.281**	**3523.969**	**3801.25**

Source: Field Survey, 2006

4.10.3 Reduction in Revenue by 25%

This could result from two conditions; a decrease in output by 25% or a decrease in price by 25%. However, owing to the high demand for grasscutter meat, coupled with the existence of a dynamic cooperative of domestic grasscutter farmers, the former condition (decrease in price) is unlikely to be encountered. Hence the reduction in revenue is assumed to be a consequence of a 25% decrease in output, which could be as a result of increased mortality. With this third scenario, the project's profitability is reduced by as much as ***GH¢ 950.313*** from ***GH¢ 982.075*** to ***GH¢ 31.762***. Nevertheless, the project achieves a positive NPV, a greater than unity Benefit-Cost ratio of ***1.011***, and an IRR of ***26%***, which is an indication that the venture would still be profitable or financially viable. Table 4.14 summarizes the sensitivity results:

Table 4.14 Results of Reduction in Revenue by 25%

Year (1)	Incremental Benefit- GH¢ (2)	Discount Factor @ 24% (3)	NPV @ 24% GH¢ (4)	Discounted Cost- GH¢ (5)	Discounted Revenue- GH¢ (6)
1	-1021.95	0.806	-823.692	1225.684	401.993
2	369.87	0.650	240.416	407.960	648.375
3	490.25	0.524	256.891	438.719	695.610
4	490.25	0.423	207.376	354.157	561.533
5	490.25	0.341	167.175	285.502	452.678
6	-59.65	0.275	-16.404	107.154	90.750
Totals			**31.762**	**2819.176**	**2850.939**

Source: Field Survey, 2006

4.10.4 Increase in Cost of Production by 25% and Reduction in Revenue by 25%

In the event of this fourth scenario, the project's profitability is eroded into negativity, and a net loss is recorded. NPV obtained is ***(GH¢ 673.035)***, Benefit-Cost ratio of ***0.809***, which is less than unity, and an IRR of negativity ***(18%)*** is achieved with this assumption. Table 4.15 summarizes the sensitivity results:

Table 4.15 Results of Increase in Cost of Production by 25% and Reduction in Revenue by 25%

Year (1)	Incremental Benefit- GH¢ (2)	Discount Factor @ 24% (3)	NPV @ 24% GH¢ (4)	Discounted Cost- GH¢ (5)	Discounted Revenue- GH¢ (6)
1	-1402.130	0.806	-1130.12	1532.105	401.993
2	212.963	0.650	138.426	509.9494	648.375
3	280.938	0.524	147.2115	548.3988	695.610
4	280.938	0.423	118.8368	442.696	561.533
5	280.938	0.341	95.79986	356.8779	452.678
6	-157.063	0.275	-43.1923	133.9423	90.750
Totals			**-673.035**	**3523.969**	**2850.939**

Source: Field Survey, 2006

From the four scenarios, it is revealed that the most sensitive variable in terms of impact on project profitability (NPV) is the combined effect of a 25% upward adjustment of the cost to production and a 25% downward adjustment of revenue. However, this scenario is an extreme case and is unlikely to be encountered. The next sensitive variable by virtue of magnitude of effect on project profitability happens to be output, which is assumed to be responsible for the 25% reduction in revenue. This is followed by the increase in cost of production by 25%, with the increase in cost of borrowing (interest rate) to 50% p.a. being the less sensitive project variable.

4.11 FACTORS AFFECTING THE NPV OF DOMESTIC GRASCUTTER

Out of the three models estimated, the linear function was chosen as the lead equation because it gave the best fit. The coefficient of determination R^2 in Table 4.16 shows that about 68% of the variation in profit was explained by variation in the socioeconomic variables included in the model. The high explanatory power of the variables is further confirmed by the highly significant ($P<0.01$) F-value. The results in the table further show that all the explanatory variables, except experience in animal rearing prior to engaging in grasscutter rearing, had negative relationships with profit. However, only the coefficient of discounted housing cost was statistically significant, suggesting that profit in the area was largely determined by this variable. Hence grasscutter farmers in the area could substantially increase profits by minimizing cost with respect to housing facilities for the animals. This could be achieved by means of utilizing available local materials for the construction of housing units. In fact, all other factors remaining constant, an increase

in the discounted housing cost by one (1) Ghana cedi would reduce profit (NPV) by about three (3) Ghana cedis.

Table 4.16 Results of Linear Regression on Some Socio-Economic Factors Affecting Profitability of Domestic Grasscutter Production

Variable	Coefficient	Std. Error	t	Sig.
Intercept (Constant)	3224.844	203.495	15.847***	0.000
Age of respondent	-0.134	1.824	-0.073^{ns}	0.942
Level of education of respondent	-7.457	21.031	-0.355^{ns}	0.724
Sex of respondent	-32.136	54.769	-0.587^{ns}	0.559
Discounted Housing Cost	-3.007	0.221	-13.577***	0.000
Experience in animal rearing before engaging in grasscutter rearing	0.465	53.707	0.009^{ns}	0.993
Dependent Variable: NPV; *$R = 0.823$; $R^2 = 0.678$; adj. $R^2 = 0.660$; Std. Error = 189.76534; F= 39.500**** ****= significant at P<0.01; ns = not significant*				

Source: Field Survey, 2006

4.12 PROBLEMS FACED BY DOMESTIC GRASSCUTTER FARMERS

Nearly all the farmers covered by the study admitted that the future of domestic grasscutter production is very promising. However, they were confronted with problems. The distribution of farmers according to problems encountered is presented in Table 4.17. High cost of grasscutter housing was ranked as the most critical problem, attracting a ranking score of ***482***. The major types of housing adopted by most of the farmers were mainly wood and mesh or concrete cages but with both types, cages were further placed in bigger housing units. This constitutes the Indoor system of housing, which attracts considerable capital input from the farmers in confirming reports by Adu *et al*, 1999 and Awotwi *et al*, 2005. However, this ensures safety and security of their stock.

Since the gestation period of the grasscutter is 152 days, meaning that the female grasscutter has a breeding potential of only two litters per year, unlike the female rabbit with a breeding potential of seven litters per year. This means that the project life of the grasscutter spans beyond a year, and current investments reap returns only in subsequent years, few of the farmers testified that, though, they had received loans some time ago, the duration of loan repayment was so short that the objective of loan acquisition could not be realized.

Again, as noted earlier the main feed of the grasscutter are the succulent stems and forages of some grasses with variable nutritional concentration and since during the dry season however, these grasses dry up and are usually of low nutritive value, the provision of sufficient feed for the animals during this period is quite difficult. Also during this period, there is competition for grass with ruminants, especially cattle resulting in long distance travels by farmers in search of decent feed for the animals. This culminates in increased cost of production; supporting the findings of Adu *et al*, (1999) and Awotwi *et al*. (2005) that dry season feeding still remains a major constraint to the grasscutter industry.

It is, therefore, not surprising that ranking scores of ***469*** and ***403***, being lack of access to credit and dry season feeding placed second and third respectively on the chart of critical problems.

Small litter size, morbidity, and marketing of animals (specifically “excess” males) were ranked fourth, fifth and sixth respectively on the ranking chart.

Table 4.17 Classification of the Major Problems of Grasscutter Production

Problem	Frequency	Score	Rank
High cost of housing facility	94	482	1
Access to Credit	96	469	2
Dry Season Feeding	99	403	3
Small Litter Size	88	308	4
Morbidity	58	159	5
Marketing of Animals	26	75	6

Source: Field Survey, 2006

4.13 EXTERNALITIES OF GRASSCUTTER PRODUCTION

In addition to employment and food, grasscutter production on a larger scale would contribute towards natural resource conservation, by reducing bush burning for game.

Droppings from the animals and leftovers of cut-grass provide a good material for composting, which can be used as an alternative means of soil fertility management by crop farmers.

Unhealthy rivalry and sometimes disputes among producers as they compete for insufficient fresh grass as feed for their animals. This is not limited to producers of grasscutter but between grasscutter farmers and traditional livestock owners as well.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY

Ghana's main sources of animal protein are fish, livestock and bush meat. However, livestock production is not sufficient to meet the national meat requirement, and there is the need therefore to develop other sources of acceptable meat in addition to conventional livestock.

The grasscutter (*Thryonomys swinderianus*) is an important source of meat and is acknowledged to be the preferred meat virtually throughout Ghana and the West African Sub-Region. The demand fo r grasscutter meat in Ghana is high with its accompanying price hikes, making the prospect of grasscutter rearing very bright and encouraging either as a full-time or part-time job.

Over the years, the demand for grasscutter meat has been met through hunting from the wild by the use of chase dogs, baiting with chemicals, which have harmful effects on consumers and other untargeted species, or by bush burning which mainly results in bushfires. There is evidence that the availability of grasscutter meat through the above-mentioned conventional means, and its sustainability is in question, necessitating domestication of the grasscutter as a sustainable means of meeting the high demand for its meat.

Nonetheless, much of current small ruminant research is dominated by descriptions of production systems and traits, with little economic analysis. Against this background, this study was conducted to assess the features and profitability of domestic grasscutter production as an economic venture among farmers in the Brong Ahafo Region. In order to achieve this it was necessary to sample domestic grasscutter farmers from the Brong Ahafo Region, identify the direct and indirect costs of production, calculate the returns to each farmer, and elicit from farmers the problems associated with domestic grasscutter production.

Benefit-Cost ratio, Net Present Value (NPV) and Internal Rate of return (IRR) as well as percentages and simple descriptive statistics formed the analytical tools used.

The study recognized the following features of domestic grasscutter production in the Brong Ahafo Region; average stock size of 42 animals, source of starter stock is mainly from the GTZ/Grasscutter Farmers' Co-operative, with only 9% being from the wild. Also, three-tier cage made with wood and mesh dominated types of cage used by as much as 80%, with concrete cage and other making up for 18% and 2% respectively. Ninety percent of the farmers used indoor housing system, and the remaining 10% used outdoor system. Again, 91% and 9% of the respondents utilized family labour and hired labour respectively. Income generation served as the main motive for domestic grasscutter production by about 63% of the respondent, with about 21% and 9% declaring employment and environmental conservation respectively as the main motive for undertaking the venture.

The study estimated Net Present Value, Discounted Cost and Discounted Revenue of a two-family starter stock for each of the 100 farmers and recorded ***GH¢ 982.075***, ***GH¢ 2819.175*** and ***GH¢ 3801.250*** as average NPV, average Discounted Cost and average Discounted Revenue respectively. In addition, profitability indicators of ***1.35*** and ***88%*** were computed for the project as Benefit-Cost ratio and IRR value respectively, a clear indication of financial viability in all instances.

A four-scenario sensitivity analysis conducted on the profitability of the project revealed that profitability of the project is most sensitive to the case of a combined effect of a 25% upward adjustment of the cost to production and a 25% downward adjustment of revenue. This is followed by; a 25% reduction in revenue, an increase in cost of production by 25%, and an increase in cost of borrowing (interest rate) from 24% to 50% p.a.

Discounted housing cost emerged as the only significant determinant of profitability (NPV), among age, sex, education, and previous experience in animal farming, as regressors of a linear regression model with an R^2 value of 67.8%.

High cost of grasscutter housing was ranked as the most critical problem, with lack of access to credit and dry season feeding placing second and third respectively. Small litter size, morbidity, and marketing of animals (specifically “excess” males) were ranked fourth, fifth and sixth respectively on the ranking chart. Lastly, contribution towards natural resource conservation, by reducing the rate of bush burning for game was identified among the externalities of domestic grass cutter production.

5.2 CONCLUSIONS

Domestic grasscutter production in the Brong Ahafo Region is mainly characterized with small scale ventures averaging 42 animals per farmer. Majority of the farmers depend on family labour, make and use of the three-tier wood and mesh cage, and have income generation as the main motive of production.

The financial benefit (returns) from domestic grasscutter production was found to be much more than the associated cost of production, establishing the project as very profitable and viable at the prevailing cost of borrowing (interest rate) of 24%.

Discounted housing cost was the only significant determinant of profitability, among age, sex, education, and previous experience in animal farming, and high cost of grasscutter housing was ranked as the most critical problem, followed by lack of access to credit and dry season feeding in that order.

Recorded externalities, according to findings from the study, include employment, food, promotion of natural resource conservation, and unhealthy rivalry or disputes among producers as they compete for insufficient fresh grass as feed for their animals.

5.3 RECOMMENDATIONS

On the basis of the present study, the following recommendations are made:

1. Grasslands should be established either by individual domestic grasscutter farmers or their co-operative body to avoid unhealthy rivalry and disputes that result from insufficient fresh grass during the dry season.
2. Awareness creation programmes should be organized by the domestic grasscutter farmers to sensitize consumers on the health and environmental implications of patronising grasscuter obtained from the wild by means of various harmful methods like indiscriminate bush burning and use of toxic chemicals as baits. This would enhance the patronage of domesticated grasscutter.
3. Credit facility should be made available to existing and prospective domestic grasscutter farmers by support agencies and institutions like the banks and NGOs at reasonable repayment terms to facilitate farm expansion and start-ups respectively.
4. There is less information and knowledge on diseases of grasscutter. Research into grasscutter diseases should be taken seriously by the government and all supporting organizations.
5. Since domestic grasscutter production has been found not only to be profitable but also viable, the unemployed, especially the youth should be encouraged with start-up capital to go into it as a source of livelihood, through government interventional programmes like the National Youth Employment Programme or the Youth in Agriculture Programme.

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APPENDICES

APPENDIX-A

PRODUCTION STATISTICS

Start-up stock of 2males:8females will result in 32offspring/litter or production cycle, with 4offspring/female. This corresponds to 64 offspring per year.

Sex ratio @ litter = 1:1 Thus 32males:32females @ litter.

But mating ratio = 1male:4females hence 8males and 32females would be selected for breeding and the remaining 24males would be fattened and sold

But mortality rate of 6.25% is assumed, corresponding to two (2) animals. This leaves the number of survivors at 15males:15females.

Assuming the Extra Males are sold as table animals,

4males will be selected for the 15females.

The 11 extra males, fattened for one and half years will be sold as table animals @ GH¢20.00/animal.

Selected breeding stock will be disposed off at three months @ GH¢35.00/animal.

The revenue stream per year is as follows:

Four (4) males:15 females (19 breeding animals) implies 19 x GH¢ 35.00 = GH¢ 665.00 for the 1st year.

GH¢ 665.00 x 2 = 1,330.00 for the 2nd year

In addition to this figure, 11 x GH¢ 20.00 = GH¢ 220.00 x 2 will be recorded for the 3rd-6thyears, from the sales of table animals, which occurs twice per year for this period.

GH¢ 1,330.00 + GH¢ 440.00 = 1,770.00 3rd year

GH¢ 1,330.00 +GH¢ 440.00 = GH¢ 1,770.00 4th year

GH¢ 1330.00 + GH¢ 440.00 = GH¢ 1770.00 5th year.

GH¢440.00 = 6th year.

Esimation of Cost of Supplementary Feeding for the 2-Family Start-Up Venture

Components of Costs

- Four 3-tier cages
- Start-up stock
- Housing Unit to accommodate cages
- Labour
- Miscellaneous cost (Feed troughs + cleaning items)
- Supplementary feeding cost

NB: Labour for 35 minutes/day @ the prevailing opportunity cost for casual labour in the study area/day = GH¢ 0; 1944.44 on the average (i.e. GH¢2.00/6hrs)

Consumption Requirement

75g 4 months for sub-adults

175g 8 months for adults

30g 3 months for young ones

Required Nutritional Component of Supplementary feed and associated Cost

Maize	10kg	GH¢4.00
Wheat Brown	15kg	GH¢1.80
Oyster shell meal	2kg	GH¢0.10
Iodated Salt	0.5kg	GH¢0.20

Total formulation cost stands at **GH¢6.10 for the 27.50kg** weight of supplementary feed. This is used as the conversion factor in estimation of the supplementary feeding cost.

Feed consumption by 2 family start-up stocks is in the following order: 75g/animal for first 4 months and 175g/animal for the next 8 months, and subsequent periods of production. 30g/animal for offspring aged 0-3 months when they are disposed off.

Complete Supplementary Feeding Requirement for 2-family start-up Venture

First Year

75g/animal x 10 animals x 120 days (4 months) as sub-adults	=	90,000g	=	90.00kg
175g/animal x 10 animals x 240 days (8 months) as adults	=	420,000g	=	420.00kg
30g/animal x 30 animals x 90 days (3 months) F_1 as adults	=	81,000g	=	81.00kg
			=	**591.00kg**

Second Year

175g/animal x 10 animals x 365 days (12 months) parents	=	638750g	=	683.75kg
75g/animal x 11 x 120 days (4 months) F_1	=	99,000g	=	99.00kg
175g/animal x 11 external males x 245 days (8 months) F_1	=	465,625g	=	462.625kg
30g/animal x 30 animals x 90 days (3 months) F_2	=	81,000g	=	81.00kg
75g/animal x 11 animals x 120 days (4 months) F_2	=	99,000g	=	99.00kg
175g/animal x 11 animals x 60 30 days (1 month) F_2	=	57,750g	=	57.75kg
30g/animal x 30 animals x 60 days (2 months) F_3	=	54,000g	=	54.00kg
			=	**1,537.13kg**

Third Year

30g/animals x 30 animals x 30 days (1 month) F_3	=	27,000 g	=	27.00kg
175g/animal x 10 parents = 365 days (12 months) parent	=	638,750g	=	638.75kg
30g/animal x 30 animals x 90 days (3 months) F_4	=	81,000g	=	81.00kg
75g/animal x 11 animals x 120 days (4 months) F_3	=	99,000g	=	99.00kg
30g/animal x 30 animals x 30 days (1 month) F_5	=	27,000g	=	27.00kg
175g/animal x 11 animals x 90 days (3 months) F_1	=	173,000g	=	173.25kg
175g/animal x 11 animals x 300 days (10 months) F_2	=	577,500g	=	577.50kg
175g/animal x 11 animals x 210 days (7 months) F_3	=	173,250g	=	173.25kg
75g/animal x 11 animals x 120 days (4 months) F_4	=	99,000g	=	99.00kg
			=	**1,895.75kg**

Fourth Year

30g/animals x 30 animals x 30 days (1 month) F_3	=	27,000 g	=	27.00kg
175g/animal x 10 parents = 365 days (12 months) parent	=	638,750g	=	638.75kg
30g/animal x 30 animals x 90 days (3 months) F_4	=	81,000g	=	81.00kg
75g/animal x 11 animals x 120 days (4 months) F_3	=	99,000g	=	99.00kg
30g/animal x 30 animals x 30 days (1 month) F_5	=	27,000g	=	27.00kg
175g/animal x 11 animals x 90 days (3 months) F_1	=	173,000g	=	173.25kg
175g/animal x 11 animals x 300 days (10 months) F_2	=	577,500g	=	577.50kg
175g/animal x 11 animals x 210 days (7 months) F_3	=	173,250g	=	173.25kg
75g/animal x 11 animals x 120 days (4 months) F_4	=	99,000g	=	99.00kg
			=	**1,895.75kg**

Fifth Year

30g/animals x 30 animals x 30 days (1 month) F_3	=	27,000 g	=	27.00kg
175g/animal x 10 parents = 365 days (12 months) parent	=	638,750g	=	638.75kg
30g/animal x 30 animals x 90 days (3 months) F_4	=	81,000g	=	81.00kg
75g/animal x 11 animals x 120 days (4 months) F_3	=	99,000g	=	99.00kg
30g/animal x 30 animals x 30 days (1 month) F_5	=	27,000g	=	27.00kg
175g/animal x 11 animals x 90 days (3 months) F_1	=	173,000g	=	173.25kg
175g/animal x 11 animals x 300 days (10 months) F_2	=	577,500g	=	577.50kg
175g/animal x 11 animals x 210 days (7 months) F_3	=	173,250g	=	173.25kg
75g/animal x 11 animals x 120 days (4 months) F_4	=	99,000g	=	99.00kg
			=	**1,895.75kg**

Sixth Year

175g/animal x 11 animals x 300 days (10 months) F_6	=	577500g	=	577.5kg
175g/animal x 11 animals x 180 days (6 months) F_7	=	346500g	=	346.5kg
			=	**924.00kg**

Seventh Year

175g/animal x 11 animals x 30 days (1 month) F_8	=	57750g	=	57.75kg
			=	**57.75kg**

Estimation of Incremental Benefits per Farmer for A 2-Family Starter-A

Hypothetical Case

Item/Activity	**Annual Cost (GH¢ /yr)**					
	1st Yr	**2nd Yr**	**3rd Yr**	**4th Yr**	**5th Yr**	**6th Yr**
Cost Elements						
Starter stock	350.00	-	-	-	-	-
Housing unit to accommodate cages	180.00	-	-	-	-	-
Three-tier	720.00	-	-	-	-	-
Labour for daily routine activities	119.60	256.67	376.74	376.74	376.74	159.69
Supplementary feeding	131.10	340.96	420.51	420.51	420.51	204.96
Miscellaneous (feeding bowls and cleaning items)	20.00	30.00	40.00	40.00	40.00	25.00
Sub-total	***1,520.70***	***627.63***	***837.25***	***837.25***	***837.25***	***389.65***
Revenue Element						
Sale of animals as breeding stock and/or for table	665.00	1330.00	1770.00	1770.00	1770.00	440.00
Sub-total	***665.00***	***1330.00***	***1770.00***	***1770.00***	***1770.00***	***440.00***
Incremental Benefits						
Total Revenue-Total Cost	**(855.70)**	**702.37**	**932.75**	**932.75**	**932.75**	**50.35**

APPENDIX-B

OUTPUT OF THE RERESSION ANALYSIS

Descriptive Statistics

	Mean	Std. Deviation	N
Net Present Value	982.0751	325.62501	100
Age of respondent	48.94	10.810	100
Level of education of respondent	2.50	.937	100
Sex of respondent	1.15	.359	100
Discounted Housing Cost	725.4000	88.43697	100
Experience in animal rearing before engaging in grasscutter rearing	1.15	.359	100

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.823[a]	.678	.660	189.76534	.678	39.500	5	94	.000

a. Predictors: (Constant), Experience in animal rearing before engaging in grasscutter rearing, Level of education of respondent, Discounted Housing Cost, Sex of respondent, Age of respondent

b. Dependent Variable: Net Present Value

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7112109.983	5	1422421.997	39.500	.000[a]
	Residual	3385023.102	94	36010.884		
	Total	1.050E7	99			

a. Predictors: (Constant), Experience in animal rearing before engaging in grasscutter rearing, Level of education of respondent, Discounted Housing Cost, Sex of respondent, Age of respondent

b. Dependent Variable: Net Present Value

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	3224.844	203.495		15.847	.000			
	Age of respondent	-.134	1.824	-.004	-.073	.942	.027	-.008	-.004
	Level of education of respondent	-7.457	21.031	-.021	-.355	.724	.049	-.037	-.021
	Sex of respondent	-32.136	54.769	-.035	-.587	.559	-.205	-.060	-.034
	Discounted Housing Cost	-3.007	.221	-.817	-13.577	.000	-.822	-.814	-.795
	Experience in animal rearing before engaging in grasscutter rearing	.465	53.707	.001	.009	.993	.066	.001	.001

a. Dependent Variable: Net Present Value

APPENDIX-C

QUESTIONNAIRE FOR SAMPLED FARMERS

DEPARTMENT OF AGRIC. ECONOMICS, AGRIBUSINESS & EXTENSION
KWAME NKRUMAH UNIVERSITY OF SCIENCE & TECHNOLOGY
KUMASI

FEATURES AND PROFITABILITY OF DOMESTIC GRASSCUTTER PRODUCTION IN THE BRONG AHAFO REGION

A. PERSONAL INFORMATION

1. Farmer's Name:
2. Sex: Male [ ] Female [ ]
3. Ecological zone: Forest [ ] Transitional [ ] Guinea savanna [ ]
4. District…….
5. Religion: Christian [ ] Islam [ ] Traditionalist [ ] Pagan [ ]
6. Age……..
7. Level of Education: Illiterate/Basic [ ] Middle/JSS [ ]
   Secondary/Commercial/Vocational [ ] Post Secondary/Tertiary [ ]
8. Occupation: Farming [ ] Civil Service [ ] Commerce [ ] Artisanship/ Others [ ]
9. Marital Status: Single [ ] Married [ ] Widowed [ ] Divorced [ ]
10. What is your family size? .....
11. How many of these people help in the grasscutter enterprise? …….....
12. For how long have you been into grasscutter rearing? …….....
13. Did you have any experience in animal rearing before entering into grasscutter reaing?
    Yes [ ] No [ ]
    14. What type of animal were you rearing? Sheep/goat [ ] Cattle [ ] Pig/rabbit [ ] Poultry [ ]

B. TRAINING

1. Have you received any training in grasscutter production? Yes [ ] No [ ] (If no, move to Farm Establishment)
2. If Yes, what did you know about grasscutter production before the training …… ……
3. What do you know after the training…….
4. Did you find the training useful? Yes [ ] No [ ]
5. Cost of training……...

C. FARM ESTABLISHMENT

1. Where did you get the initial start-up capital? Personal [ ] Family member/ friend [ ] NGO [ ] Bank loan [ ] District Assembly [ ]
2. If NGO, which NGO……
3. In what form was the support given? (Tick as many as possible): Training [ ] Initial breeding stock [ ] Cages [ ] Cash [ ] Others [ ] (specify) ……..
4. Mode of repayment of support: Cash [ ] Animals [ ] Others [ ] (If others, specify)……
5. How many animals were received/ bought for start up? Males …Females…… Total…….
6. What is your current stock size (including young ones)? ……Males…… Females…… Average litter size……
7. With this no. of females and average litter size, how many will you keep for breeding and how many for meat production? No. for breeding……...No. for meat production……..
8. How many cages do you have (compare with a 3 –tier)……
9. How many of these cages are fully stocked/occupied? ……
10. Reason for entering into grasscutter production: Income [ ] Employment [ ] Environmental conservation [ ] others e.g own interest/hobby [ ]
11. What is your objective/aim of production? Breeding [ ] Breeding& Meat production [ ] Meat production
12. Have you receive any bank loan to support your grasscutter production enterprise? Yes [ ] No [ ] If yes, when…… And how much……

D. FARM MANAGEMENT (Assuming for 2 families)

I. HOUSING

1. Type of cage being used. Wood + mesh [ ] Concrete [ ] Mud/ Laterite [ ] Others [ ] if other, specify……. Cost……
2. Housing system being used: Indoor [ ] Cost ……Outdoor [ ]
3. Any problem associated with type of housing system……

……

……

……

……

……

……

II. LABOUR

1. Form of labour used: Self/ family [ ] Hired [ ] If hired, Casual [ ] Permanent [ ]
2. No. of labourers/ hands employed per day …….. Unit cost of labour if hired/ day…… Average time spent per day(for family labour) Morning……..Afternoon……Evening……..Total……

III. FEEDING

1. What type of feed do you use? (Tick as much as applicable) Grass [ ] Supplementary feed [ ] Household waste [ ]List them……Others [ ]
2. If other, specify……
3. How many times do you provide feed per day: Once [ ] Twice [ ] Three times [ ] Four times [ ]
4. How many trips of grass do you fetch per week? Once [ ] Twice [ ] Three times [ ] Four times [ ] Daily [ ]
5. How much does/would cost per week: Wet season … .Dry season……
6. How much does it cost to give supplementary feed per week……
7. How much does it cost to serve water + washing of feed/water troughs……
8. Do you encounter problems with feeding of the animals? Yes [ ] No [ ]
   If yes, mention the problems……..
   ……
   ……
   ……
   ……
   ……
9. What do you do to address the problems
   ……
   ……
   ……
   ……
   ……
   ……

IV. DISEASE/ANIMAL HEALTH

1. Have you encountered disease or health problems? Yes [ ] No [ ] If yes, mention the disease/ health problem encountered
   ……..…….
   ……
2. Who do you consult when you encounter such problems?
   Veterinary officer [ ] Colleague farmers [ ] Own ideas [ ]

3. What medications are used in treating disease/health problems
   ……...…….……
   …..……
4. Is there any precaution or special feed you give that prevents or safeguards animals from disease/health problems? Yes [ ] No [ ] If yes, mention them
   ……..……
   ……...…….
5. Are there particular group of animals that are usually affected? Yes [ ] No [ ] If yes, which group of animal: Young ones [ ] Sub adults [ ] Adults [ ]
6. Is there a particular period in the year where disease/health problems are common? Yes [ ] No [ ] If yes, which period 1st quarter [ ] 2nd quarter [ ] 3rd quarter [ ] 4th quarter [ ]
7. How much does it cost per month to treat disease/health related problems……
8. Any comments concerning animal health……...

   ……
   ……

E. PRODUCTION COSTS

Fixed Assets

Item	**Quantity**	**Unit Cost**	**Total**
Housing (if in-door)			
Cage			
Breeding stock			
Other equipment Feed/water trough Wheel barrow Cutlass Scraper Shovel/spade Head pan/ basin			

Operating Expenses

Item	**Cost/ week**
Supplementary feed	
Cleaning materials	
Grass	
Labour	
Other expenses	

F. MARKETING

1. Have you sold some animals? Yes [ ] No [ ] If yes, how many ……
   Breeding……Meat…….

Selling Price

	Breeding	Meat (Weight)
Male		
Female		

2. Who sets price of domestic grasscutters: Market forces [ ] Farmers' Association [ ] GTZ [ ]
3. What are the most important factors in determining price of animal?.....

   …….
4. Are there some particular groups of people who buy your grasscutters for consumption? Yes [ ] No [ ] If yes, who are they Private Individuals [ ] Chop bar/Restaurant [ ] Others [ ] …….
5. What problems are associated with sale of domestic grasscutters…….

   ……

   ……

   ……..
6. What benefits have you derived from domestic grasscutter production

   ……..

   .....

   .....

   .....
7. How do you see the future of domestic grasscutter production: Very Promising [ ] Promising [ ] Do not know [ ] Less Promising [ ]

G. ASSOCIATION

1. Do you belong to any co-operative association? Yes [ ] No [ ] If yes, what benefits do you derive from the association? Get easy access to breeding [ ] Get advice and assistance on problems related to animal health from colleague farmers [ ] Marketing of animals [ ] Access to credit facility [ ]

2. Do you find the farmer co-operative beneficial? Yes [ ] No [ ]

   If yes, why?

   ……

   ……

   ……

   ……

   If no, give reason

   ……

   ……

   ……

   ……

3. What problems are you faced with as far as domestic grasscutter production is concerned? (Rank them from 1 to 6): i. Dry season feeding ii. Access to credit facility iii. Disease and animal health iv. Marketing of animals v. High cost housing vi. Small litter size

4. What suggestions/recommendations can you give to help improve domestic grasscutter production in Ghana:

   ……

   .....

   .....

   .....