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Journal of Agricultural Extension and Rural Development

Full Length Research Paper

An 'innovation-cycle framework' of integrated agricultural knowledge system and innovation for improving farmers' climate change adaptation and risk mitigation capacities: A case of Bangladesh

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The main objective of this paper is to present a new 'innovation-cycle' integrated conceptual framework of 'TVET-adaptive AKSI' (TVET: Technical and Vocational Education and Training; AKSI: Agricultural Knowledge System and Innovation). Thus the aim here is to discuss from existing body of literature of how 'TVET-adaptive AKSI' can be the 'Next Frontier of Green Innovation' and adaptation strategy to improve agricultural-based producers' understanding of 'risk perception and mitigation' (a case of Bangladesh is considered). Given the present state of producers' risks perceptions and the increased risks of safe agricultural food production, sustainable environment and health, it will be unprecedented challenges due to increasing demand for safe food supply for future growing population in Bangladesh. Studies show that producers (farmers) are still lagging behind with lack of necessary capacities including shortage of adequate knowledge of understanding in both 'environmental' and 'health' risks, which are contributing to excessive use of pesticides, fertilizers and agrochemicals for agricultural production, mixing of prohibited or hazardous chemicals with foods and foodstuffs for food adulteration, post-harvest preservation, and processing without being sufficiently aware of health and environmental consequences. To address the issue, very little investigations were done to understand how producers' perception and ignorance of risks are interconnected to the ways of their risky behaviour. Thus the aim of this paper is to explore existing literature to draw an understanding by developing a 'conceptual framework' about the urgent need of future 'Game Changer' strategy (e.g. Next Frontier of Green Innovation) for the safety and security of rapidly growing population by tackling the challenges of sustainable agricultural and safe food production in Bangladesh.

Key words: Agricultural knowledge system, Bangladesh, climate change adaptation, conceptual framework, next frontier of green innovation, networks, risk perception and ignorance, risk mitigation, Technical and Vocational Education and Training (TVET).

INTRODUCTION

In global context, the impacts of climate change are posing huge challenges for agricultural sustainability (IPCC, 2014; Barros et al., 2015; Chen et al., 2015; Wood and Mendelsohn, 2015) and thus adaptation (Gerlitz

et al., 2014; Ngugi et al., 2015; Niles et al., 2015; Truelove et al., 2015; Waongo et al., 2015) and mitigation (Havlík et al., 2014; Makkonen et al., 2015; Gelfand and Robertson, 2015; Domínguez and Fellmann, 2015) have become the core issues in many countries (Ipcc, 2014; Noble et al., 2014; Nam et al., 2015). Despite many initiatives, adaptation of agricultural innovations by smallholder farmers specially in developing countries seems to be slow (Meijer et al., 2015; Berkhout et al., 2015), this is due to farmers' proper knowledge gap about the risks of climate change (Rahman, 2013; Banerjee, 2015; Kalafatis et al., 2015). In relation to Bangladesh, the impacts of climate change and human induced unplanned development activities are posing a huge challenge to millions of rural people's livelihoods (Hijioka et al., 2014; Ipcc, 2014; Amin et al., 2015; Mishra et al., 2015). For instance, in the context of human security, people are facing serious water pollutions and scarcity, heat stress, seasonal food shortage for low agricultural productivity (Adger et al., 2014; Hellberg and Chu, 2015; Kamruzzaman et al., 2015). To address these challenges, there has been huge change of agricultural knowledge systems during last decade. Main driving forces for such changes are the dynamic structure of supply and demand of agricultural markets such as new types of products and services for growing population (Ahmed et al., 2014; Jordan, 2014; Hassan, 2015).

The agricultural sector provides livelihoods to more than two-thirds of the population of Bangladesh and employs about 62% of the total population (Biswas et al., 2001; Rasul and Thapa, 2004; Rashid et al., 2014). To address the issues of agricultural-based safety and environmental adaptation, Government of Bangladesh started to take many initiatives through agricultural extension programmes including harnessing technology more effectively since many years ago (Islam and Grönlund, 2007; Habiba et al., 2011; Islam et al., 2015; Rahman and Siddiquee, 2015). For example, for the last 40 years, popular agriculture based TV programmes '*Mati-o-Manush',* and *'Nodi o Jibon*' have been trusted by farmers (Ahmed, 2010; Uddin and Qijie, 2013).

Other major initiatives include the World Bank's advocacy of the Training and Visit (T and V) approach to extension in the 1970s, 'Agricultural Support Services Project (ASSP, 1992-1999)', 'Agricultural Services and Innovation and Reform Project (ASIRP, 1999-2002)', 'Thana Cereal Technology Transfer and Identification Project (TCTTI, 1995-2000), Integrated Soil Fertility and Fertilizer Management Project (SFFP, 1993-2000)', 'Agricultural Diversification and Intensification Project (ADIP, 1997-2004)', and latest 'e-KRISHI Vision 2025'. According to Ahmed (2010), agricultural extension workers were specially trained to assist farmers in adopting new technologies for High Yielding Varieties (HYVs).

Despite of various technology-based initiatives, evidences show that farmers in rural areas in Bangladesh are lagging behind with lack of necessary capacities for understanding about the impacts of climate change and agricultural-based risks (Chen et al., 2004; Parvez et al., 2006; Rahman, 2013; Ahmed et al., 2015). The impacts of climate change such as drought, floods are understood by high numbers of local producers as 'Divine Retribution' or 'Natural matters' (Paul and Routray, 2011; Rahman, 2013). All of these are contributing to increase the risks of climate change and environmental adaptation as well as posing threats to human health and livelihoods. The lack of necessary capacities is further contributing to excessive use of pesticides, fertilizers and agrochemicals for agricultural production, mixing or adding of prohibited or hazardous chemicals to foods and foodstuffs for food adulteration, post-harvest preservation, and processing (Wooster et al., 2005; Hossain et al., 2008; Ali, 2013; Rahman, 2014; Robson, 2014; Hassan, 2015).

Overuse of pesticides and chemicals and their impact are highlighted in many researches (Rahman, 2003; Isin and Yildirim, 2007; Pretty, 2008; Heong et al., 2015). It is alarming that in Bangladesh majority of farmers are not trained in pesticides use or handling fertilizers or spraying preservatives, and most of them openly admit to using little or no protective measures while applying pesticides (Dasgupta et a., 2005; Hassan, 2015). This results in increased health and environmental risks due to contamination of water, loss of biodiversity and deterioration of soil quality and toxic elements in the food chain (Huq et al., 2006; Altieri, 2009; Chowdhury, 2010; Khan et al., 2011; Munnaf et al., 2015; Hassan, 2015). A summary of the key risks due to 'risk ignorance' or lack of producers' capacity of risks mitigation is given as follows:

(i) Overuse and inappropriate use of agrochemicals, overuse and imbalanced use of irrigation, inorganic fertilizers and pesticides leading to contamination of water, loss of genetic diversity and deterioration of soil quality.
(ii) Increasing evidence of human health problems associated with agricultural production, consumption of agrochemicals (including pesticides) and adding of prohibited or hazardous chemicals to foods and foodstuffs for food adulteration. Post-harvest preservation and processing are also emerging as toxic elements in the food chain.
(iii) Increased risks of implementation of climate change adaptation strategies by ignoring (based on Divine Retribution concept) the linkages of the impacts of climate change to the risks of natural events such as

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drought and floods.

Thus, the above concerns highlight the urgent need to explore the potential strategy to reduce future producers' risky behaviour towards sustainable agricultural food production. In recent years, technological approaches including 'information technology' in a global context have increasingly become an important aspect of environmental sustainability including sustainable rural development (Dao et al., 2011; Unwin, 2009; Schafft et al., 2006; Forsyth, 2014). It is widely accepted that vocational education and training (VET) plays an exceptional role in the development of a skilled work force as a contribution on the road to innovation and economic competitiveness (BANBEIS, 2012; Mahmud et al., 2014; Shan et al., 2015). This can further integrate valuable local knowledge to share with farmers local stories and experiences related to risks perceptions and local mitigation approaches. However, the process is far incomplete, not only in implementation but also in policy analysis (Rivera, 2011). Therefore, the aim of this review is to analyse the existing literature and identify a holistic conceptual framework of agricultural knowledge system (AKS), which can be used to increase agricultural-based producers' adaptive knowledge capacity. It is required because the basic principle of a conceptual framework is the construction or assembly of a broad set of ideas to describe how a system operates with the intention of developing a better understanding of the underlying relationships in the field of enquiry (Korb and Nicholson, 2004; Bredehoeft, 2005; Trkman and Turk, 2009; Kroeger and Weber, 2014, Carayon et al., 2015). The framework provides an explicit structure of thinking within which the reality can be examined (Knol et al., 2010). Smyth (2004) points out that a well-articulated conceptual framework can act as a scaffold on which to build research.

PROPOSED INTEGRATED CONCEPTUAL FRAMEWORK AND RELEVANT LITERATURE

Studies about farmers' *risk perception* have been conducted in many countries (Finucane and Holup, 2005; Adrian et al., 2005; Guehlstorf, 2008; Hashemi and Damalas, 2010; Duinen et al., 2014; Ayinde et al., 2014; Remoundou et al., 2015), and in Bangladesh (Robinson et al., 2007; Hossain et al., 2013). Yet less attention has been given to investigate: what extent addressing producers risk ignorance is important for the effectiveness of agricultural extension policies? How can agri-based vocational education be reinforced with making technological resources more available to change producer's less risky and more sustainable behaviour? Interrelated issues in Bangladesh, such as inadequate institutional support, more centralized, hierarchical and top-down strategies resulted in less impacts of technological approaches for local farmers' capacity development, especially to address climate change induced risks and harmful pesticides use (Balaji et al., 2007; Rahman and Siddiquee, 2015; Parvin et al., 2015).

For a long time (more than four decades), risk research has developed various concepts of risks and identified strategies to manage those environmental risks (Renn, 1998; Vandermoere, 2008). However, two contrasting concepts of risks perceptions are highly relevant, for instant risk as a physical reality existing independently of our knowledge of it (*the realist approach*), and secondly risk as a *social construct*, with emphasis on the contrasting and whether it is useless or at least not sufficient of educating the public with only non- social forms of knowledge or argument (Otway and Thomas, 1982). Similarly*, risk ignorance* is a multidimensional concept with various facets (Raghunathan and Koehler, 2004; Ehrich and Irwin, 2005; Kutsch and Hall, 2010; Poullis et al., 2015), although it is often cited as a lack of 'true' knowledge and people's evaluation behaviour during information retrieval system interactions (Greisdorf, 2003). Ignorance is closely linked to relation between judgments of probability and preferences between bets and sometimes people even pay a significant premium to bet on their judgments (Heath and Tversky, 1991). However, the issue of risk ignorance is influenced by various factors; it is linked with either an 'error' (similar of the realist approach of risk perception), meaning it is beyond one's control, both systemically and cognitively (Slovic et al., 2004; Paharia et al., 2013), or '*deliberate or wilful'* ignorance or irrelevance (similar to *the social constructive approach* of risk perception), driven by social factors and conditioning (Raghunathan and Koehler, 2004; Kutsch and Hall, 2010). Perfect knowledge about an issue is not always possible, and error will occur despite attempts of corrections. However, in contrast, deliberate ignorance is defined as irrelevance (Smithson, 1989; 2010). It is not that information is missing or wrong, but rather that the presence of particular information is not deemed important by stakeholders' risk in a particular contexts (Kelsey and Quiggin, 1992; Ehrich and Irwin, 2005). An integrated conceptual framework is developed (Figure 1) based on relevant literature presented in this paper.

Adaptive innovation

The development and diffusion of IT in appropriate manner are considered to be one of the most relevant options, which can further help local farmers to address risks (UNFCCC, 2006; Below et al., 2010; Lybbert and Sumner, 2010). An 'innovation' of an integrated agricultural knowledge system embedded with Agri-based vocational education and IT resources would enable extension workers and farmers have high levels of interaction, especially about risks (Gandhi et al., 2007). 'Innovation' in this case links to 'social innovation' (Brown and Wyatt, 2010; Phills et al., 2008), which can be well

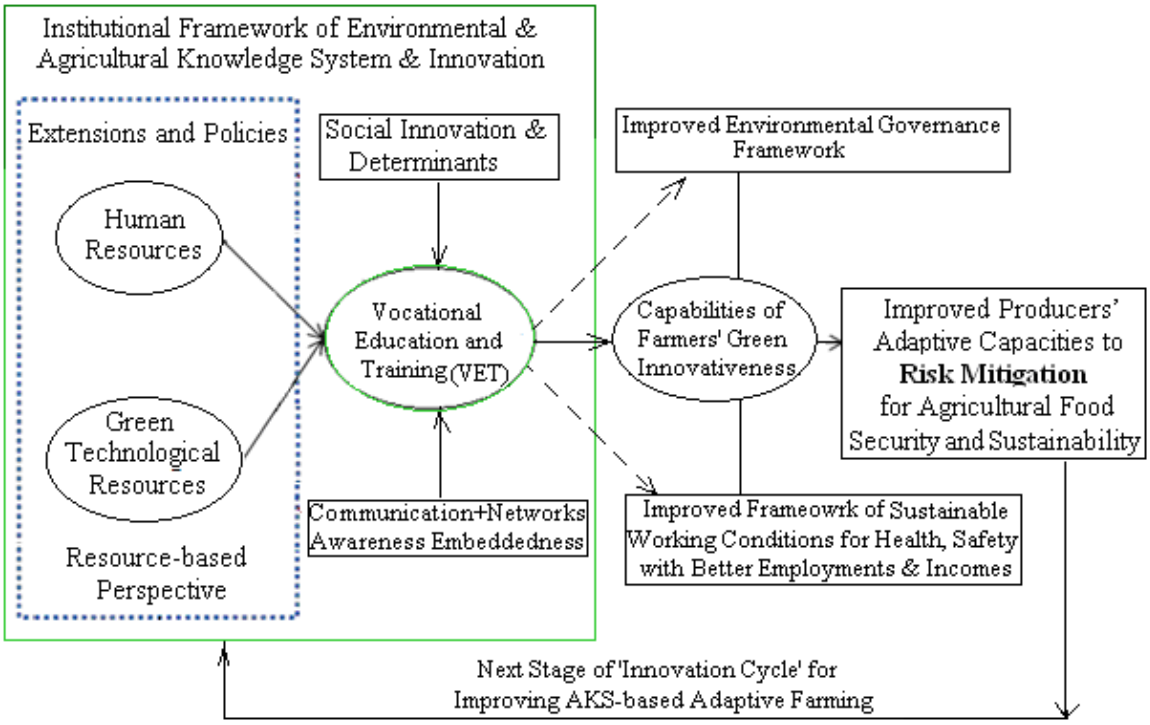

Figure 1. 'Innovation-cycle Framework' of TVET integrated agricultural knowledge system to improve producers' risk perception and mitigation capacities.

placed for an effective planning to develop 'Next Frontier of Innovation' (Brown and Hagel, 2005; Goldblatt, 2010) to fulfil the demand of safe agricultural food supply. It is important that there is a critical need to understand the role of local people, society and their institutions as mechanisms for negotiating socio-ecological and socio-technical change in natural resource management (Niemeyer et al., 2005; Kofinas, 2009; Smith and Stirling, 2010). Ideal selection of local 'entrepreneurship' thus can be a mechanism for empowering innovation.

Moreover, 'innovation' is generally defined as that which introduces something new, makes changes in anything established (Tanimoto, 2010). According to Drucker, 'social innovation' includes not only technology but also frameworks of social insurance and healthcare which have a huge impact on society (Drucker, 1987; Drucker and Drucker, 2007). Social innovation is considered as important element for enhancing sustainable human–environment interactions (Baker and Mehmood, 2015).

The needs of unifying social and technological innovation are discussed by Gardner et al. (2007) in the context of global health issues. Gardner et al. (2007) pointed out that 'innovation' should be understood as the entire process from idea to implementation (Figure 1). Particularly improving access to essential products and services requires three forms of innovations (Gardner et al., 2007), such as '1) '*technological innovation*' to ensure availability of products that are more cost-effective than existing. This innovation involves solutions in technological aspects 2) '*social innovation*' to ensure the distribution of essential goods and services and understanding the adaptive process in complex socio-ecological systems (Baker and Mehmood, 2015); and 3) '*adaptive innovation*' involving both providers and communities, to conceptualize the adaptation of goods and services to local settings.

Both social and adaptive innovations involve solutions those are new ways to recognize human resources, information, and decision making in environment and risks management. There-fore, in all cases, 'innovation' involves both the solutions and its implementations (Gardner et al., 2007), especially 'adaptive innovation' that links both providers and communities.

TVET for green innovativeness and sustainability

The positive impact of using technology, to help solve environmental problems and improve users capacity for sustainability, is referred to as green technology (Watson et al., 2010; Green, 2015). The potential environmental benefits enabled by technology and information technology include prevention of pollution, reducing the environmental footprint of communities, businesses, supply chains and nation and enforce people's behavioural

changes (Melville, 2010; Davidson et al., 2011). Studies have shown that technological innovation with information technology is useful to boost agricultural knowledge by enabling rural people to gather, store, retrieve, adapt, localize and disseminate a broad range of information needed (Davison et al., 2005; Balaji et al., 2007; Tambo and Abdoulaye, 2012).

However, issues such as inadequate institutional support, complex characteristics of agricultural extension systems due to continued emphasis on more centralized, hierarchical and top-down approaches have resulted in less impact of technological approaches on local farmers' capacity development; specially to address climate change induced risks, which include risks due to harmful pesticides use (Balaji et al., 2007). In the context of technological innovation, Technical and Vocational Education and Training (TVET) is an important approach to education and job training in modern educational systems in both developed and developing countries (Gazi et al., 2009).

TVET integrated education is very necessary for nation building because of the production of skill manpower through improving resource-based perspective (Green-technology resources and Human resources). These resource-based perspective linked to agriculture could easily be integrated with agricultural extension for better services and productivities. Yet, in relation to local producers capacity building in environmental risks mitigation, significant investments are needed to develop effective agricultural education systems.

According to Benitez-Amado et al. (2010) technological oriented education, capabilities local green innovativeness and capacities of risk mitigation are interlinked. Technological resources at vocational institutes can improve TVET institutes' learning environment for understanding of sustainability and green creativity. That can empower local farmers with adequate technical knowledge related energy efficiency including use of renewable energy resources for agriculture and potential adaptive measures. It will enable farmers to exchange knowledge and collaborate with other producers as shown in Figure 1.

Networks, communication and awareness embeddedness

Collaboration, communication and networks embeddedness are assumed to be important factors of successful agricultural-based TVET and environmental awareness development. Environmental knowledge sharing among community members are highly influenced by the patterns of social networks and knowledge passing from elders (Rahman, 2013). Thus, in order to address the issues of above pointed risk ignorance and mitigation problems and to improve actionable strategies, it is important to collaborate from the beginning with relevant stakeholders in the process (Figure 1). Moreover collaboration, networks and collective participation in sustainable development are important aspects in awareness building (Kofinas, 2009; Walker et al., 2015). It provides better understanding the relationship among institutions, organizations, networks and individuals within and across multiple scales (Chapin III et al., 2009; Taylor and Van Grieken, 2015), which in turn leads to develop a long-term planning (Kemp et al., 2007, 2009).

According to Fowles (2000) The frame-work's collaborative participation can be described as the transformation from the 'ignorance' into a complementary 'knowledge' through participation, collaboration and continuous learning through reinvesting the improved human capital as shown in Figure 1 (feedback line: Innovation cycle).

CONCLUSION

The review presented has shown that increasing ignorance of environmental and health 'risks' by producers is 'in an alarming state' that will pose huge challenges for sustainability of the next growing population in Bangladesh. Although there are initiatives for incremental development initiatives, however, still major change initiatives are missing as described in the review. Therefore, with the growing technological resources, a 'game changer' initiative must be considered together with society as an integrated component. In response, this review has painted and developed an innovation-cycle oriented integrated conceptual framework that highlights the option of 'Next Frontier of Green Innovation'. This is a significant step forward by using local context with state-of-the-art technological availability and vocational training. The initiative is not only a significant step to address the potential climate change adaptation strategy, but also to improve producers' social and technical understanding of risk perception for 'risk mitigation to develop sustainable and green agricultural systems in Bangladesh.

Further development

The above presented 'TVET-adaptive innovation-cycle conceptual framework' is being developed by author as 'first step' of a proposed research project 'Agricultural Knowledge System and Innovation' at Humboldt University in Berlin, Germany. To address the point of 'networks, communication embeddedness', the author has also established an international consortium 'AKSinDC' (Agricultural Knowledge System and Innovation in Developing Countries) and 'KRS Nexus' (KnowledgeSociety-ResourceEfficiency-Sustainability Nexus). In future, empirical research results will be presented based on this framework.

Conflict of Interest

The author has not declared any conflict of interest.

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Farmers' knowledge, attitudes and perceptions of occupational health and safety hazards in Trinidad, West Indies and implications for the Agriculture sector

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Studies have shown that Trinidad has an aged farming population. Young persons are not entering the sector. As such, older farmers will continue to be the backbone of Trinidad's agricultural sector. There is urgent need for focus to be placed on improving the state of occupational health and safety within this sector. This study sought to determine farmers' knowledge, attitudes and perceptions towards occupational health and safety issues in agriculture and recommend actions to reduce/prevent health and safety hazards in agriculture. A total of 100 small-scale commercial-oriented vegetable farmers from ten of the most populated agricultural pockets across Trinidad were surveyed as part of this study. The results of this study indicated that farmers had overall good knowledge, fairly positive attitudes but strong negative perceptions towards occupational health and safety issues in agriculture. Gender was not a significant factor on knowledge, attitude or perception levels. Additionally, attitude varied significantly based on characteristics of farmers (age and job type) and communication efforts by extension. This study validates the need for more emphasis to be placed on occupational health and safety within Trinidad's agricultural sector, which can be achieved through directed programs, policies and practices by government and its related agencies.

Key words: Occupational health and safety, Agriculture, knowledge, small-scale farmers, Trinidad.

INTRODUCTION

Occupational health and safety (OHS) is a set of guidelines that aims to: (a) maintain and promote the health of workers, as well as their working capacity; (b) improve the working environment and the job task so that it becomes conducive to health and safety; and (c) develop work organisations and working cultures in a direction which supports workplace health and safety (International Labour Organisation, 2014). Farming is considered to be amongst the most hazardous occupations since its workers are exposed to a wide range of occupational hazards on a daily basis. The job of a farmer usually entails performing labour-intensive

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physical activities, often in unfavourable conditions. Further, it has been postulated that occupational health and safety issues in agriculture exist not only because of the hazards present, but also because of ignorance, illiteracy, the lack of use or availability of personal protective equipment, inadequate information on occupational hazards, and/or non-existent or inadequate training (Ewete, 2011). Therefore, the knowledge level of farmers on occupational health and safety hazards and their perceived risks, as well as their attitudes and behaviours towards safety, play a crucial role in the safe operations of farming activities (Demirbas et al., 2009).

Farmers' knowledge and attitudes towards OHS and perceived risks

Most farms do not have a documented health and safety policy, including arrangements for managing safety effectively since they do not operate in an organisational context. Due to a lack of organisational structure, compliance with OHS is difficult to monitor in all farms, regardless of its operational span. Therefore, it can be argued that farmers do not take health and safety seriously. This is evident by research conducted in the United Kingdom, which showed that farmers in general had unfavourable attitudes to safety, despite being aware of the potential risks associated with their jobs (Cooper, 2012).

In addition, Cooper (2012) reported that the majority of farm owners never provided health and safety training for their hired labourers, nor did they ever discuss health and safety issues with them. Moreover, farmers have an informal perspective of health and safety, in particular, the role that their job plays on their health and safety (Amshoff and Reed, 2005). However, there is an agreement that agricultural practices and the industry as a whole is more likely to be unsafe if assessed under OHS guidelines (Cooper, 2012). With regards to knowledge, many farmers lack knowledge about health and safety issues and thus, fail to comply with health and safety legislation and standards (Elkind, 1993).

Studies have shown that farmers who were not provided with, or shown how to use, personal protective equipment, suffered from higher rates of occupational accidents, injuries and diseases (Lekei et al., 2014). Thus, farmers believe that if they are provided with more up-to-date information and advice regarding health and safety on farms, not only would it make their job less hazardous but also, it will also positively change their attitudes towards safety. However, Elkind (1993) disagrees and argues that the provision of information about farm hazards does not always correspond with changes in attitudes and behaviours and thus, do not ensure safer practices. Elkind (1993) went on to suggest that the presence of a multitude of farm hazards, as well as farmers' willingness to change their attitudes, behaviours and cognitive perceptions may be socially, politically or economically influenced. Furthermore, in terms of risk perception, farmers' attention to and processing of information relating to hazards in their work environment is influenced by scientific communications, farmers' peers or trusted figures in society, as well as the mass media. As such, Pidgeon and Beattie (1997) argues that, 'external information on hazards and their effects are selected for attention and interpreted on the basis of individual cognitive processes, which are shaped by external information sources'.

OHS in Agriculture: Trinidad

In Trinidad, approximately 19,111 farmers (4% of the labour force) are involved in agricultural production (Jugmohan, 2013), and research conducted by the Economic Commission for Latin America and the Caribbean (2004), has indicated that Trinidad has an aged farming population, with the majority of farmers being older than fifty years of age. This is mainly attributed to the fact that young adults are opting not to pursue professions in agriculture. As such, the agricultural industry in Trinidad will continue to comprise of aged workers, making the issue of occupational health and safety within the sector an alarming concern. Further, studies have shown that the older farmers tend to suffer disproportionately high mortality and morbidity rates (Amshoff and Reed, 2005).

To add to this situation, in Trinidad, the farming sector has been traditionally neglected due to the high significance placed on industrial development. Most agricultural production activities are manually performed by small-scale, self-employed landowners. These farmers tend to produce crops to satisfy the demands of local markets, often with the help of family members. However, when specializing in cash crop production (such as tomatoes, cucumber, celery etc.), farmers tend to employ hired labourers. Additionally, research has indicated that there is a moderate prevalence of occupational hazards among small-scale, commercial-oriented vegetable farmers in Trinidad, with OHS outcomes differing based on each individual's job role (Baksh, 2014). Thus, this study seeks to fill the gaps in the literature not only as it relates to the knowledge, attitudes and perceptions of this farming group in Trinidad, but also by determining if these factors differ based on their individual job roles. Furthermore, if farmers are not aware of the occupational hazards that exist as a result of their job and due to their work environment, as well as the potential risks that these hazards pose to their health and safety, it can have negative impacts on national food security goals and the long-term sustainability of the sector.

Problems specific to the profession of vegetable farming in Trinidad which justifies an investigation include: (a) The extent of which up-to-date occupational

health and safety information is being made available to agricultural crop workers is unknown; (b) The attitudes and perceptions of vegetable farmers towards occupational health and safety issues is generally unknown; and (c) The provision of training for agricultural crop workers, if any, by the relevant authorities in occupational health and safety is not currently available.

In Trinidad, this area has attracted little research attention. No study has critically assessed farmers' knowledge, attitude and perception towards occupational health and safety issues in agriculture. Further, no attempts have been made to determine farmers' perspectives on the subject. Therefore, the aim of this study is to (i) determine the knowledge, attitudes, perceptions, and practices levels of small-scale commercial-oriented vegetable farmers in Trinidad, towards occupational health and safety issues in agriculture, (ii) investigate whether or not significant differences exist based on selected personal and demographic variables, and (iii) recommend actions to reduce/prevent the risk of occupational accidents, injuries and diseases among small-scale commercial-oriented vegetable farmers in Trinidad.

METHODOLOGY

Population and sample

The target population for this study was small-scale commercial-oriented vegetable farmers working on farms in ten of the most populated agricultural areas in north Trinidad. The sample population consisted of 100 small-scale commercial-oriented vegetable farmers from Aranguez (*n* = 10), Mt. Lambert (*n* = 10), Macoya (*n* = 10), Maloney (*n* = 10), Bon Air (*n* = 10), Arima (*n* = 10), Wallerfield (*n* = 10), Aripo (n = 10), heights of Guanapo (*n* = 10), and Valencia (*n* = 10).

Instrumentation

The questionnaire comprised of four (4) sections with questions related to: (i) demographics and job information; (ii) farmers' knowledge on the health and safety hazards in agriculture; (iii) farmers' attitudes towards safety; and (iv) farmers' perceptions of occupational health and safety. The questionnaire was examined for content validity by three subject matter experts, who made some recommendations for improvement. A pre-test was conducted among a small group of farmers (*n* = 5) in Aranguez to assess the practicality of the questionnaire and based on the feedback, adjustments were made to all sections of the questionnaire.

Sample

The list of farmers provided by Extension proved to be old (based on the 2000 agricultural census) and not updated. Consequently, it was decided to pursue a convenient sampling method. At the first selected location in each vegetable growing area selected for study, the researcher approached and asked the first farmer/farm worker found on the holding to assist with the survey. If the farmer/farm worker agreed to take part in the survey, an interview was done using the survey instrument. If the person declined to take part in the survey, the next farmer/farm worker found working on a farm was approached. This process was repeated until the target sample size (*n* = 10) was obtained for the first selected area and was repeated at all ten selected areas. Each survey was conducted in the form of face-to-face interviews and took approximately 15 min to complete.

Coding and data analysis

The data obtained from the questionnaires were numerically coded and statistically analysed using the Statistical Package for Social Sciences (SPSS v. 16). To determine the knowledge, attitude and perception of the sample population, total scores were obtained by summating the scores of all questions within each of the sections. The total scores for each section varied. For the section on knowledge, responses to statements (n=12) were scored as follows: *Yes* = 1 and *no* = 0, and the scores were combined to give a score range of 0-12. For the section on attitude, responses to statements (n=5) were scored as follows: *Strongly agree* = 5, *agree* = 4, *neutral* = 3, *disagree* = 2, and *strongly disagree* = 1, and the scores were combined to give a score range of 5-25. For the section on perception, responses to statements (n=7) were scored as follows: *Strongly agree* = 5, *agree* = 4, *neutral* = 3, *disagree* = 2, and *strongly disagree* = 1, and the scores were combined to give a score range of 7 to 35.

Next, overall scores in each area were tallied for descriptive purposes. For knowledge, low knowledge ranged from 0-4, fair knowledge ranged from 5-8, and high knowledge ranged from 9-12. For attitude level, very unfavourable or poor attitude ranged from 5-10, unfavourable attitude ranged from 11-15, favourable attitude ranged from 16-20, and highly favourable attitude ranged from 21-25. With respect to perception, statements were reversed (negatively stated) so that agreement with a negative statement showed unfavourable perceptions towards the OSH act. Accordingly, very favourable perception ranged from 0-5, favourable perception ranged from 6-15, and unfavourable perception ranged from 16-20.

Results regarding knowledge, attitude and perception were reported based on frequencies. One-way ANOVA tests with the associated post-hoc test (Tukey's b) were also performed to examine significant differences among means of knowledge, attitude and perception levels with the independent variables being age, gender, job role, whether or not farmers were visited by extension officers, the frequency of visits by extension officers, and farmers' familiarity with health and safety issues in agriculture. Cronbach's alpha (α) was used as a measure of internal consistency scales. With respect to the perception scale, α = 0.72, suggesting a fairly good level of reliability; for the attitude scale, α = 0.61, suggesting an acceptable level of reliability and; knowledge, α = 0.67, also an acceptable level of reliability.

RESULTS

Characteristics of farmers

The majority of farmers were males (82%) and some 32% of the sample was 46-60 years old, 31% were 31-45 years old, 19% were older than 61 years, and 18% were between 18-30 years old. Most farmers (58%) reported secondary level education, 35% completed primary education, 4% possessed a technical or vocational certificate level education, 2% attained tertiary education, and 1% had no formal level of education. Most

Table 1. Knowledge, attitude, perception.

	Statements					Yes (%)	No (%)
Knowledge	Do you know of the Occupational Safety and Health (OSH) Act?					72	28
	Do you know of the ill effects that lifting heavy objects and working in uncomfortable positions can have on your body?					67	33
	Do you know how to reduce/prevent muscle pains/discomforts caused by your job?					38	62
	Do you know the ill effects that chemical use/exposure can have on your health?					89	11
	Do you know the consequences of re-using empty chemical containers for domestic purposes?					83	17
	Do you know how to reduce/prevent the harmful effects that chemicals can have on your health?					89	11
	Do you know the ill effects that working in the sun can have on your health?					67	33
	Do you know how to reduce/prevent the sun's harmful effects on your heath?					51	49
	Do you know how to reduce/prevent stress and depression?					37	63
	Do you know how to reduce/prevent workplace violence/harassment?					41	59
	Do you know what can cause you to slip, trip or fall on your farm?					86	14
	Do you know what to do in case of accidents/emergencies?					86	14
	Summary (mean) knowledge					67	33
		SA[1]	**A[2]**	**N[3]**	**D[4]**	**SD[5]**	
Attitude	My personal safety is more important than anything else	56	39	0	4	1	
	Because I have been doing my job for many years, I believe I can skip some safety steps	19	21	8	33	19	
	If I saw someone doing something unsafe, I would say something directly to him/her	40	37	2	21	0	
	People should take personal responsibility for each other's safety	28	40	0	28	4	
	Safety is a high priority for me when I am doing my job	53	41	0	5	1	
	Mean attitude	**39**	**36**	**2**	**18**	**5**	
Perception	My job is dangerous	29	20	1	40	10	
	I could get easily hurt while doing my job	27	25	1	35	12	
	My health can be threatened while doing my job	26	30	2	32	10	
	My extension officer is well informed about health and safety on farms	3	5	4	21	36	
	The OSH Act is not useful	31	34	0	7	2	
	The OSH Act is not effective at reducing injuries and illnesses	31	34	0	5	4	
	The OSH Act does not apply to my workplace or job	33	32	1	4	4	
	Mean perception	**31**	**28**	**1**	**18**	**6**	

[1]Strongly Agree; [2]Agree; [3]Neutral; [4]Disagree; [5]Strongly Disagree.

respondents (65%) were farm owners, while 28% were hired labourers and the remaining 7% were family workers. Some 47% of the sample had more than 15 years of farming experience, 28% had 1-5 years of experience, 16% had 10-15 years of experience and 9% had 5-10 years of experience farming.

The majority of the farmers (72%) did not reside on the farm premises. In terms of hours worked per day on the farm, the majority of farmers (48%) worked 6-8 h day^{-1}, while 35% worked 4-6 h day^{-1}, 13% worked 2-4 h day^{-1}, and the minority (4%) worked 1-2 h day^{-1}.

With regards to extension visits, 67% reported that they were visited by extension officers, of which 39% reported monthly visits, 16% experienced annual visits, 7% of farmers were visited irregularly, and 6% were visited weekly by extension officers.

Finally, 53% of the farmers stated that they were not familiar with the health and safety issues in agriculture, while 47% expressed some familiarity.

Farmers' knowledge

Table 1 shows that with respect to overall level of knowledge; mean frequencies suggested that 67% of farmers knew of the health and safety hazards in agriculture, while 33% did not. Farmers had highest knowledge with respect to "*the ill effects that chemical use/exposure can have on your health"*, *"how to reduce/prevent the harmful effects that chemicals can have on your health", "what can cause you to slip, trip or fall on your farm"* and *"what to do in case of accidents/emergencies"* Lowest knowledge was with respect to knowledge of "*how to reduce/prevent stress and depression",* and *"how to reduce/prevent muscle pains/discomforts caused by your job".*

There were moderate levels of knowledge with respect to knowledge of "*how to reduce/prevent the sun's harmful effects on your health"* and *"how to reduce/prevent workplace violence/harassment?"*

Farmers' attitudes

With respect to overall attitude towards safety, mean frequencies showed that the majority (75%) of farmers had fairly positive attitudes towards safety (39% of farmers strongly agreed with the statements and 36% agreed with the statements). Some (25% of farmers) did not have a positive attitude towards safety (18% disagreed with the statements, 5% strongly disagreed, and 2% were neutral). Farmers agreed most with the statement, *"My personal safety is more important than anything else"* and *"Safety is a high priority for me when I am doing my job".* Similarly, farmers agreed with the statements, *"If I saw someone doing something unsafe, I would say something directly to him/her" "People should take personal responsibility for each other's safety"*. There was varied of agreement with the statement, *"Because I have been doing my job for many years, I believe I can skip some safety steps"*.

Farmers' perceptions

Table 1 provides the responses to statements aimed at determining farmers' perceptions of occupational health and safety. Sample frequencies showed that 59% of farmers agreed on some level with the negatively worded statements, suggesting that farmers had a fairly strong negative perception of occupational health and safety issues.

Some farmers (25%) had a fairly positive perception of occupational health and safety. Response showed that the majority (65%) of farmers negatively perceived the OSH Act as "*not useful"*, *"not effective at reducing injuries and illnesses"*, and *"it does not apply to my workplace or job".* Most farmers (57%) held the view that extension officer "*is not well informed about health and safety on farms".* There were mixed perceptions of their job as being dangerous, that they could get hurt while doing their job and that their health can be threatened while doing their job.

Relationships with farmers' knowledge scores

Table 2 presents the results of the ANOVA tests. Farmers' mean knowledge scores were significantly different based on their familiarity with health and safety issues in agriculture ($F_{(1, 98)}$ = 14.39, p < 0.01). Tukey's b post hoc test indicated that farmers who were familiar with health and safety in issues in agriculture were significantly more knowledgeable on health and safety hazards in agriculture (FK_L = 9.3) than farmers who were not familiar with the health and safety issues in agriculture (FK_L = 7.0). Farmers' mean knowledge scores did not significantly differ with age, gender, job role, whether or not they were visited by extension officers, and the frequency of visits by extension officers.

Relationships with farmers' attitude levels

ANOVA tests indicated that farmers' mean attitude scores were significantly different based on age, on-farm job role, whether or not farmers were visited by extension officers and the frequency of visits by extension officers.

With respect to age, there is a significant difference in farmers' mean attitude scores ($F_{(3, 96)}$ = 3.59, p < 0.05). Tukey's b post hoc test indicated that farmers between the ages of 46-60 (FA_L = 15.7), farmers 31-45 years old (FA_L = 13.5), and farmers more than 61 years of age (FA_L = 14.3), had a significantly more favourable attitude towards safety than farmers 18-30 years of age (FA_L = 13.2).

Results also suggested that there was a significant difference in farmers' mean attitude scores based on job-role on farm ($F_{(2, 97)}$ = 4.15, p < 0.05). Tukey's b post hoc test confirmed that farm owners (FA_L = 14.9) had a significantly more favourable attitude towards safety than hired labourers (FA_L = 13.0) and family workers (FA_L = 13.2). With respect to whether or not farmers received extension visits, there was a significant difference in farmers' mean attitude scores ($F_{(3, 64)}$ = 3.35, p < 0.10). Tukey's b post hoc test confirmed that farmers who were not visited by extension officers (FA_L = 14.7) had a significantly more favourable attitude towards safety than farmers who were visited by extension officers (FA_L = 13.5).

There was also a significant difference in farmers' mean attitude scores based the frequency of visits by extension officers ($F_{(3, 64)}$ = 7.06, p < 0.01). Tukey's b post hoc test confirmed that farmers who were visited annually by extension officers (FA_L = 12.5), farmers visited irregularly (FA_L = 12.9), and farmers visited monthly by extension officers (FA_L = 15.2) had a significantly less favourable attitude towards safety than farmers visited on a weekly basis (FA_L = 18.8). Farmers' mean attitude scores did not significantly differ with gender and farmers' familiarity with health and safety issues in agriculture.

Relationships with farmers' perception scores

ANOVA tests indicated that farmers' mean perception scores were significantly different based on whether or not farmers' were visited by extension officers ($F_{(1, 98)}$ = 8.22, p < 0.01). Tukey's b post hoc test confirmed that farmers who were visited by extension officers (FP_L =

Table 2. ANOVA model of several independent variables on farmers' knowledge levels (FK_L), attitude levels (FA_L) and perception levels (FP_L).

Factor/levels	Knowledge levels			Attitude levels			Perception levels		
	FK_L (SD)	*F*	b	FA_L (SD)	*F*	B	FP_L (SD)	*F*	b
Age									
18-30	8.4 (0.7)	1.9		13.2 (0.7)	3.6**	A	12.4 (1.2)	0.2	
31-45	7.7 (0.6)			13.5 (0.5)		B	11.6 (0.9)		
46-60	8.9 (0.6)			15.7 (0.5)		B	12.0 (0.9)		
> 61	6.9 (0.7)			14.3 (0.7)		B	11.2 (1.2)		
Gender									
Male	8.1 (0.4)	0.3		14.2 (0.3)	0.2		11.7 (0.6)	0.1	
Female	7.7 (0.8)			14.6 (0.7)			12.1 (1.2)		
Job									
Farm owner	8.2 (0.4)	0.57		14.9 (0.3)	4.2**	A	11.8 (0.6)	1.6	
Hired labourer	7.6 (0.6)			13.0 (0.5)		B	12.5 (1.0)		
Family worker	8.8 (1.3)			13.2 (1.2)		B	8.5 (2.1)		
Extension visit									
Yes	8.0 (0.4)	0.1		13.5 (0.5)	3.4***		12.8 (0.6)	8.2*	a
No	8.2 (0.6)			14.7 (0.3)			9.7 (0.9)		b
Frequency of visit									
Annually	7.5 (0.7)	0.8		12.5 (0.7)	7.1*		11.6 (1.2)	1.0	
Monthly	7.9 (0.5)			15.2 (0.5)			13.5 (0.7)		
Weekly	9.0 (1.2)			18.8 (1.2)			11.8 (1.9)		
Irregularly	9.3 (1.1)			12.9 (1.2)			14.9 (1.8)		
Familiar HSE									
Yes	9.3 (0.4)	14.4*	a	14.2 (0.4)	0.1		11.4 (0.7)	0. 6	
No	7.0 (0.4)		b	14.4 (0.4)			12.2 (0.7)		

*p < 0.01, **p < 0.05, ***p < 0.10.

12.8) had a significantly less favourable perception towards occupational health and safety than farmers who were never visited by extension officers (FP_L = 9.7) (Table 2). Farmers' mean perception scores did not significantly differ with age, gender, job role, frequency of visits by extension officers and farmers' familiarity with health and safety issues in agriculture.

DISCUSSION

Farmers had good knowledge levels of the health and safety hazards in agriculture. Results indicated that farmers were very knowledgeable on chemical and accident hazards and less knowledgeable on physical (heat) hazards. It was found that farmers' knowledge levels significantly differed based on their familiarity with health and safety issues in agriculture.

Additionally, studies showed that farmers who had completed higher levels of education had greater awareness of issues, such as pesticide toxicity (Lekei et al., 2014; Osewa et al., 2013).

In contrast, Ogunjimi and Farinde (2012) observed that cacao farmers in Nigeria had poor knowledge levels with regards to precautionary measures in agrochemical usage and concluded that this shortcoming in knowledge was attributed to the lack of contact with extension officers. Thus, according to Pidgeon and Beattie (1997), the term knowledge has different meanings based on who is doing the interpretation and for the purpose for which it is being done, since farmers rely on their own experiences as a source of knowledge.

However, knowing about health and safety hazards may not necessarily lead to the adoption of practices to mitigate its effects, especially when farmers do not consider it relevant to their situation. Pidgeon and Beattie (1997) argue that it is the farmers' perceptions of the risks associated with the hazards that are more relevant in determining what precautionary practices farmers may adopt.

The attitude levels of farmers towards safety were fairly positive. It was found that most farmers felt some level

of responsibility to ensure their personal safety and the safety of others in the farming environment.

These findings correlate with BOMEL (2009) who found that farmers in England had an overall positive attitude towards safety. Further, Knowles (2002) found that in England and Wales there were interrelationships between farmers' background and experiences and their behaviours regarding attitudes to health and safety. Farmers' attitudes towards safety are argued to be greatly influenced by pressures to produce crops commercially, their past experiences, their supervisor or the farm owners, and the existence of regulations (BOMEL, 2009).

It is evident that with regards to attitude, there is adequate room for improvement. However, it is recommended that in order to achieve a much more favourable attitude there is much need for further studies to be conducted, specifically, studies that seek to: (a) Determine why farmers take risks despite being aware of the potential hazards; and (b) Determine what can be done to change farmers' perceptions of risks. Further, the relevant authorities should undertake activities to promote a safety culture among farmers in the areas of health support/guidance, training/retraining and legislation.

Farmers' perception levels of occupational health and safety were not favourable. They expressed strong negative perceptions of the OSH act and the extension officers who should be their source of information. This can be attributed to the fact that in Trinidad, extension officers are not currently trained on occupational health and safety issues in agriculture, and are therefore unable to provide farmers with the information that they require. Similarly, studies conducted by Agbarevo and Obinne (2009) indicated that farmers in Nigeria found extension services to be ineffective and thus, were perceived negatively.

Additionally, Aphunu and Otoikhian (2008) found that there was a significant association between the effectiveness of extension services and farmers' adoption of best practices and technologies. Further, most farmers perceived their neighbouring farmers and agricultural suppliers as much more effective sources of valuable information (Mirani, 2013). Thus, this stance indicates that farmers obtain their information from peers in their social groups and therefore, it can be argued that these 'external' sources of information also influence farmers' perceptions of the OSH act.

To add to this, at present in Trinidad, there is no legislation specific to health and safety in agriculture. As a result, there is insufficient awareness among farmers regarding occupational health and safety issues in agriculture, which may arguably be another why reason farmers negatively perceived the OSH act.

Therefore, the development of any new agricultural health and safety programs must include the input of farmers in order to ensure the programs' practicality and applicability, as well as farmers' acceptance.

Conclusion

Farmers appeared to have good knowledge and (based on the mean scores) moderately favourable attitudes on health and safety hazards in agriculture. Also, attitude seemed to be the variable, which showed the most differentiation based on the characteristics of the farmers examined in this study.

Additionally, farmers also have negative perceptions about selected issues related to health and safety on farm. Thus, it can be argued that extension officers play a vital role in the farmers' knowledge, attitude and perception of health and safety issues in agriculture. Extension officers are key to providing farmers with awareness-knowledge (information that hazards exists), how-to knowledge (information needed to properly adopt precautionary measures) and principles knowledge (information regarding how agricultural health and safety benefits them). Only when farmers are provided with knowledge, can positive attitudes and perceptions towards agricultural health and safety be fostered, which would then in turn encourage the adoption of precautionary measures to mitigate the effects of hazards thereby reducing the prevalence of those hazards.

Recommendations

The findings of this study indicate that there is considerable room for improvement in the three key areas of policy development, government actions, and future research and training.

Policy development

It is recommended that a national framework be established for occupational health and safety in agriculture to promote a preventive occupational health and safety culture and the effective management of occupational health and safety. This national framework should be comprehensive and afford protection for all workers within the agricultural sector, regardless of their gender or job role. Additionally, this national framework should identify the specific rights and duties of self-employed farmers with respect to occupational health and safety in agriculture.

Government actions

Firstly, establish a competent body to ensure that measures are taken so that self-employed farmers can benefit from the health and safety protection afforded by the national framework. These measures include:
(a) Ensuring compliance with regulations;

(b) Disseminating information about hazards and risks in agriculture; (c) Addressing hazards and risks in agriculture; (d) Developing appropriate educational programmes and materials, and providing occupational health and safety training for farmers concerning work-related hazards; (e) Collaborating with insurance companies to develop special insurance schemes; and (f) Providing training to extension officers or competent individuals in agricultural occupational health and safety. Secondly, provide subsidies for ergonomically designed tools and personal protective equipment such as, goggles, safety boots, gloves, and respirators.

Further research and training

There are many gaps in the knowledge of exposures and the magnitude of specific health risks among farmers in Trinidad. Therefore, further individual quantitative studies on each category of occupational hazards must be conducted to determine these levels of exposure and also take into consideration farmers' health status. In addition, qualitative studies are also needed to obtain information regarding farmers' beliefs and experiences of occupational health, as well as the factors hindering or facilitating farm safety.

With regards to training, health and safety courses should be introduced into the curriculum of tertiary level agricultural institutions such as UWI's ECIAF curriculum, which would facilitate capacity building among extension workers. Together with in-service training and farmer training courses, farmers could be educated.

Implications

The majority of farmers are over the age of 50, and younger farmers are not opting to pursue a profession in farming. Therefore, older farmers will continue to be the backbone of Trinidad's agricultural sector. If actions are not taken the health of farmers could decline and food security objectives and agricultural sustainability goals in Trinidad could be jeopardised. Therefore, there is need for urgent action to improve the state of occupational health and safety within Trinidad's agricultural sector. If appropriate actions are taken in a timely manner then the well-being of Trinidad's aged farming population would be positively impacted and food security goals are not compromised.

Conflict of Interest

The authors have not declared any conflict of interest.

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Adoption of innovations and best management practices by goat farmers in eastern Mediterranean Region of Turkey

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Goat farming has traditionally been a major livelihood for many rural families in the mountainous and uphill areas of the Eastern Mediterranean region of Turkey. In recent years, the increased demand for goat products raised the issue of developing a sustainable goat sector in the region. The primary purpose of this study was to determine best management practices and innovations in goat farming and their adoption levels in the Eastern Mediterranean Region of Turkey. For this purpose, 140 goat farmers were surveyed and their socioeconomic characteristics, management practices, problems encountered, levels of applying innovations and best management practices, as well as factors influencing their adoption were investigated. Results of the study revealed that goat farmers face problems with expensive feeds, low governmental subsidies, and cheap prices for goat products. Adoption level of innovations and best management practices were found quite low and it was influenced by farmers' experience, income, travels, and contacts with extension service and private veterinarians.

Key words: Adoption, goat farming, management practices, rural development, Turkey.

INTRODUCTION

Goat farming has traditionally been the main livelihood of many rural families in the Eastern Mediterranean region of Turkey (Jordan et al., 2002). It represents a type of family farming in the mountainous areas of Adana, Osmaniye, Hatay, and Kahramanmaras provinces where farmland has environmental restrictions for cultivation. Using farm machineries such as tractors, cultivators, combines, and seeding machines is both uneconomical and erosion sensitive. As moving from low lands to uphills and mountainous areas the slope of landscape increases and farmlands turn in smaller and fragmented parcels where machinery use is more costly and in some cases technically impossible. If farming practices which require soil operations are insisted without taking adequate measures, they will trigger soil erosion and therefore weaken natural resource base which presently provides livelihood, even not self-sufficient for many rural families.

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An agricultural system forcing farmers to cultivate lands in uphills and mountainous areas doesn't provide rural people with income which would make it possible for them and for their children to enjoy at least an averaged quality of rural life (Jordan et al., 2002). This farming system accompanied with lack of regular services of education, health care, and transportation in rural areas, force farmers to migrate big cities where more opportunities are to be found.

There have been at least two major driven forces which encourage goat producers in the uphill and mountainous landscape of the region. One of them is a gradually growing interest in goat meat and milk. According to many consumers in the region, goat is the most frequently consumed meat and is hardly subsidized for weal or muffon. Goat milk is also considered healthier as it is believed to have a lower level of fat (Coşkun and Öndül, 2004).

The second driven force is the continuously growing demand for goat milk which is the major input for internationally well-known "Kahramanmaras ice-cream". At least three large companies, namely, Mado, Edo, and Carpedo have exceeded regional even national borders and they started franchising activities in many cities around the Middle east and the Europe. Not long time ago they were purchasing goat milk solely from farmers around the province of Kahramanmaras. However, they have recently started to raise Saanen goats to produce their own milk, but due to the growing demand for Kahramanmaras Ice-cream, there have been shortages in goat milk and therefore mixing caw milk which inevitably reduces the quality of ice-cream. In order to overcome the goat milk shortage Kahramanmaras ice-cream companies have started to initiate contract farming with goat producers in mountainous areas.

The number of goats in Turkey and in the Eastern Mediterranean Region changes according to economic stability of the country and macroeconomic policies related to animal husbandry. In the last two decades, the sharpest decrease in the number of goats in Turkey and in the East Mediterranean region was in 2009 when the number of goats decreased to 4,9 million and 0,37 million, respectively (Turkish Statistical Institute – TSI, 2013). Later on governmental subsidies and project incentives for animal production gave their positive results and the number of goats for the year 2011 reached to 7,1 millions in Turkey, and 0,56 millions in the East Mediterranean Region (TSI, 2013). The increase rates were calculated as 45%, and 51%, respectively.

Literature review reveals that there have been studies on the adoption of innovations and best management practices among farmers in different parts of the world. Some of the studies concentrated on innovations regarding dairy farms (Jaisridhar et al., 2013; Barham et al., 2004; Foltz and Chang, 2002); forage crops (Lapar and Ehui, 2004); beef cattle farming (Johnson et al., 2010; Gillespie et al., 2007; Suppadit et al., 2006; Kim et al., 2005; Chaudhry et al., 1993), and sheep producers (Budak et al., 2011). However, there is no study which is directly focused on the adoption of innovations and best management practices in goat farming. Nevertheless, Smith (2010), Kaymakçi and Dellal (2006), and Kaymakçi (2002) gave basic principles and information about goat farming while Ozturk (1999) investigated the problems encountered by goat farmers in Kahramanmaras province of Turkey.

In order to achieve a sustainable goat production sector at large, it is important for goat farmers not only depend on the governmental subsidies and incentives but also the application of best management practices and innovations. Therefore, the overall purpose of the study was to determine the application levels of best management practices and innovations in goat farming and socioeconomic factors and information-seeking behavior influencing their adoption. The specific objectives are:

a. Determine socioeconomic characteristics of goat farmers;
b. Acquire basic information about goat farming in the region;
c. Determine what problems are being encountered by goat farmers;
d. Determine awareness and application levels of selected innovations and management practices
e. Determine the extent to which socioeconomic factors and information-seeking behavior influencing the adoption of management practices and innovations.

MATERIALS AND METHODS

Area of study and sampling procedure

Basic material used for this study was information obtained by administering a questionnaire to 140 goat farmers in the Eastern Mediterranean Region of Turkey. Target population to which the findings of this research were to be generalized was all goat farmers operating in this region. In order to draw an accurate sample to represent this population, first of all an accessible population in which every goat farmers had an equal and independent chance of being included in the sample was determined. For this purpose, 36 villages from four provinces of the region (Adana, Hatay, Kahramanmaras, Osmaniye) were selected with the help of province directorates of the Ministry of Food Agriculture and Livestock.

Lists of goat farmers with their numbers of goats were obtained from district directorate offices. Because some district directorates did not have an updated list of statistics for every village, these villages were visited in advance to determine the goat farmers and the number of animals they owned. Lists of goat farmers from the 36 villages made the accessible population. Based on the number of goats owned by each farmer, the accessible population was divided in three strata.

Then Yamane (2009), stratified sample size determination formula was used accepting 5% error term from the mean and 95% confidence interval.

$$n = \frac{N\sum N_h S_h^2}{N^2 D^2 + \sum N_h S_h^2}, \; D^2 = \frac{e^2}{t^2}$$

n = Sample size, N = Number of farmers in accessible population, N_h = Number of farmers in each stratum, S_h = Standard deviation within each stratum, D^2 = Desired variance, e = Permitted error from the mean of accessible population, t = t-table value of accepted confidence interval.

The number of sample size was determined as 140. This number was proportionally distributed to each of the three strata and respondents from each stratum were randomly selected.

Data collection procedure

A two section questionnaire was prepared to collect data; the first section included questions about goat farming, management practices, innovations, and animal care; the second section included questions about socioeconomic characteristics and information-seeking behavior of farmers. Kaymakçi (2002), Vincent (2005), Smith (2010), Tölü et al. (2011), Savaş et al. (2012), and Ceyhan (2012) were explicitly utilized for the questionnaires. Questionnaires were mostly filled in respondents' farms or houses. In several cases they were contacted while they were grazing their herd on mountains. Data were collected in January-June 2008 period.

Analitical procedure

Descriptive statistics including frequencies and percentages were used to analyze data regarding objectives 1, 2, and 4 while means and standard deviations were used for objective 3. For the fifth objective the ordered probit method was used to determine the extent to which selected socioeconomic characteristics and information-seeking behavior influenced the application of best management practices and innovations among goat farmers. The dependent variable of the model was constructed with three levels (0 = low level adoption, 1 = medium level adoption, and 3 = high level adoption).

For this purpose, 30 management practices and innovations regarding goat farming in the region were predetermined considering the literature reviewed and specific characteristics of the region. Considering the frequency distribution of the responses on the questions whether or not farmers applied these practices or innovations, three adoption categories were formed. Those who adopted at least 10 practices or innovations were assigned to the low level adoption category, those who adopted between 11 and 20 were assigned to the medium level adoption category, and finally those who adopted more than 20 were assigned to the high level adoption category. Two separate models (the first one for socioeconomic characteristics and the second one for information-seeking behavior) were run. The ordered probit model can be expressed as follows:

$$y^* = \beta' x_i + \varepsilon, \; \varepsilon \sim N(0, 1) \quad (1)$$

$y = 0$ if $y^* \leq 0$, $y = 1$ if $0 < y^* \leq \mu_1$, $y = 2$ if $\mu_1 < y^* \leq \mu_2$, where y^* denotes the vector of unobserved dependent variable, β' denotes a vector of coefficients, x_i denotes a vector of explanatory variables, ε denotes a vector of error terms normally distributed N[0,1], y denotes the observed dependent variable with three adoption levels, and finally μ denotes the threshold values which indicate the inclinations of adoption (Greene, 2012). Because the vector of error term is normally distributed, the likelihood of beef cattle farmers falling one of the three categories of the dependent variable can be expressed as:

$$\begin{aligned} &\text{Prob } (y = 0) = 1 - \Phi(-\beta' x), \\ &\text{Prob } (y = 1) = \Phi(\mu_1 - \beta' x) - \Phi(-\beta' x), \\ &\text{Prob } (y = 2) = 1 - \Phi(\mu_1 - \beta' x), \end{aligned} \quad (2)$$

where Φ denotes the cumulative standard normal distribution and μ_1 is greater than zero. Empirically, this model was similarly used by Boz et al. (2011), Budak et al. (2011), Boz and Akbay (2005), Chen et al. (2002), Abdel-Aty (2001), and McLean-Meyinsse (1997).

Measurement of variables

Income level was asked in the question that "If all farmers at your village were to be divided in three income categories as low, medium, and high income levels which category you would likely to fall in".

For the third objective 23 predetermined items were listed and asked by goat farmers to respresent each item in a five point Likert-scale with 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), 5 = Strongly Agree (A). Respondents were also asked to feel free to express any other problems left out of the questionnaire. Means, standard deviations and response categories wee also calculated. To interpret the means of all the items listed in the table an interpretative scale (0.00-1.49 = SD, 1.50-2.49 = D, 2.50-3.49 = N, 3.50-4.49 = A, 4.50-5.00 = SA) was developed.

For the fourth objective of the study 30 predetermined innovations and best management practices were determined by an extensive use of the literature, explicitly Kaymakçi (2002), Kaymakçi and Dellal (2006) and Veteriner cc. (2012). Respondents were asked if they applied these practices in their own cases.

For the fifth objective, initially respondents were divided in three categories according to the number of applied innovations or best management practices. Of the 30 innovations and best management practices respondents who applied at least 10 items were assigned to the low level category and coded as '0'; those who applied between 11 and 20 items were assigned to the medium level category with a code of '1'; and finally those who applied more than 20 items were assigned to the high level category with a code of '2'.

The independent variables were selected from Table 1 and entered the model as dummies in the following dichotomous categories: Age (older than 35 = 1, 0 otherwise), experience (more than 20 years = 1, 0 otherwise), education (beyond elementary = 1, 0 otherwise), cooperative membership (farmer is a member = 1, 0 otherwise), investment (farmer invested in goat farming in the last three years=1, 0 otherwise), land owned (more than 25 decares = 1, 0 otherwise), and level of income (high level = 1, 0 otherwise).

Several models were run and the one presented was significant at an alpha level of 0.01 or better (Model chi square for socioeconomic factors = 28.313, Degrees of freedom = 7). The estimated threshold value ($\mu 1 = 1.088$) was positive and significant at 0.01 alpha level indicating that there was a natural ordering in the three levels of innovations and best management practices among goat farmers in the region.

Model chi square for information seeking behaviour = 38.637, Degrees of freedom = 7. The estimated threshold value ($\mu 1 = 1.162$) was positive and significant at 0.01 alpha level indicating that there was a natural ordering in the three levels of the dependent variable.

The independent variables entered the model as dummies with the following codes: Reading newspaper (At least once a week = 1, 0 otherwise), listening to radio (Every day = 1, 0 otherwise), Watching television (Every day = 1, 0 otherwise), Use of the Internet (Several times a month = 1, 0 otherwise), traveling to city

(At least once a week = 1, 0 otherwise), contacts with extension service (At least once a month = 1, 0 otherwise), contacts with veterinarians (At least once a month = 1, 0 otherwise).

RESULTS

Socioeconomic characteristics of the respondents

Socioeconomic characteristics of the goat farmers were presented in Table 1. From the table it can be seen that 47.9% of the respondents were 35-50 age gap, 21.4% younger than 35 and 30.7% older than 50 years of age. The average age of respondents was 45.67. More than one-third of the respondents (36.4%) had less than 10 years' experience with goat farming while 34.3% had an experience between 10 and 20 years, and 29.3% more than 20 years. The mean of experience with goat farming was calculated as 18.68 years. In terms of education 63.6% held at least an elementary school degree while 20% received an education beyond elementary and 16.4% were illiterate.

Similarly, 39.3% of the respondents were in the medium income category while 30.7% and 30.0% in highy and low categories, respectively. The percentage of those who were members of cooperatives was 18.6% while 16.4% participated in village administration, 35.7% invested on their farms in the last three years buying live animals, land, and/or farm equipment.

The percentage of farmers owning farm land of smaller than 25 decares was 48.6% while the percentages of landless farmers was 27.1% and those who owned more than 25 decares made 24.3%. Average farmland of the respondents was 16.73 decares. Those who owned improved breeds of goats were 16.4% while those who owned native breeds were 87.9%. The average goat keeper in the region owned 16.4 improved breeds, and 64.7 native goats.

Selected management practices

The results on goat management practices are presented in Table 2. Based on the sales of milk and its products, it was established that 42.9% of the respondents sold teir milk daily while, 17.9% every 2-3 days and 12.1% weekly. Twenty-seven percent reported that they process goat milk into cheese or butter and sold it later. Majority of the farmers (51.4%) sold their milk to milkmen and 37.9% to traders. Similarly, majority of the respondents (76%) sold their animals to dealers and 51% sold goat hair to traders.

Almost half of the respondents (49.3%) carried out disease surveillance in their herds and monitored other livestock management problems while 27.1% practiced this duty yearly. Majority of the farmers (71.4%) thought that pasture lands around their village had been grazed properly. They stressed that lack of strict law and regulations cause early and excessive grazing which lowers the quality of pasture and degrades the fragile landscape leading to environmental problems such as erosion. Twenty-one percent reported that there was no publicly owned pasture land around their villages. Thus, they had to graze their herds in the pastures and bush areas owned by neighbor villages.

In addition cotton and grain harvested fields provide a good grazing opportunity especially around Kirikhan and Hassa districts of Hatay. However, it was qualitatively noted that respondents from these districts reported that large land owners in the area cannot stand any longer their harvested cotton and grain land to be grazed for free by goat farmers. Especially close to cotton harvest time they use some chemicals to drop the leaves of the crops due to a more convenient and economical harvest. Because many goat and sheep deaths have been reported in harvested cotton fields, herders abstain from grazing their animals in these fields.

Another restriction reported was that as long as farmers harvest their crops they burn residues to prepare soil for the upcoming crops leaving no grazing opportunity for herders. Although, there have been a strict regulation for residue fires, little success has been achieved so far.

Manure is considered very important fertilizer. More than half of the respondents (52%) sell their goat manure while 29.3% use it on their farm and 18.6% use it for heating their houses during the winter season. Majority of respondents (75.7%) used natural breeding methods and more than half of the respondents (57.1%) reared goats with after half-milking the mother.

Although, there have been improved breeding and rearing methods which enable goat farmers to increase their income, they seem not familiar with these methods.

Problems encountered by goat farmers

Problems encountered by goat farmers are presented in Table 3. According to the interpretative scale given in the analytical procedure and measurement of variables section of this study, respondents agreed with five items, remained neutral with ten items and disagreed with eight items. There were no items in SA and SD response categories.

The most seriously encountered problems in goat farming were expensive feeds, lack of governmental subsidies, lack of concentrated feeds, and lack of fodder crops, and low milk yield. From the farmers' point of view these can be considered as the immediate measures which will affect their cash income and therefore well-being. They offered simple solution for their problems which they focused on cheaper and abundant inputs, higher governmental subsidies, and higher prices for goat products.

It seems interesting that the respondents disagreed with the problems that lack of training and extension

Table 1. Socioeconomic characteristics of goat farmers.

Socioeconomic characteristics		
Age	**N**	**%**
Below 35	30	21.4
35-50	67	47.9
More than 50	43	30.7
Experience	**N**	**%**
Less than 10 years	51	36.4
10-20 years	48	34.3
More than 20 years	41	29.3
Educational level	**N**	**%**
İlliterate	23	16.4
Elementary school	89	63.6
Beyond elementary	28	20.0
Income level*	**n**	**%**
Low income	42	30.0
Medium income	55	39.3
High income	43	30.7
Cooperative membership	**n**	**%**
Yes	26	18.6
No	114	81.4
Participation in village administration	**n**	**%**
Yes	23	16.4
No	117	83.6
Invested in farm	**n**	**%**
Yes	50	35.7
No	90	64.3
Farm land	**n**	**%**
No land	38	27.1
25 or less decares	68	48.6
More than 25 decares	34	24.3
Improved goad breeds	**n**	**%**
Yes	23	16.4
No	117	83.6
Native goat breeds	**n**	**%**
Yes	123	87.9
No	17	12.1
Total	140	100.0

*Income level was asked in the question that “If farmers at your village were divided in three income categories such as low, medium, and high income categories, which category would you fall in”.

activities, care of the doe at kidding, rearing of baby goats, mating, animal insurance, keeping farm records, hygiene of barns, and trimming and keeping goat hair. During the interviews, it was figured out that almost no training and extension programs regarding small ruminants had been implemented in the region. Also, no animal insurance was observed. In general they indicated that they are conventionally knowledgeable about the items with which they disagreed and therefore they do not see them as problems.

Table 2. Selected management practices regarding goat farming.

Selected practices with goat farming	Number	Percent
Frequency of milk selling		
Every day	60	42.9
Every 2-3 days	25	17.9
Weakly	17	12.1
Milk is processed in cheese and sold later	38	27.1
Total	140	100.0
Milk is sold to		
Milkman	72	51.4
Trader	53	37.9
Farmer markets milk by his own	9	6.4
Neighbors or relatives with no animals	6	4.3
Total	140	100.0
Live animals are sold to		
Local live animal market	6	4.3
Dealer	107	76.4
Slaughterhouse	24	17.1
Animal board	3	2.1
Total	140	100.0
Goat hair is sold to		
Used in the family or given free to relatives	30	21.4
Neighbors	38	27.1
Traders	72	51.4
Total	140	100.0
How often are animals carefully observed for diseases		
Daily	16	11.4
Weekly	5	3.6
Monthly	12	8.6
Seasonal	69	49.3
Yearly	38	27.1
Total	140	100.0
Do you believe that publicly owned meadow and pasture land is properly grazed and protected?		
No publicly owned pasture and meadow land	30	21.4
Yes	100	71.4
No	10	7.1
Total	140	100.0
Where do you use manure?		
In my own land	41	29.3
Sell	73	52.1
Use it heating the house	26	18.6
Total	140	100.0
Breeding methods applied		
Hand breeding	32	22.9
Separate breeding pens	2	1.4

Table 2. Contd.

Natural breeding	106	75.7
Total	140	100.0
Methods of rearing goats		
Natural rearing	56	40.0
Artificial rearing	11	7.8
Rearing after half milking does	73	52.1
Total	140	100.0

Table 3. Problems encountered with goat farming.

Problems	Mean	Standard deviation	Response category
1. Feeds are expensive	4.15	0.753	A
2. Lack of governmental subsidies	4.11	0.754	A
3. Lack of concentrated feeds	3.80	1.575	A
4. Lack of fodder crops	3.64	1.579	A
5. Low milk yield	3.51	1.050	A
6. Milk harvesting and hygiene	3.46	1.801	N
7. Lack of pasture and grazing land	3.39	1.679	N
8. Lack of organization among goat farmers	3.21	1.292	N
9. Marketing of milk	3.10	1.875	N
10. Proper goat breed selection	3.06	1.906	N
11. Selection of goat kept for raising	3.06	1.911	N
12. Marketing of live goats	3.01	1.801	N
13. Dealing with diseases	3.00	1.468	N
14. Goat nutrition	2.95	1.955	N
15. Lack of information on doe raising	2.60	1.736	N
16. Lack of training and extension activities	2.45	1.429	D
17. Care of the doe at kidding	2.44	1.183	D
18. Rearing of baby goats	2.43	1.780	D
19. Mating	2.36	1.788	D
20. Animal insurance	2.09	1.603	D
21. Keeping farm records	1.67	1.322	D
22. Hygiene of barn	1.65	1.344	D
23. Hair cutting and keeping the hair	1.53	1.233	D

It was observed that except the immediate income generating measures such as lower input prices, higher governmental subsidies and output prices; goat farmers paid less attention and saw little benefits in other management practices which must be considered crucial to increase competitiveness and keep it up with changing market conditions.

Respondents' application of management practices and innovations

Results of the management practices and innovation applied by the respondents are presentad in Table 4. Majority of the respondents (91.4%) indicated that they practice goat pen proper cleaning and disinfection. Similarly, 83.6% indicated supplementary feeding before and during mating and 82.6% practice vacination against foot and mouth diseases.

More than half of the respondents took proper care of udders and nails, and trimmed goat hooves. They had hay feeders, separate pens, and feed storages in their shelters. In addition they vaccinated their animals against foot and mouth diseases, contagious caprine pleuropneumonia, goat prox, anthrax, and rabies (vaccine for dogs). Of the 30 selected innovations or best

Table 4. Awareness and application level of selected innovations and management practices.

Innovations-management practices	Yes		No		Unaware	
	n	%	n	%	n	%
1. Using separate breeding pens	2	1.4	106	75.7	32	22.9
2. Supplementary feeding before mating	117	83.6	19	13.6	4	2.9
3. Tie-up the umbilical cord with dental floss	16	11.4	51	36.4	73	52.1
4. Using machine for cutting goat hair			140	100.0		
5. Proper care of goat udders	109	77.9	15	10.7	16	11.4
6. Trimming goat hooves	82	58.6	42	30.0	16	11.4
7. Disbudding baby goats	80	57.1	52	37.1	8	5.7
8. Deodorizing bucks	10	7.1	38	27.1	92	65.7
9. Neutering males not planned on breeding	12	8.6	40	28.6	88	62.9
10. Using hybridization methods to improve the herd	23	16.4	107	76.4	10	7.1
11. Hay feeders	86	61.4	54	38.6	0	0
12. Combine feeders	16	11.4	124	88.6	0	0
13. Grain feeders	49	35.0	91	65.0	0	0
14. Silage feeders	3	2.1	137	97.9	0	0
15. Mineral feeders	7	5.0	133	95.0	0	0
16. Separate pens	80	57.1	60	42.9	0	0
17. Feed storage	102	72.9	38	27.1	0	0
18. Milking pens	66	47.1	74	52.9	0	0
19. Hair cutting pens	50	35.7	90	64.3	0	0
20. Bathroom	52	37.1	88	62.9	0	0
21. Care and selection pens	3	2.1	137	97.9	0	0
22. Proper cleaning and disinfecting goat shelter	128	91.4	2	1.4	10	7.1
23. Vaccine against foot mouth disease	116	82.9	18	12.9	6	4.3
24. Vaccine against goat pox	107	76.4	21	15.0	12	8.6
25. Vaccine against Ecthyma Contagiosum	55	39.3	40	28.6	45	32.1
26. Vaccine for dogs against rabies	71	50.7	49	35.0	18	12.9
27. Vaccine against Brusella Melitensis	86	61.4	33	23.6	21	15.0
28. Vaccine against contagious caprine pleuropneumonia (CCPP)	108	77.1	15	10.7	17	12.1
29. Vaccine against pseudo tuberculosis	58	41.4	19	13.6	63	45.0
30. Vaccine against anthrax	98	70.0	28	20.0	14	10.0

management practices only 3 were applied by more than half of the respondents while the remaining 16 items had quite lower application levels. Among the all respondents 65.7% had no information about ‘deodorizing bucks’, 62.9% about ‘neutering males not planned on breeding’, and 52.1% about ‘tie-up the umbilical cord with dental floss’. On the other hand, 4.3% of the respondents were unaware of vaccine against foot mouth disease while 45% were unaware of vaccine against pseudo tuberculosis.

Socio-economic factors ınfluencing the adoption of ınnovations and management practices

The results obtained through ordered probit procedure are presented in Table 5. It can be seen from the results that 52.1% of the respondents were in low category, 32.1% in medium and 15.7% in high category of the innovations adoption. Of seven socioeconomic characteristics entered in the ordered probit model, ‘experience’ ($p = 0.064$) at 0.1 alpha level, and ‘income’ ($p < 0.01$) at 0.01 alpha level was found significant. Both variables had positive signs indicating that as experience and income level of farmers go up they tend to adopt more innovation and best management practices. However, adoption level was not affected by education, cooperative membership, investments, and farm size. The marginal effects for the significant socioeconomic variables showed that as farmers have more experience their likelihood of being in the low level adoption category decreases by 0.0057 percentage point while the likelihood of being in the medium and high level adoption categories increases by 0.0028 and 0.0029 percentage points, respectively. As farmers have higher income their likelihood of being in the low level adoption category

Table 5. Socioeconomic factors influencing the adoption of innovations and best management practices and their marginal effects.

Variable	Coefficient	Standard error	P	Marginal effects		
				Low level	Medium level	Advanced level
Constant	-1.8150***	.549114	.0009			
Age	.00250	.009193	.7831	-.0010	.0005	.0005
Experience	.01440*	.007801	.0649	-.0057	.0028	.0029
Education	.40706	.271642	.1340	-.1611	.0661	.0950
Cooperative membership	-.27743	.284215	.3290	-.1611	.0661	-.0510
Investments	-.07974	.225538	.7236	.0317	-.0156	-.0161
Farm size	-.00047	.005760	.9341	.0002	-.0001	-.0001
Income	.68116***	.145561	.0000	-.2711	.1322	.1389
µ1	1.0885***	.141216	.0000			
Log likelihood function	-125.1670					
Restricted log likelihood	-139.3237					
Chi squared	28.31335					
Degrees of freedom	7					
Prob[ChiSqd > value] =	0.00192					

Table 6. Information-seeking behavior influencing the adoption of innovations and best management practices and their marginal effect.

Variable	Coefficient	Standard error	P	Low level	Marginal effects	
					Medium level	High level
Constant	-.6512	.25214	.0098			
Redding newspaper	-.0373	.23953	.8760	.0149	-.0078	-.0071
Listening to radio	.1355	.22153	.8280	-.0539	.0286	.0253
Watching TV.	-.0456	.26290	.8622	.0182	-.0093	-.0089
Use of the Internet	-.4589	.32864	.1626	.1772	-.1062	-.0710
Traveling to city	.9519***	.25916	.0002	-.3590	.1204	.2387
Contacts with extension service	.6363***	.24303	.0088	-.2492	.1098	.1394
Contacts with veterinarians	4679*	.23453	.0460	-.1850	.0903	.0947
µ1	1.16201	.15182	.0000			
Log likelihood	Function	-120.0051				
Restricted log likelihood		-139.3237				
Chi squared		38.63718				
Degrees of freedom		7				
Prob[ChiSqd > value] =		0.00002326				

decreases by 0.2711 percentage points and being in the medium and high adoption categories increases by 0.1322 and 0.1389 percentage points, respectively.

Information seeking behavior ınfluencing the adoption of ınnovations and management practices

The model for information-seeking behavior is presented in Table 6. Of the seven explanatory variables entered the model ‘traveling to city’ and ‘contacts with extension service’ were significant at 0.01 alpha level while ‘contacts with veterinarians was significant at 0.05 alpha level. From this finding we can conclude that as goad farmers have more travels to cities, and have more contacts with extension service and veterinarians they tend adopt management practices and innovations. The marginal effects for the significant variables showed that as farmers have more travels to cities their likelihood of being in the low level adoption category decreases by 0.359 percentage point while the likelihood of being in the medium and high level adoption categories increases by 0.1204 and 0.2387 percentage points, respectively. As farmers have more contacts with extension service their

likelihood of being in the low level adoption category decreases by 0.2492 percentage points and being in the medium and high adoption categories increases by 0.1098 and 0.1394 percentage points, respectively. Finally, as farmers have more contacts with veterinarians their likelihood of being low level adopters decreases by 0.1850 percentage points and while the likelihood of being medium and high level adopters increases by 0.0903 and 0.0947, respectively.

DISCUSSION AND CONCLUSIONS

The discussion of findings can be focused on four significant issues regarding goat farming in the region. First of all from the socioeconomic characteristics and selected practices with goat farming it can easily be said that goat farming in the region is quite conventional. Comparing with national indicators, goat farmers' levels of education and income were quite low. Almost one-third of them had no land, and the ratio of owning improved goat breeds was even lower than one-fifth. Goat farming in the region can be classified as a traditional livelihood passing from generation to generation with minimal changes both in the family and rural community. The landless goat farmers are even poorer and they have to graze their goats in public pastures and forest areas which many times create lagal problems. It was observed that most of the farmers operating in a traditional way were willing to quit goat farming and change occupation if they had an opportunity in the other sectors of the economy. However, this seems quite difficult due to their low level of education and lack of skills required for other occupations, especially in industrial and services sectors.

The second issue was that according to goat farmers' point of view the most important problems they encountered were market oriented. Inputs they needed, especially, concentrated feeds and fodder crops were seemed quite expensive. Farmers expected higher governmental subsidies for goat farming. On the other hand, practices that assumed to make significant contributions to sustainable goat farming in the region, such as training and extension activities, care of the doe at kidding, rearing of baby goats, mating, animal insurance, keeping farm records, hygiene of barn, and trimming weren't seen as serious problems. The emergency needs they stressed were cheaper inputs and higher prices, as well as higher governmental support.

The third issue is that in the research area application of innovations and management practices in goat farming was quite low. Unawareness rate of some practices such as 'tied up the umbilical cord with dental floss', 'deodorizing bucks', and 'neutering males not planned on breeding' was even higher than 50%. In addition many farmers had no information about vaccines. These findings indicate that in order to provide a sustainable goat farming in the region, farmers need to adopt innovations and best management practices, and unawareness rates must fall to zero. For this reason, reliable, affordable and easily accessible extension advisory services for goat farming are essential/vital/necessary.

Finally, results of this study confirmed that goat farmers with more experience and higher income had higher adoption levels as compared with farmers without these attributes. In terms of information-seeking behavior, those who had more travels to cities and had more contacts with extension service and veterinarians had also higher level of adoption. Economic possibilities and adoption of innovations and best management practices can be considered as complementary factors.

Concentration on one side will probably influence the other side. However, what is crucial is how the goat farmers can access sustainable financial support from the limited governmental sources, and how to establish a two-way information exchange linkage between extension organizations and farmers. Therefore, proper use of limited governmental support and increased rate of adoption among goat farmers depends largely on continuous capacity building which includes training and extension programs of farmers. The high level adopters can be utilized as catalyzers to reach the other farmers, especially the hard to reach.

Conflict of Interest

The authors have not declared any conflict of interest.

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New trends in rural community development practice in Africa: The case of Cameroon's grassfield rural development project

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This paper examines a new trend in rural community development in Cameroon using the Grassfield Rural Development Project, to highlight the challenges of the participatory approach in an African context. There is an on-going debate about the future of the rural sector in developing countries, centred on implementation of participatory projects to alleviate poverty and deteriorating rural living conditions. Using data from project documents and evaluations, participant observation and interviews with key stakeholders, this paper examines project outcomes achieved in the priority communities that underwent the new policy implemented between 2004 and 2010. The project provides a new approach to engage the state and local government stakeholders in strategic decisions on long-term rural development. Achievements are evident in community infrastructure (classrooms, halls, feeder roads, improved water schemes, slaughter slabs, rural radio), and also in social capital and enhanced leadership. However, challenges remain in the implementation of participatory projects; and dependence on external sources of funding community projects persist, due to hash economic constraints and long-term neglect in providing rural areas with quality services.

Key words: Grassfield rural development project, outcomes evaluation, rural community development, participatory approach, poverty alleviation.

INTRODUCTION

Rural development strategies aimed at reducing poverty and ameliorating human living conditions on a sustainable basis are undergoing tremendous transformations in Africa.

Since independence, Cameroon, in an effort to accelerate the pace of social change, adopted a series of five-year development plans starting in 1961 and ending in 1991 with the overall objective of improving the welfare of the population (Amin, 2008). After experiencing a high average growth rate of 7% from the 1970's to the mid-1980's, Cameroon underwent a severe economic crisis characterized by a dramatic fall in commodity prices, and government revenues that precipitated a contraction in public spending on education, health and infrastructure

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(IFAD, 2007; UNDP, 2006). In addition, this led to a decline in per capita income by nearly 50% between 1986 and 1993, prompting the Government to initiate a series of policy reforms aimed at improving macroeconomic stability and restoring export competitiveness.

Key among the reforms was the 1994 nominal devaluation of the CFA Franc. However, the Government's cash flows were insufficient in meeting domestic obligations and servicing external debt and additional reforms were initiated in 1997 by adopting a three-year enhanced structural adjustment facility with the IMF. This programme resulted in a substantial reduction in state support for production, the elimination of price and quality controls on key agricultural commodities and their marketing, a freeze in further employment and a reduction of more than 60% in the salaries of state employees in 1993. Completion of this initiative in 2000, along with a poverty-reduction and growth facility, worked with the World Bank, made it possible for Cameroon to become eligible for the enhanced Debt Initiative for Heavily Indebted Poor Countries (Amin, 2008).

It is within this framework that the Government formulated the Poverty Reduction Strategy Paper (PRSP) that has been guiding its development actions and setting the principles of engagement with the donor community (Tollens, 2000). Under the Rural Sector Development Strategy of the PRSP, poverty, food insecurity, poor market integration, and unsustainable utilization of natural resources were identified as major challenges to rural sector growth. The Grassfield Rural Development Project was initiated within this context of poverty, and implemented over a period of 6 years, to accompany and support underprivileged rural communities in their development process.

Funded by the Cameroon Government in partnership with the African Development Bank and the rural communities of the North West Region, the project's implementation package comprised three specific objectives: Agricultural development, capacity building, and rural infrastructure. Increasingly, governments and other development agencies like Heifer Project International which promotes livestock extension in Cameroon, now see the wisdom in providing support and encouragement for community-driven initiatives instead of the dominant top-down approach, which directs development practice solely from the perspective of the government. Because of their serious comparative disadvantages in the context of poverty and growing global market competition, rural areas need different development approaches and solutions to their specific problems. The 'comparative disadvantages' result, first, from underdevelopment of physical infrastructure, leading to limited communication of people, products, money and information; and second, from the limited ability and resources to produce saleable goods and services.

The Grassfield Rural Development Project adopted a participatory approach, which aims to overcome comparative disadvantages, helping farmers, largely through advice and capacity building to be more productive and competitive (IACD, 2005; Aigner et al., 1999; Bhattacharyya, 1995).

A genuinely participatory approach encourages a marked shift from the traditional dependence and reliance on elaborate and detailed blue-prints, providing a basis for control and prediction of development outcomes (Littrell and Littrell, 2006; Taylor, 2005; Odeleye-Lagbedu, 1997). Persistent failures of past development strategies in Africa have proven that development is not simply a matter of aid and striving to 'close the gap' to catch up with the more advanced societies. The failures can be attributed to neglect of the critical role of people's participation in the development process (Dia, 1996; Adedeji, 1990). However, as shown in this research, even this approach does not solve all community problems; in fact it raises new challenges, which should be taken into account in future development policies.

The objective of this paper is to examine the rationale, outcomes and challenges of participatory development in an African context drawing from the experiences of the Grassfield Rural Development Project in Cameroon. According to Green et al. (2000), *outcomes* are long-term measures of change in peoples' quality of life or their community, such as decreased poverty or more people accepting leadership roles.

The measurement of development outcomes is a difficult issue because of the various ways of defining project success (Beslam and Mullin, 2007; Koster and Randall, 2005). As Berlie (2002) remarks, success has many connotations when it comes to public participation, depending upon who you ask. He suggests that success in public participation includes incorporating public values into decisions, improving substantive quality of decision, resolving conflict among competing interests, building trusts in institutions, and educating and informing the public.

Emery and Flora (2006) opine that there are many different types of outcomes that must be considered when measuring "success" such as behavioral, social, economic, physical and learning outcomes. Some outcomes are tangible in nature, whereas, other outcomes, like social capital and the enhancement of community capacity are less tangible (Cleaver, 2001; Flora and Luther, 2000). Subsequent to this introduction, the structure of the paper includes the problem, methodology, results and discussion, and conclusion.

The problem

Feasibility studies to establish a reference situation in the North West Region before implementation of the Grassfield Rural Development Project revealed an

estimated 70% of the rural population living below the poverty line (Ministry of Agriculture and Rural Development, 2006; African Development Fund, 2003). The productivity of smallholders in the region was low due to the limited use of modern farm inputs, high input prices and low output returns; poor quality of advisory services, seeds, animal species and feed; limited access to markets; lack of credit facilities; inadequate water supply; and poor linkages between research and extension services. The rural areas lacked decent road infrastructure, classrooms and health facilities.

The involvement of local communities in project design and management was weak and there was widespread poverty in the rural areas. In order to remedy this situation, the Government deemed it necessary to mount a project in which the rural population will participate in the identification of its planning needs and development actions. This paper focused on the outcomes of this initiative. Rural people who are better placed to understand their development problems to determine their own priorities for poverty alleviation and improvement of their well-being have often been marginalized, thus aggravating the rural poverty situation.

METHODOLOGY

Description of the study area

This study was undertaken in the North West Region found in the Western Highlands between Longitude 10 and 11° East, and Latitude 6 and 7° North within the Cameroon Volcanic Line. The vegetation is predominantly Savannah with some patches of forest. The topography is undulating and composed of steep hill slopes, narrow valleys and strong ridge crests with a variety of waterfalls and crater lakes. The region is bordered to the south by the West and South-West Regions, to the east by the Adamawa Region and to the north by the Federal Republic of Nigeria. It is made up of seven administrative Divisions: Boyo, Bui, Donga-Mantung, Menchum, Mezam, Momo and Ngoketunjia with Bamenda as the regional capital town.

The basic unit of local government is the council or municipality, and there are 34 councils in the region with a total of 560 villages, comprised of a variety of ethnic and linguistic groups. The economy of the region is predominantly agricultural with over 75% of it involved in this activity for livelihood. This study was concerned with 140 villages of the seven administrative divisions of the North West Region with a total population of about 1.73 million inhabitants (ADB, 2008).

Sampling procedure

The purposive sampling procedure was employed in this study. The 140 village communities were sampled from the 560 villages of the North West Region in accordance with the government policy guidelines and the project's selection criteria. The criteria included the existence of a village development plan, a development committee and financial contribution towards prioritized projects. This procedure targeted individuals (key informants) who were particularly knowledgeable about the issues under investigation in the Grassfield Rural Development Project. Each sample element was selected for a purpose, usually because of the unique position of the sample. The research strategy sought to generate contextual information on participation and decentralization processes as well as project outcomes in the villages with community projects.

Data collection

This study relied largely on primary and secondary data sources with a focus on outcomes evaluation. Qualitative methods relying on project documents and evaluations, participant observation and interviews with key informants (stakeholders) were employed to obtain the data to assess the extent to which stated goals and objectives of the Grassfield Rural Development Project (the case study) were met.

Besides accumulating a breadth of information on particular cases, case studies give greater depth of projects (Herman et al., 1987). After analysis of project documents and discussions with project management, field visits were conducted from February 2008 to May 2009 in all the seven Divisions of the North West Region to assess how project activities and services fit into the experiences of the rural communities. Visits to project construction sites made it possible to undertake consultations with project stakeholders and participate in planning workshops to make observations.

The participant-observation technique was triangulated with other tools like semi-structured interviews and study of project documents to improve the degree of reliability and validity of the study results. In participant-observation, researchers join the group or programme they intend to study, and working 'from the inside', conduct observations to understand their structure, process, problems and attitudes, without it being known that they are researchers. Further information was elicited through personal interviews with key informants and secondary sources including press releases, project plans and reports. Interviews were conducted to assess the communities' level of participation and inclusion as well as the level of consensus around shared goals. Project reports serve as an action plan for stakeholders to follow and forms a baseline by which they can benchmark the progress made in project implementation. A descriptive analysis of data was adopted. This type of analysis makes use of narratives to evaluate what is being studied to bring its content or process close to the natural setting.

RESULTS AND DISCUSSION

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Agricultural development

One of the major issues addressed by the Grassfield Rural Development Project was that of low agricultural production in an attempt to increase crop yields to satisfy the high demand for food in the region. In this light the project procured and distributed 13 tons of improved maize, 88.5 tons of potato, 2 tons of beans, 16,000 tons of cassava cuttings, and 46 tons of rice as well as 265.000 day-old chicks, 543 piglets as support to farmers.

As for infrastructure, the local communities had to contribute 30% in the form of labour, building materials or cash. Thirty-two percent of feeder roads, 53% of the water supply schemes and health centres were constructed as well as 67% of classrooms, leading to an increase in school enrolment as a result of the added space (Ministry of Agriculture and Rural Development,

2010). These were identified and prioritized through a participatory process and the farmer groups targeted had to contribute 25% of the total cost. Although such interventions were intended to increase the productivity of small farmers by offering better technology and bringing clean water, good roads and schools to rural areas, in the final analysis the better-off farmers enjoyed project benefits more than the poor. The widespread use of service providers in the infrastructure projects raised a particular challenge about the sustainability of community development initiatives. This challenge was addressed by offering training to the village development committees specifically related to proper utilization and maintenance of the completed projects in a participative spirit.

Capacity building

The capacity building component was aimed at strengthening the skills of village development committees and farmer organizations to enable them apply participatory approaches in the planning and management of their project activities. The project envisaged the training of public sector community development field staff and the staff of civil society organizations in Information, Education and Communication methods with regard to raising public awareness on the prevention and control of endemic diseases and HIV/AIDS.

This pandemic is changing the profile of rural poverty in Africa as it puts an unbearable strain on poor rural households, where labour is the primary income-earning asset. This component also targeted community mobilization and the professionalization of farmers through advisory services. The project made provisions for the establishment of rural radio stations designed to raise public awareness about economic and social change issues; and the establishment of a self-managed village savings and credit fund. Training was also provided for members of community infrastructure management committees relating to water and sanitation and timely repairs of any damages on completed projects.

The project's vision was that of enabling communities to take on more responsibility for managing their own development, including project design and implementation. This requires a culture of public administration that views the rural communities as development partners, rather than mere recipients of the benefits of public expenditure. The project attempted to give local groups and organizations decision making and resource allocation authority in project identification, implementation, monitoring and evaluation with respect to their priorities. The project introduced new approaches to poverty reduction, including decentralized project funding, promotion of food security, building the management capacity at the rural community level. Members of village development committees were trained in participatory planning and management of community projects to enhance local organizational capacity and sense of ownership. Village Development Committees are set up within the participatory process to oversee matters related to project design, fund-raising, implementation, and maintenance.

Community needs were assessed and formalized into village development plans to guide the choice of projects for funding. However, many of these plans were never implemented due to technical and financial reasons, raising questions about the effectiveness of involvement of the rural population in the decision-making process. In some cases, delays in collecting the communities' own quota of project contributions affected the implementation process (Ministry of Agriculture and Rural development, 2010).

Some agricultural extension literature strongly advocates greater farmer participation and reliance on community-based indigenous institutions (Schafft and Greenwood, 2003; Cleaver, 1999). In collaboration with the Agricultural Research Institute (IRAD-Bambui), and the Regional Delegation for Agriculture and Rural Development, farmer organizations received training in appropriate techniques of production, storage and marketing of seed and ware potatoes (*Solanum Tuberosum*), cassava (*Manioc Esulenta*), and yams (*Discorea species*). Such trainings were conducted in the key producing areas involving in-house discussions and field demonstrations with opportunities for participating farmers to adopt the innovations.

Participants were chosen purposively based on their role in the farmers' group and literacy, because they had to train their group members afterwards. The workshops provided an interactive learning forum on appropriate techniques of crop cultivation to improve productivity and generate more income and also helped to make the project's activities really process-oriented. Extension Booklets were produced on these crops and distributed to farmers and extension staff.

Thirty five community development field staffs of the Regional Delegation of Agriculture and Rural Development were trained in Information, Education and Communication methods, while 320 members of deliberating organs of municipal councils were trained in techniques of community mobilization and rural outreach work. The project raised public awareness among 12,700 persons regarding prevention and control of endemic diseases and HIV/AIDS.

Thirty-two motorcycles were purchased for use by agricultural extension workers in their contacts with farmers. Extension messages were published on a monthly basis in the '*Farmers' Voice'* News Bulletin and equally broadcast in local languages and Pidgin English (a lingua franca) over 5 rural community radio stations. These radio stations were established with support from the project to raise awareness among the communities

on issues related to economic and social change. Tracking capacity building outcomes from project interventions required enormous time. Apart from the difficulty in tracking project outcomes due to the tendency to go for tangible or physical results, there is the risk of leaving intangible outcomes, which in fact constitute the process aspects of community development.

Rural infrastructure

The rural infrastructure component was geared towards facilitating the farmers' access to input and output markets, empowering local communities for income generation, and networking for improved service delivery. The project supported the construction of community infrastructures to facilitate the marketing of agricultural commodities and improvement in rural living conditions. In this regard over 200 km of feeder roads leading to the most productive and remote farm areas and selected in the local development plans, were rehabilitated.

Funds and technical assistance was provided for community development works like water supply, health centres, abattoirs, storage warehouses, community education and action centres and classrooms. Works for the various infrastructures were carried out on contract basis with the participation of the beneficiaries, in the form of labour, local construction materials cash, estimated at 30% of the total project costs. Awareness-raising campaigns were conducted in the beneficiary communities to elicit their participation in the various micro-projects.

The challenges

Problems encountered in the project did not end with making adequate financial and technical provisions but extended to the construction and management phases. Contrary to expectations and promises, the rural communities became reluctant to make timely contributions towards community projects arguing that these were mandatory support from the government. Delays in providing farmers with planting materials contributed to the slow process of monitoring agricultural outcomes in the communities that received advisory and financial support.

Among the challenges that make participation unlikely to attain full success in rural community development, are: The constraints of everyday life, rural poverty, contextual factors and the role of the state (ESCAP, 2009). The Grassfield Rural Development Project did not go far enough to remove the constraints of everyday life despite the efforts made to increase agricultural output, supply clean water and build schools, health centres and feeder roads in the rural communities. The participatory process within rural community projects needs to go beyond the rhetoric of poverty alleviation towards empowering people to become less dependent on relations of patronage for daily subsistence.

The rural communities face multiple deprivations from lack of assets, isolation, dependence, to powerlessness. Disparities exist within rural areas: In particular, disparities between the ruling elite and small farmers; and disparities among farmers over access and rights to fertile lands. In this context, a lack of income and productive assets; a lack of access to essential economic and social services; and a lack of power, participation and respect constitute a challenge to participatory rural development projects. Such factors reinforce each other, keeping the poor trapped in poverty (ESCAP, 2009, 2007). A lack of awareness of this multi-dimensionality of rural poverty or a reluctance to confront it, may explain much of the failure of past rural development strategies in reducing rural poverty.

Another challenge of the participatory approach concerns contextual factors and the role of the state. Efforts were made by the Grassfield Rural Development project to empower rural people to identify, plan, implement, and evaluate project interventions that give them an opportunity to realize their development goals. Nevertheless, their state of poverty is unlikely to be resolved without deliberate and proactive government policies, backed by appropriate and timely resource allocation. For this to occur, the state must work with the rural communities on a partnership basis, creating the conditions for their participation and supporting it with resource transfers, capacity building and working to reduce inequality and promote social justice.

Van Heck (2003) advocates that rural development policies targeting participation should include legislation for rural people's organizations, including full freedom of association; reorientation of the extension services towards the needs of the rural poor; full integration of women in development; decentralization of decision-making, planning and resource allocation; rural poor-oriented research, input supply, credit and marketing, supported by the necessary financial resources and aimed at enhancing income-generating activities and just fiscal and pricing systems.

Biggs (2006) points out in relation to poverty reduction programmes that effective innovation in the policy and institutional arenas can only be understood with reference to time, place, culture and political context. This dimension can contribute significantly to participatory rural development by providing a spatial and social context for the process to become more meaningful to marginalized people.

The employment criteria adopted by some service providers, increased the costs of building materials and the ravages of torrential rains contributed to delays. The difficulties encountered in transporting building materials to project sites led to further delays in meeting up with project time schedules. As more field activities

commenced, the project implementing unit could not effectively handle all the supervisory work and decided to engage full-time field supervisors who did not always live up to the task. Some stakeholders made impromptu visits to project sites, accompanied by some members of the project implementing unit and causing further delays. Chambers (1997) describes such phenomenon as 'rural tourism'.

A lesson learnt at virtually every stage of implementation of the project was the near-unpredictability of the situation on the ground, leading to modifications in the programme on several occasions. Contrary to expectation and promises, the local populations were not only unfamiliar with the procedures of engaging project funds in their favour, but they were also not always ready to provide free labour in situations where contractors employed labour from communities other than theirs. Tracking capacity building outcomes from project interventions required enormous time.

Apart from the difficulty in tracking project outcomes due to the tendency to go for tangible or physical results, there is the risk of leaving intangible outcomes, which in fact constitute the process aspects of community development. The intangible outcomes included improved interaction on project matters in the community, increased social capital, and greater involvement in decision-making and leadership roles based on acquired rather than ascribed skills.

The feasibility study envisaged the entire North West Region but when project implementation started, only 140 of the 560 village communities in the region were targeted (African Development Bank Group, 2008). At the implementation phase, the study, proved to be inadequate in a number of key areas. The contributions from the government and the local population towards the project were not always done in time, causing the African Development Bank to delay providing its own quota of funds.

Among other things, some contractors did not always find ready labour in the project localities and had to employ people from outside, and this affected the local people's spirit of participation in the projects. Perhaps the worst areas were in technical details. Project plans had not paid sufficient attention to the issue of inflation, local soils and topography.

Apart from the issue of inflation which could not be entirely controlled or predicted by the local stakeholders, the other challenges might have been resolved with a well-implemented participatory process involving the local communities throughout the project cycle from project identification through implementation to evaluation. Initial cost estimates were made in 2002 while the project effectively started three years later when prices of constructions had increased.

The participatory approach fails to take into account what Cleaver (2001) describes as the recursive relationship between structure and agency.

Consequently, it ignores the complexities of power, and how these are embedded into social and cultural practices which tend towards treating participation as a technical method of project work, laying emphasis on collective action, while depoliticizing what should be an explicitly political process. For Chambers (1997) an essential aspect of participatory ideology and practice is self-criticism.

The greatest challenge for managers of rural development projects revolves around best strategies for managing unpredictability, especially those that reduce the unknown elements to facilitate timely implementation. The government at all levels must continue to play its traditional role of providing an enabling environment for the initiatives of the local communities to translate into development-oriented action.

The success or failure of rural development interventions depends as much on the conditions surrounding the particular intervention as on the quality of the work done at the local level. Among the conditions most frequently mentioned are economic growth, a favourable political and administrative environment, good governance, and the presence of cultural traits or ideologies that favour participation, self-reliance and collective action (ESCAP, 2009).

Conclusion

There is growing interest among development planners to emphasize on what governments intend to do for the rural communities rather than strengthening their capacity to participate in their own socio-economic development. Using the outcomes of the Grassfield Rural Development Project, this paper shows the partnership between the Government of Cameroon, rural communities and the African Development Bank as a new trend in rural community development practice. In its current, mainstreamed and populist form, participation highlights the importance of placing local realities at the heart of rural development interventions.

Field experience in the project shows that people embrace participatory projects for what they stand to gain. The interest among project service providers seemed to be more on how much benefits they could reap quickly from the project rather than on the timely completion and delivery of infrastructures for the benefit of the rural population.

Despite tangible project outcomes, the full import of the participatory approach has yet to be realized because the process aspects of community development take more time to bear fruit. The frustration that attends most participatory development efforts calls for a lot of commitment on the part of policy makers and extension agents.

Apart from a long waiting period spent on fund raising, short-listing and appointment of the management

personnel, the constantly changing project scenarios are enough to kill the participatory spirit of local communities.

The lessons gained from this assessment show, first, that due consideration must be given to the rural communities' capacity to plan, organize and implement projects that fulfill their aspirations. Second, that it is important to incorporate intangible aspects into community development right from the start without rushing to accomplish infrastructure which may sooner or later go into ruins due to lack of a maintenance culture.

Engaging private, non-governmental agencies in community projects is gaining ground as a best practice and successful case of management contracting. As the outcomes of the Grassfield Rural Development Project indicate, its goal of strengthening local capacity for development of the agriculture and infrastructure base reasonably reflects rural community development. However, challenges remain due to persistent economic constraints and dependence on external sources of funding community projects. These challenges and the long-term neglect in providing rural communities with quality services must be overcome to improve the chances for success of participatory programmes.

Conflict of Interest

The authors have not declared any conflict of interest.

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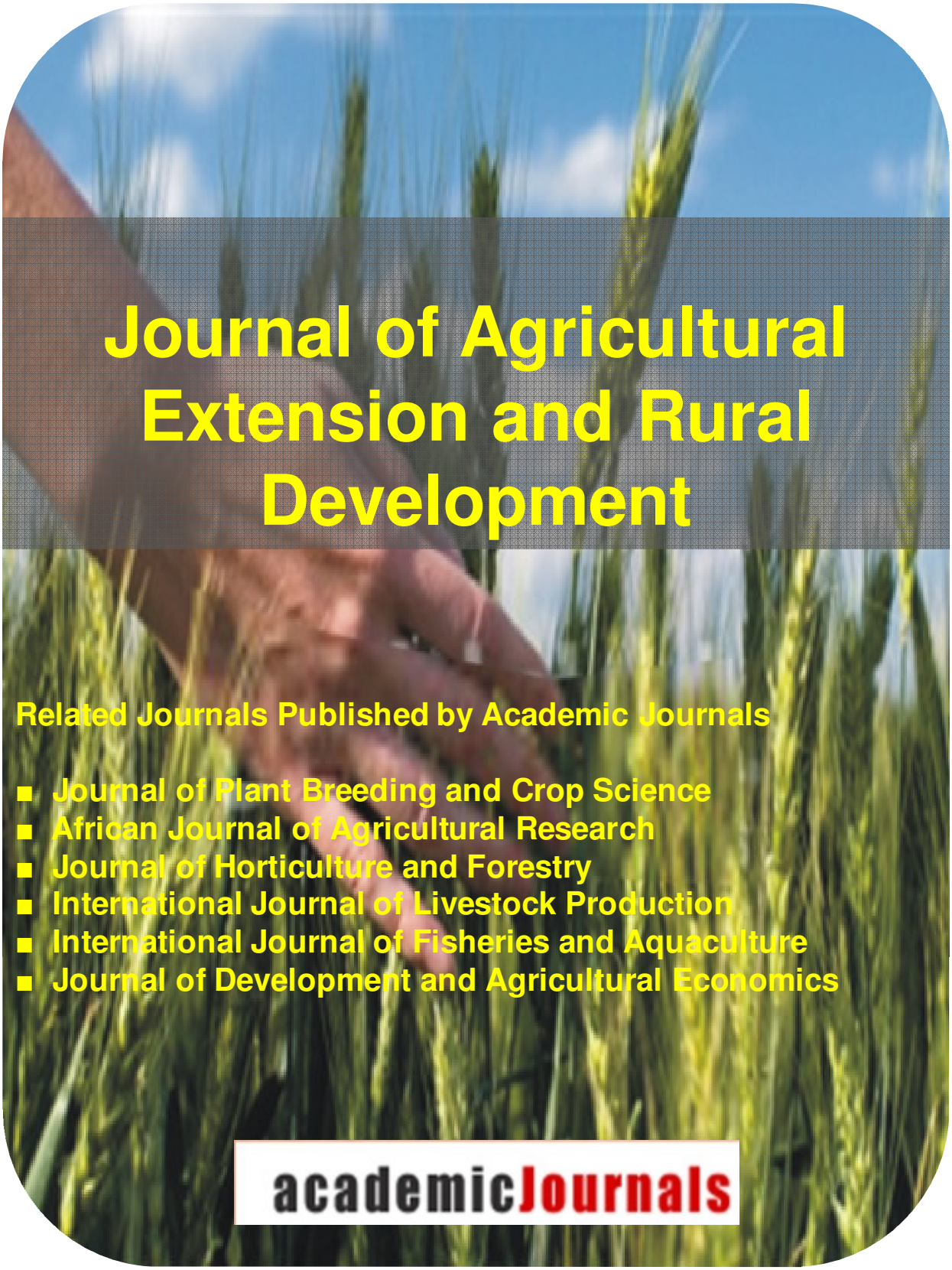

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