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Agricultural Extension in the Facilitation of Improved Sugarcane Productivity among Small Scale Growers in Swaziland: A Swot Analysis

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Authors' contributions

This work was carried out in collaboration between both authors. Author MMD designed the study and wrote the first draft of the manuscript under the guidance of Professor SHW who went on to manage the literature searches and edited the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Sugarcane production especially among the small scale growers in the rural areas of Swaziland has continued to be an area of great concern not only to the sugar industry but also to the country's economy as a whole mainly due to its continued downward trend in terms of productivity. This is further worsened by the different production challenges facing the industry including economic, production and management challenges. Agricultural extension emerges as the main player in the industry that can bring a positive response towards improved productivity of these small scale growers. Using the connectivity that exists between sugarcane production and the extension service, this study presents a philosophical argument exploring the role that agricultural extension can play in the realization of the sugar industry's goal of improving the small scale grower productivity. Drawing from relevant published works, this paper argues that extension is particularly well positioned to address small scale sugarcane production challenges through improved teaching

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and learning, promotion of farmer group formation, strengthening of stakeholder linkages, improved information management and technology adoption.

Keywords: Agricultural extension; small scale; sugarcane growing; productivity; Swaziland.

1. INTRODUCTION

The crucial role of agricultural extension in the social and economic development of the nation cannot be over emphasized. Never before in the history of Swaziland has the necessity for educating and raising the productive capacity of small scale farmers been of such importance as it is today especially in the sugar industry. Increased agricultural productivity depends primarily upon the acceptance of cultural and technological changes at the rural farm level.

The sugar industry sector in Swaziland contributes about 18 percent towards the Gross Domestic product (GDP), 35 percent towards private sector wage employment and 11 percent to national wage employment. Production takes place in the Lowveld because of the good soils and the favorable climatic conditions. The crop is grown over a period of 11 to 12 months. Growers can be categorized into four groups: millers cum planters (MCPs) and estates (77 percent of production), large growers (17 percent), medium and smallholder growers (6 percent). While accounting for a smaller volume of the production, a majority of growers fall under the medium and small scale grower category. The Swaziland sugar industry produces sugarcane in excess of 6 million tons per season. Area under cane by grower group indicated that MCPs had 26,283 hectares, large growers had 8,745 hectares while medium and smallholder growers had about 13831 hectares. These figures increase every year as more sugarcane farmers join the industry [1].

Thus, for Swaziland sugarcane production to improve, our farmers have no alternative but to learn and adopt recommended scientific farming techniques in place of their traditional practices. Perhaps the slow development of small scale sugarcane growers in Swaziland can be attributed to the inability of the Swazi farmers to respond positively to new ideas. For farmers to respond positively to new ideas, they must be properly educated on how best to apply the new ideas to their farming activities. This is mainly because the new ideas are often complex, technical and they can hardly be understood by most of the rural farmers. Small scale sugarcane growers in Swaziland cannot achieve increased sugarcane production at the rural farm level except through the provision of basic sugar cane production education, particularly the non-formal or extension type that will help move most of these farmers from traditional farming to progressive farming.

The meaning of the term extension has evolved over time and has different connotations in different countries. [2] define extension as an informal education function that applies to any institute that disseminates information and advice with the intention of promoting knowledge, skills and aspirations. Although the term “extension” tends to be associated with agriculture and rural development but it also encompasses the welfare of farmers. It does not matter who performs it, as long as it is done satisfactorily.

The contribution of agricultural extension towards improved sugarcane production among small scale growers has been debated in most sugarcane growing countries in Africa and abroad but very little has been discussed in Swaziland. Even the very little that has been reported has focused mainly on the old and well known approach of technology adoption which has not addressed the learning and the learning capacity of small scale sugarcane farmers to improve their productivity [3]. [4] noted that the issue of low productivity on small scale sugarcane farmers was a major concern in many countries forming part of the SADC region. Yield difference between large-scale and small-scale farmers in South Africa often reach 50% or more and the causes for this gap are largely assumed and have not been confirmed scientifically. [4] continues to suggest that there should be an understanding of the existing small scale farming systems and a diagnosis of the factors that limit the adoption of new technologies for improved production amongst the countries growing sugarcane in the SDAC region. This would help in identifying those areas that need to be addressed. A gap in knowledge and skill between large and small scale farmers is another area according to [4], that must be addressed if the small scale farmers

are to be assisted towards improving their performance.

Emerging approaches to agricultural extension suggest a re-evaluation and modification of the agricultural extension models to maximize the productivity of small scale farmers in such a way that the productivity gap that exist between them and the large scale farmers is reduced. This paper therefore discusses ways in which agricultural extension can assist small scale sugarcane farmers to improve their productivity. It starts by discussing the general history of extension in Swaziland followed by the extension service providers in the sugar industry and agricultural extension paradigms. The Information Communication Technology (ICT) infrastructure in Swaziland is also briefly discussed and finally the paper suggest ways through which agricultural extension can foster learning and learning capacity using ICT among the small scale sugarcane growers to improve their productivity.

2. HISTORICAL PERSPECTIVE OF AGRICULTURAL EXTENSION IN SWAZILAND

Agricultural extension in Swaziland was formally organized in the 1930s when the colonial government introduced the agriculture extension service of the Department of Agriculture to produce cash crops, such as cotton and tobacco that provided raw materials for industries in Europe. In the early 1960s the Swaziland Agricultural College and University Centre (SACUC) was established for training of two year certificate graduates in agricultural extension. These were generalist extension workers. In 1965, the Department of Agriculture put forth a strategy for Agricultural Development Areas which aimed at self-sufficiency in the stable food, a strategy which was put in place until the advent of the Rural Development Area Programme (RDAP) in 1970. This programme (RDAP) was established by the ministry of Agriculture through funds from the World Bank, the United States Agency for International Development (USAID) and the Overseas Development Ministry (ODM) of the United Kingdom [5].

In the late 1980s, the training and visit system (T&V) was introduced and it led to drastic changes in extension system of the country however the system was later abandoned due to a number of technicalities, and a modified commodity approach was introduced and it's still being pursued by the Ministry of Agriculture.

In 1980, the number of extension personnel was very high with the 'extension-farmer ratio of 1:250 and the corresponding impact was the attainment of self-sufficiency especially in cereal production. However in the 1990s, the impact of extension in production was hampered as the number of extension officers decreased through natural attrition, and officers going for further education and looking for greener pastures. This scenario was worsened by the Government of Swaziland's decision to reduce the civil service by implementing a zero growth among her employees as a strategy for reducing expenditure on labor cost. Currently the public extension service is provided by a few officers with a ratio of 1:1000 [5].

3. EXTENSION SERVICE PROVIDERS IN THE SUGAR INDUSTRY OF SWAZILAND

Extension services are one of the single most important factors in facilitating improved performance of small scale sugarcane growers especially in countries where a large proportion of cane supply comes from external suppliers. Extension plays an important role in maintaining basic production principles of sugarcane production, introducing new technology and ensuring that good management practices are implemented to protect the industry and the environment [2].

The specific objectives of extension in the sugar industry globally as listed by [6] include but not limited to securing adequate cane supply, ensuring control of diseases, providing crop growing recommendations, maximizing production and sustainability, introducing new developments and techniques, advising on soil conservation and environment, preparing and monitoring farmers for new legislation or regulations, educate growers on how the industry operates, communicate industry information to recipients, facilitate the use of micro credit for crop improvement, advise on records and management.

[7] concluded that participatory approaches to planning extension is important because it enables all stakeholders to receive and disseminate valuable inputs on challenges and opportunities within the wider community. They went to on to advise that the extension model in

use should be decentralized in order to reduce costs and increase the ownership by the out growers. The following section describe the organizational set up and functions of all institutions concerned with the provision of advisory services and training to the sugarcane planters of Swaziland. These institutions include Swaziland Sugar Association (SSA), Swaziland Water and Agricultural Development Enterprise (SWADE), Financiers, input suppliers and Government. These organizations have a responsibility to provide solutions to all the challenges that are faced by the sugarcane growers especially the small scale sugarcane grower that is always less productive compared to the large scale grower.

3.1 The Sugar Industry Institutions

This occurs where a number of millers buy from a pool of out growers with similar interest [6]. The Swaziland Sugar Association uses this model to provide extension services to all the sugarcane growers irrespective of their category. The extension function is under the department of technical services. All the sugarcane growers are affiliated under the Swaziland Cane Growers Association (SCGA). Any extension service by SSA is coordinated through this association and it includes advice on all aspects of sugarcane husbandry, identification of sugarcane production problems and conduct projects to overcome special problems. Extension also arranges seminars, field demonstration, publish newsletters, reports and recommendations [3].

[6] noted that industry institutions carry out applied research and disseminate their work through extension and outreach programs. They also monitor compliance to regulations through extension workers who will visit farmer communities. These extension workers according to [6] have an advantage that they are mobile and can assist in the adoption of new techniques quickly. The disadvantage with this model is that it is not demand driven and officers cannot always provide guidance or advice when it is needed. Extension workers also do not reside with farmers within the community and the trust level between the famer and the extension worker may be reduced resulting in limited uptake of advised practices.

Industry institutions providing extension to sugarcane farmers are well positioned to use Information and Communication Technology (ICT) to facilitate the smooth and timely flow of information between all the stakeholders. These institutions employ literate people who in most cases are qualified and have experience in both crop husbandry and extension. The use of ICT by such people cannot be a challenge. The industry also has the financial muscle to provide the necessary ICT equipment for information management. These ICT advantages have not been fully manipulated to improve sugarcane productivity among small scale sugarcane growers. The Swaziland sugar industry has also not yet fully capitalized on these advantages leaving a room for improvement on its information management to improve its productivity.

3.2 The Government

Extension services provided by governments are only effective in countries where there is adequate and efficient funding. Government extension is likely to combine sugarcane extension with other crops and livestock and this compromises the level of commitment in as far as sugarcane production is concerned. Government extension officers are trained in many subsistence crops and lack technical expertise in sugarcane production unless specifically trained by the industry. With this model there is also less reward for productivity and Governments salary rates are in most cases less than the industry rates. Extension workers in this model often live within the farmer community and share knowledge with the farmers. This provides guidance to the farmer across the entire crop cycle and the farmers gain a lot of confidence in the mentorship [6].

This model, according to [6] is often slow to respond to introduction of new techniques and practices as it is physically difficult to reach individual extension workers. Consequently, the level of services and interaction required by the growers and industry suffers. The Swaziland sugar industry has only two extension officers that are hired by government and their contribution in the sugar industry is very minimal. Due to poor financial backup from government, this model is less effective in the Swaziland sugar industry as extension officers lack means of transport to visit the farmers. Their pay is also not related to their performance. The use of ICT for information management is also compromised due to poor financial backup from government [3].

3.3 Commercial Suppliers

[6] observed that private companies that supply products or services to the sugarcane growers are becoming increasingly involved in direct extension with their sugarcane growing customers. This type of extension is usually specific and driven by the commercial interest to maximize the uptake of certain product or activity (e.g. agrochemicals, fertilizers, implements and finance). Many banks that provide finance to small scale farmers enter into a tripartite agreement (bank, miller and farmer) to ensure that credit repayments are paid from source. In addition, some banks get involved in the provision of extension to these farmers. This reduces the risk to the bank and also improves the profitability of the farmer's enterprise. The Financial Corporation (FINCORP) and the Swazi Bank are so far the two financial institutions that have hired extension officers to provide extension services to all the small scale farmers who received finance from them. These extension officers are people who are academically qualified and have a lot of experience in sugarcane production. Other institutions that provide extension services include the input supply companies such as the Swaziland Agricultural Suppliers, Farm Chemicals and many more [3]. The use of ICT in the management of information through this model is very advanced as this organizations are profit driven and the use of ICT helps in the reduction of costs as well as increasing their client base.

4. APPROACHES OF AGRICULTURAL EXTENSION

As Swaziland becomes more concerned about improving sugarcane productivity to increase its contribution to the national economy and improve the standard of living for most of its poor rural folk through the provision of employment and small scale farmer development, extension emerges as a powerful tool to achieve this. To understand what role agricultural extension can play in addressing sugarcane productivity issues, it is essential to consider the general objectives and approaches of agricultural extension

Agricultural extension has evolved through a number of stages to what it is today. It began from the top down approach (Transfer of Technology model) where emphasis was on the adoption of modern technology developed from research stations. Farmers were not involved in the technology development. Then this approach was followed by the human development concept which aimed at improving human competency through learning and capacity building.

Farmer's participation in technology development later emerged which according to [8] aimed at better understanding the farmer's complex environment so as to design technologies that are adapted to their conditions. Later the farmer first concept was introduced with an overall objective of involving the farmer in the process of generating, testing and evaluating technologies to improve agricultural production especially among small scale resource poor farmers [9].

In the 1990s, the Agricultural Knowledge and Information systems approach emerged to strengthen information flow in agricultural systems. [10] noted that an effective agricultural system can only be realized if the different actors in the system (farmers, researchers and extensionists) have a successful access to information and technology.

Three broad approaches to extension were identified by [11] and these were: linear, Advisory and Facilitation. [12] proposed a fourth approach: facilitated learning. [11] examined these using eight critical factors: Purpose, assumptions, source of innovation, promoter's role, farmer's role, supply/demand and target. Table 1 provides a brief comparison of these approaches using Blum's framework.

The linear approach is basically a one way transfer of technology. The technology is developed without the farmer's involvement. The resulting technology is assumed will correspond to the farmer's problems and the farmer is perceived to be a passive recipient of the technology.

The advisory approach is also a form of technology transfer where by predetermined technology waits for the farmer's request. The assumption here is that the farmer knows what he/she needs and will ask. Even though farmers participate through requesting information but they are still excluded in the research process.

The learning approach emphasizes on individual and collective learning as a focus of the extension engagement. [12] proposed that farmers should be engaged in genuine partnerships with research, extension workers, funders and policy makers for the purpose of

learning. Making the farmers full partners in the research and innovation process will improve their productivity. Innovative farmers in the process will be produced and will be partners instead of recipients of extension programs [12].

Since extension is basically communication and communication has to do with information dissemination, ICTs are therefore ideal tools that extension can manipulate to enhance the process of handling and disseminating information. ICTs can also ensure accurate and timely information delivery to target audience for proper decision making. The following is a brief overview of the ICT infrastructure availability in Swaziland.

5. ICT AND EXTENSION IN THE SUGAR INDUSTRY OF SWAZILAND

Raising the productivity of small scale sugarcane growers is a necessary condition for increasing incomes and improving livelihoods among the rural poor in Swaziland. Smallholder farmers are limited by a variety of constraints many of which are caused by lack of timely and accurate

Table 1. Extension models/approaches

Characteristics	Linear	Advisory	Facilitation	Learning
Purpose	Production increase through transfer of technology Government policy	Holistic approach to farm entrepreneurship	Empowerment and ownership	Awakening desire and building skills in learning for advancement as jointly defined by partners
Source of innovation	Outside innovations	Outside innovations and by farm manager	Local knowledge and innovations	Synergistic partnership of farmers, researchers and extension
Promoter's role	Extending knowledge	Providing advice	Facilitating	Promoting learning skills and facilitating partnerships for learning
Farmer's role	Passive: Others know what is best Adopting recommended technologies	Active: Problem solving Asking for advice Taking management decisions	Active: Problem solving; owns the process Learning by doing Farmer-to-farmer learning	Considering all possibilities Contributing to own and others' learning; partner in learning
Assumptions	Research corresponds to farmer's problem	Farmer knows what advisory services he needs	Farmer willing to learn to interact and to take ownership	Farmer less powerful in learning relationship; needs support in developing desire and skill to learn
Supply/ Demand	Supply	Demand	Demand	Supply to evoke dynamic relationship of supply and demand
Orientation	Technology	Client	Process	Client and process and „right" placement of technology
'Target'	Individuals Farmer organizations Projects	Individuals Groups with common problems	Groups and organizations, interaction of stakeholders, networking	Farmers in context of a learning partnership Others in partnership in context of facilitated learning

Source: [13]

information to make good decisions. Improving the information, communication and networking resources available to farmers is essential to making smallholder agriculture more productive. The appropriate deployment and use of information and communication technologies (ICT) is central to this improvement and the basic function of extension as explained by [14] remains that of transferring and exchanging of practical information for the farmer to improve his outcomes. [15] noted that smallholder farmers face higher information costs, both as producers and sellers as a result of their greater isolation as well as the poor state of their rural information and communication infrastructure.

Swaziland has a fairly developed ICT infrastructure. The country has a strong telecommunications infrastructure and a well-developed radio and television network. The country is covered by a GSM 900 mobile network, 3G plus internet service wireless broadband data card (dongle) and other cutting edge ICT network and support tools [16]. The rise of mobile telephony in particular and its associated applications are the most striking examples. The penetration rate of mobile telephone in Swaziland stood at 86 percent as at 2014, a growth of more than 20 percent from the 2009 statistics. However, the penetration rates of other telecom services were very limited (Fixed 5 % and Internet 27%), leaving a significant potential for growth. Swaziland currently has a single source of mobile cellular service (MTN-Swaziland) with a geographical coverage of about 90 percent and a rising subscribership base (Swaziland communications, 2014). With regards to broadcasting, the country has one state owned Television station with one channel, however satellite dishes are able to access South African and other international providers, There are also two radio stations, one state owned with three channels and the other one privately owned with one channel.

Both the Government and the private sector have invested heavily in the ICT infrastructure over the years and these infrastructure makes it practical for a number of ICT initiatives to be accomplished. However, there is inadequate backbone infrastructure as well as limited production and recording facilities in broadcasting, including development of content. The government of Swaziland is yet to design a master plan for infrastructure development. At the moment, ICT initiatives are undertaken in uncoordinated manner [16]. There is also a lack of strategy on infrastructure sharing resulting in situations where operators build parallel infrastructure on the same route thus making it more expensive for the end user. The government of Swaziland has a monopoly over the telecommunications market and it is leading the way in terms of providing ICT structures, information, systems and capabilities. This then tends to limit advances in accessibility and the greater use of technology, thus, undermining expansion of innovative ICT solutions [16].

The literacy rate of Swaziland according to the World Fact book (2014) stands at 86 percent of the entire population yet in 2008 the literacy rate was 81.6 percent. The country has two official languages which are English and SiSwati. Both languages are used in professional and business life. Thus, Swaziland has a high literacy rate, relative to its size with the most tertiary graduates in the region. The culture of Swazis regarding knowledge collection and storing was based on oral communication implying that local knowledge was not stored or recorded in technological tools but kept in people's minds and passed from generation to generation through story-telling, songs, poems and other informal ways of teaching. As a result, a lot of knowledge has been lost over the years because of failure to store information especially indigenous knowledge. In addition [16] noted that the majority of the older Swazi generation still hold fast to the belief of the traditional ways of conducting business and, thus, still stick to manual processes. They prefer to have both traditional and non-traditional channels of ICT delivery at their disposal and are experiencing difficulties in embracing and adopting new technologies because of their reservations regarding technology. The Swazi population is homogenous in that it has two official languages (SiSwati and English), a common culture and traditions. This homogeneity provides cost saving benefits in a number of areas especially in communication in that there will be little need for interpreters and programming than where the target audience is diverse.

With regards to electricity supply, the Rural Electrification project has played a significant role in ensuring its availability in the rural areas and country wide. It is the Government's policy to increase domestic generation capacity and extend electricity provision to rural communities and also reduce dependency on imports. Electricity outages in Swaziland, however, is still a challenge, particularly in stormy weathers and

these undermines the effectiveness of business related ICTs. Other challenges include the ever increasing costs of electricity however the availability of electricity throughout the country suggest the potential for a higher level of ICT diffusion [16]. Based on this background, the concept of utilizing ICT, specifically mobile phones to provide low cost, timely and actionable information to farmers to increase their ability to increase yield and eventually enhance their earning capacity can be manipulated.

6. EXPLOITING EXTENSION APPROACHES TO IMPROVE SMALL SCALE SUGARCANE PRODUCTIVITY

The main productivity issues that were of common interest in the SADC region as identified by [4] affecting small scale sugarcane production were: water; land; cost of production; agricultural extension support. A fifth area suggested were the socio-demographic factors [17].

A number of attempts have been made by extensionists in the past using different extension approaches to improve sugarcane production and these attempts have yielded less than the expected results. This has required the re-examination of these approaches to determine their shortfalls and hence modify/change them with the ultimate objective of improving smallholder production of sugarcane in Swaziland. In addressing extension's failure to improve the welfare and productivity of resource constraint smallholder farmers, [12] developed a concept which he called the 'Agriflection model' which is more of a refinement of the facilitation approach to extension. This approach emphasizes on the learning aspect of extension intervention mainly among three participants which are Farmers, Extensionists and 'Enablers'. Extension has a responsibility to foster learning and learning capacity among the farmers.

The role of extension according to [12] in driving the learning process would be in the development of options that the farmer will use to address problems and opportunities as well as increasing the capacity of the farmer to command the learning process. This then implies a move according to [12] from a technology dominated paradigm to a farmer learning dominated paradigm where the primary concern is not technology adoption but rather creating an environment aimed at building the capacity of the farmer to engage in scientific enquiry.

The following are options that can be used by extension to drive the learning process thus addressing the sugarcane productivity challenges in an attempt to increase the capacity of the famers to command the learning process. These options include: teaching and learning; promoting farmer group formation; enhanced information management; strengthening stakeholder linkage and facilitating technology adoption.

6.1 Improved Teaching and Learning

One of the many instruments that can be used by sugarcane extension to improve sugarcane production by smallholder farmers is education (teaching and learning). Educational activities can be carried out through a combination of the several extension methods of teaching among which are; workshops, field trainings, field visits and demonstrations [13]. Training of sugarcane farmers becomes easy when they are in groups. The cost of travelling from one farmer to another is reduced and information is uniformly distributed to all of them. The use of different teaching techniques such as demonstrations and use of multimedia to explain a concept is also made easier. What makes it even more effective is the fact that these farmers are a homogeneous group since they all grow sugarcane.

The success of any programme according to [18] depends entirely on the quality, characteristics and skills of planners and implementers. For the sugar industry to contribute its share to the economic development of the country, local institutions staffed by trained man power are essential. Improved sugarcane production requires a large number of extension agents and farmers whose capacity is developed to understand and solve sugarcane production problems.

Substantial knowledge of an intervention coupled with literacy does influence the willingness of an individual to engage in collective action that will bring about collective gains [19]. One of the overall goals of an extension system is to develop a well-trained and motivated staff that will effectively cater for a variety of actors along targeted value chains in the sugarcane production process. However a key challenge facing the sugar industry, which has seriously limited and affected the productivity of farmers is inadequate and poor quality of staff.

Adoption of an innovation comes through a learning process [20] in two phases. The first one

being the collection, integration and evaluation of new information to make an informed decision about that new innovation. The second phase is improvement in the skill of farmers to better incorporate the innovation to their local situations. The first phase shows that farmers are uncertain about the benefits of the new innovation and as such are reluctant to adopt it. Their uncertainty is only reduced after they have been educated and it is then that they can make informed decisions regarding the new innovation. The other aspect of the learning process assumes that an innovation can only be implemented when the farmer has some degree of background information about the innovation [21].

A Study conducted by [22] observed that lack of ICT training among extension staff in developing countries inhibits their capacity for collection and handling of agricultural data and services to meet data user needs. In this respect, all actors involved in the extension delivery should be adequately funded and trained for prospective professional attributes in order to improve productivity. These trainings should be scheduled and effectively carried out at various levels of extension personnel to ensure success and sustainability of the sugar industry in Swaziland.

6.2 Promoting Farmer Group Formation

Smallholder sugarcane farmers in Swaziland have grouped themselves into farmer's associations, farmer's cooperatives, or companies. Currently this sector comprises of registered growers in excess of 160 with a large portion of them registered as farmer groups. This number however fluctuates every year as some new farmers groups join while others move out (Swaziland Sugar Association, 2016). Farmer groups are very essential for the growers because they allow growers to combine their operations that are either too small or too big for individual growers. This improves the level of commitment, motivation, skill development and cost effectiveness. It also enables groups to receive free or subsidized assistance from different institutions [23].

This has been one area that has been advocated for many years but very little attention has been paid on assessing whether smallholder farmers do understand the rationale behind the formation of these farmer groups. How to go about doing it and what criteria should be used to select people. At the end of the day, groups are formed and only to dismantle within a short time after formation and the reason being that there was no thorough teaching and learning among the farmers so that they understand what they are doing. Internal disputes are a common reason for most farmer groups to dismantle and the extension service has to ensure that these groups are taught how to handle disputes. [24] indicated that farmers' decisions on land use are greatly dependent on the relationships among the farmers themselves and the general social context of the community in which decisions are being taken.

With extension promoting farmer group formation in the course of improving sugarcane productivity among the small sugarcane farmers, awareness of new farming systems among these farmers could be guaranteed. The adoption of any program aimed at improving the productivity of small scale sugarcane growers can be made easy among all stakeholders concerned including the mill, financiers, SSA, input suppliers and many others.

[25] noted that the formation of farmer groups within a community ensures a better chance of successfully adopting innovations at a general scale to achieve collective results and benefits. Collective resources that can be pulled together through the use of farmer group formation in a community include natural resources, physical resources, human resources and information resources [26].

6.3 Improving Information Management

According to [6], Information is one of the most valuable resources for improving productivity among small scale sugarcane farmers and extension is ideally positioned to facilitate its free flow within all the sugar industry stake holders. Correct and timely information can assist small scale sugarcane farmers in making informed decisions and taking appropriate action. To speed up development and hence improve productivity, crucial information needs to be made available and accessible through the use of ICT particularly to the small scale sugarcane growers. [27], argued that the challenge with most underdeveloped communities is that the farmers do not know what information they lack nor do they know what information is available to help them solve their problems. This is where extension comes in to assist the farmers through education and the facilitation of information

availability and accessibility to these ignorant farmers. The strengthening of linkages by extension among the sugar industry players also enables the free flow of vital information for improved productivity especially among the disadvantaged small scale sugarcane farmers. The availability of communication infrastructure, especially in the rural areas where most of the small scale growers are located should be a priority for the government if productivity is to be improved. Extension again has a responsibility to engage all the actors in the sugar industry with an objective of educating them on the use of ICTs to manage information.

6.4 Strengthening Stakeholder Linkage

The current level of coordination among the sugar industry stakeholders in Swaziland is not very good as some stakeholders are working independently of the other. The different institutions (Government, Suppliers, Finance, SSA, etc.) tasked with rendering advisory services to the farmers do so independently of the other yet all of them are targeting the same farmer growing the same crop. This then opens an opportunity for contradiction, repetition and competition which eventually leaves the poor farmer confused and not sure which direction to take. Linking these stakeholders so that their activities are coordinated could improve the performance of the industry.

Therefore, another instrument of extension through which sustainable sugarcane production can be improved among small scale sugarcane farmers is sugarcane stakeholder linkage. This means that extension must assist small scale sugarcane farmers to set up a vertical integration with both downstream and upstream organizations and also establish a horizontal integration among people of different interest groups within the sugar industry. This involves the creation of a network of people with a common vision and goal. The linkage entails that extension should create a working relationship among the industry players, groups or organizations for the sole purpose of maximizing productivity. Extension has to start by educating each of these groups about the importance and the benefits of forming a linkage among themselves. For example financial institutions that offer loans to the famers can be linked with the millers that buy the sugarcane from the farmers so as to assist the rural farmer to easily pay the debt. Farmers can also secure favorable deal from input suppliers including buying prices and delivery issues. [28] concluded that extension is well positioned to educate and establish these linkages with the relevant groups.

6.5 Facilitating Technology Adoption

Sugarcane research activities would have no value if the results are not made known and adopted by the sugarcane farmers [29]. The promotion of sound agronomic practices developed by research and the subsequent adoption of same by the sugarcane growers enables them to achieve competitiveness and sustainability. A strong research-extension-farmer linkage is very crucial in the development and subsequent adoption of appropriate technologies by sugarcane growers to improve their productivity.

In most instances, small scale sugarcane growers are often neglected when it comes to research and all the research output is directed and adopted by large scale growers. Extension has a responsibility to facilitate technology transfer for adoption by the industry players including the small scale sugarcane growers so as to improve productivity.

The Swaziland sugar industry relies mainly on the South African Sugar Research Institute (SASRI) for the training of their employees and for most sugarcane research output. The SSA through its technical services department conducts minor research locally. Most of the new research outputs released by SASRI are then taken up by the sugarcane extension personnel and disseminated to small scale sugarcane farmers.

7. CONCLUSIONS AND RECOMMENDATIONS

The major strength of the sugar industry extension lies in the high educational background and experience of its extension personnel which translates to efficient cane production mainly from the large scale producers. This is further enhanced by premium markets to which the Swazi sugar is sold. The strategic multifaceted role played by the long-time existing sugar industry in the economy of Swaziland has enabled it to receive special attention and assistance from Government and this has been the reason why smallholder cane growing has received particular policy attention. Against these strengths, several weaknesses that threatens the future viability of this industry have been

observed which include the ever increasing costs of producing cane coupled with the weakening efficiency of sugarcane production by smallholder farmers especially the new farmers who have just entered the industry. Poor stakeholder linkage within the system has encouraged each stakeholder to operate independently of the other, thus compromising the benefit of a joint effort. Poor adoption of new technologies by smallholder farmers is another weakness mainly due to lack of accurate, reliable and timely information dissemination for effective decision making. The high costs and inefficiency of transportation is another critical factor affecting the cost reduction of the industry. These weaknesses are the reason why smallholder sugarcane production must be given the necessary support from all the stake holders for its sustainability and improvement.

Several opportunities lie within the industry for extension service to manipulate and they include the possibility of taking advantage of the ICT supporting infrastructure in Swaziland to improve information and knowledge dissemination among the industry stakeholders. The country has a well-developed network for radio and television usage. It is also covered by a GSM 900 mobile network, 3G plus internet service wireless broadband data card (dongle) and other cutting edge ICT network and support tools. The use of such infrastructures could lead to an improved productivity, efficiency, and competitiveness among smallholder farmers. The biggest threat facing the sector is that of climate change which has a huge impact on the productivity of smallholder sugarcane growers who in most cases lack accurate and timely information for proper decision making. Failure of smallholder farmers to run their farms efficiently is another threat which has led to low returns on investment. Furthermore the HIV/AIDS pandemic has also threatened to impact negatively on the productivity of farmers as most of them get infected or affected by the virus.

Through agricultural extension, improved sugarcane productivity among small scale sugarcane growers can be achieved. The different means that can be employed by agricultural extension to foster learning and learning capacities using ICTs include farmer group formation, strengthening stakeholder linkage, improving teaching and learning, facilitating technology adoption and enhancing free flow of information. Extension is basically communication and communication has to do with information dissemination, ICTs are therefore ideal tools that extension can manipulate to enhance the process of handling and disseminating information to assist small scale farmers improve their productivity. ICTs can also ensure accurate and timely information delivery to target audience for proper decision making.

Agricultural extension should therefore be an integral tool of all the industry players that provide extension services to address the issue of poor productivity among the small scale growers. The different approaches of extension that are at the disposal of the extension service personnel within the sugar industry of Swaziland, can be exploited to improve the way in which extension services are delivered thereby improving the productivity of smallholder sugarcane growers. Irrespective of which approach or combination of approaches are being used (technology transfer, advisory, facilitation, or learning) to address farmer's challenges, agricultural extension programs should be adjusted so that they contribute towards improving the productivity of small scale sugarcane growers. Different institutions providing sugarcane extension services in Swaziland have been identified to facilitate improved performance among smallholder farmers however there is a need to coordinate their services in such a way that their advice is delivered with one voice to the smallholder sugarcane farmers. The use of ICTs in this regard as discussed would improve their service delivery to the farmers.

Since the sugar industry of Swaziland is an organized entity guided by an act of parliament, the Swaziland Sugar Association in partnership with the Government of Swaziland are better positioned to facilitate the coordination and the subsequent implementation of the above.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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