“The Effectiveness of Agricultural Extension Programs in the Desert Areas of Nubaria, Egypt: A Case Study of a Sugar Beet Program”

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Dedication

This work is dedicated to the soul of my father, as well as the Arabic spring martyrs

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Abstract

The Egyptian government has applied extensive programs for land reclamation as a strategy to meet rapidly growing demand for food. Public extension services have applied many programs to deliver technical support which is deemed appropriate for the physical, financial, and institutional conditions of the newly reclaimed lands. Nevertheless, many studies have indicated that these programs are not effective. Furthermore most of these studies assess the impact of extension services at the adoption level only, which is less informative regarding the applications' shortcomings and the external factors that could influence program performance. The Sugar Beet Program (SBP) is one of those programs and is implemented on both old and new lands. The SBP's intended outcome is to improve Sugar Beet Growers' (SBGs) knowledge and applications, thus leading to increase production efficiency and profits. The objective of this study is to elaborate on the knowledge surrounding the strengths and weakness of such programs according to when, where, and how they are planned, implemented and evaluated. These results could help policy makers and extension staff to design more effective programs in the future. This study can be described as an ex-post assessment designed to explore the effectiveness of the SBP or as a case study of the extension programs in the desert areas. A random sample of 117 SBGs was selected in the Nubaria region. All Extension Staff (ES) were involved in the study with a total number of 22 participants. Three analytical procedures were applied: Path Analysis (PA) for exploratory purposes, an Evaluation Logic Model (ELM) for model specification, and Content Analysis (CA) of 36 reports to describe the extension activities. The findings show that SBP has no significant impact on its intended outcomes. This result could be due to the poor human and financial resources invested in the program. Additionally, both the insufficient community services and the environmental circumstances of new lands influence the program's performance. The main limitations of this study are a lack of information at the village level, and an inconsistent data set as a result of the heterogeneity of the geographical administrative classifications among different governmental bodies.

Key words: Agricultural Extension - Effectiveness - Path Analysis - Evaluation Logic Model Land Reclamation - Sugar Beets - Nubaria

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Abbreviations and Acronyms

1 feddan = 4,200.883 meter square
1 feddan = 0.42 Hectare
PPM =Parts Per Million
EP = Egyptian Pound

Bulletin Diss.	Bulletin Dissemination
CA	Component Analysis
CAAE	Central Administration for Agricultural Extension
Demo. Fields	Demonstration Fields
ELM	Evaluation Logic Model
ES	Extension Staff
Ex. Meeting	Extension Meeting
GAA	Governorate Agricultural Administration
MALR	Ministry of Agriculture and Land Reclamation
NAA	Nubaria Agriculture Administration
NSC	Nubaria Sugar Company
PA	Path Analysis
SBGs	Sugar beet Growers
SBP	Sugar Beet Program
SBPP	Sugar Beet Promotion Project
SCC	Sugar Crops Council
SCRI	Sugar Crops Research Institute
SCs	Sugar Companies
SD	Standard Deviations
SIS	Soil Improvement Service
SMS	Subject matter specialist
VEW	Village Extension Workers
VIF	Variance Inflation Factor
WNP	West Nubaria project
YGP	Youth Graduate Project

1 Introduction

1.1 Agriculture in Egypt

Egypt is located in the arid area of North Africa, with a total area of around one million square km (238 million feddans: 1 hectare = 2.38 feddans). However, the inhabited area is only around 14 million feddans (6% of total area) and the cultivated area is estimated at 8.2 million feddans (3.5% of total area) (Egyptian Environmental Affairs Agency, 2006; Rafea, 2000) The productive land in Egypt is under pressure due to many different reasons, for example, between 10–75 thousand feddans/year of very fertile soil is lost due to urbanization and desertification (Hanna & Osman, 1995). On the other hand, Egypt is one of the most populated countries in the world; in 2010 the population was estimated at 84 million. The annual growth rate in 2008 was estimated at 1.8%. One-third of the population is aged less than 14 years old (World Bank, 2011). Accordingly, insuring the food supply and offering new jobs is a main challenges facing the Egyptian government (Egyptian Environmental Affairs Agency, 2006).

The agricultural sector is an important sector of the Egyptian economy. It provides jobs for 31% of the labour force and contributed to around 13% of gross domestic product in 2008 (World Bank, 2011). Egypt has adopted a liberalization program since 1980s in order to release the prices of inputs and outputs, as well as to get rid of the constraints regarding cropping patterns. The liberalization program is aimed at a better use of land and water resources and creating more market oriented production. Still, however, maximizing the economic benefits is the principle basis for selecting the cropping pattern. The national policy in place to meet the growing demand for food argues for an increase in yields through research and extension activities and an expansion of the cultivated area through developing desert lands (Hanna & Osman, 1995). Additionally, cropping patterns have been adjusted by replacing high water-consuming crops with less consuming ones to save water for future demand (Siam & Moussa, 2003). Agriculture extension plays a central role in the implementation of such a policy (Contado, 1997).

1.1.1 Land and water resources

Egypt's cultivated land can be classified into old and new lands. Old lands contain mostly very fertile, loamy-clay soil and are located in the Nile Valley and the Delta and hence directly irrigated from the Nile. They occupy around 5.7 million feddans (2.4 million ha). New lands are characterized by poor soil (sandy and calcareous soils) and were

developed from desert areas over the last three decades. They comprise around 2.2 million feddans (0.92 million ha) of the irrigated lands and 0.3 million feddans (0.12 million ha) of the rain-fed area (Egyptian Environment Affairs Agency, 2005; Rafea, 2000).

Regarding water resources, the Nile is the principle water source in Egypt with a fixed annual discharge of 55.5 billion m^3. The rain fall rate near the north coast (e.g. Alexandria) is 200 mm/year, and rapidly decreases to close to zero in Cairo. Rechargeable ground water is available in the Nile Valley and the Delta basin which is recharged annually by Nile water and over-irrigation. The total storage capacity of the aquifer is about 500 billion m^3 and it produces 2.6 billion m^3/ year. The salinity is around 800 parts per million (PPM). Non-rechargeable ground water is located in the western desert and Sinai. The volume of water extracted is estimated at 0.5 billion m^3 and the salinity ranges from 200 to 700 PPM. The western desert aquifer storage is estimated at 40 000 billion m^3 (Hegazi et al., 2004; Rafea, 2000).

1.1.2 Intensive agricultural system

Egypt applies an intensive agricultural system. Three seasons can be cultivated in Egypt. The winter season is between October-December (planting) and April–June (harvesting). The main crops cultivated are wheat, barley, berseem, lentils, winter onions and vegetables. The summer season lasts from March-June (planting) to August–November (harvesting). The main crops cultivated during this season are cotton, rice, maize, sorghum, sesame, groundnuts, summer onions and vegetables. The third growing season is known as 'Nili' and is considered a delayed summer season during which rice, sorghum, berseem and some vegetables are grown. Due to the overlap between Nili and the summer cropping seasons, only two crops can be cultivated a year on the same unit area, winter and summer or Nili crops (Yates, 1998). Moreover, an extensive use of inputs, irrigation, fertilization and pesticides are employed to meet the rapid demand growth for food (Egyptian Environmental Affairs Agency, 2006).

1.1.3 Land fragmentation

Land fragmentation is one of the main barriers to improving the agricultural and irrigation systems in Egypt. Nearly 73% of holders have less than one feddan (0.42 ha) and about 91% of holders have less than 2 feddans (0.84 ha). Such a situation makes the farmer more in favour of production than land maintenance. Moreover smallholders have less access to technology and innovations (Egyptian Environmental Affairs Agency, 2006).

1.2 Land reclamation

The current Egyptian government plans to reclaim and develop an area of 3.4 million feddans (1997-2017). Water requirements for this projected area are estimated at 8.8 billion m^3 /year. The government plans to secure this amount through water-rationalization schemes of the old lands, in addition to adopting modern irrigation techniques in the new lands, and the recycling of drainage and sewage water (Hanna & Osman, 1995).

1.2.1 Types of farm holders in the new lands

According to Zalla and Fawzy (2000) the new land holders can be subdivided into five main groups: smallholders, graduates, small investors, large investors, and squatters.

Smallholders are farmers who lost their land tenure as a result of returning the lands to landlords according to the adjustments of the law of tenant contracting relationship. They were granted lands without the provision of any resettlement support, however; nowadays they receive some types of resettlement support.

The graduate category includes graduates who have an agricultural education or a non-agricultural education. Most graduates only have a high school degree and they received an intensive training program to qualify them to establish a farming system based on the circumstances of the new lands. Graduates are most likely to receive resettlement support, i.e., infrastructure, finances, and extension services. Moreover, the government charges new holders only half of the reclamation costs and the maintenance costs of the canals where the land is located in. The term beneficiaries refer to two categories nowadays: smallholders and graduates. Beneficiaries became the focal category of most of the development programs under the supervision of the Graduates Project.

Small investors are individuals who purchased a small area of newly reclaimed land, usually less than 20 feddans (8.4 ha), directly from the government. In general, this category pertains to the farmers with big families who replaced their small land property in the old lands with a larger area in the new lands.

Graduates, smallholders, and small investors mostly face similar barriers such as a lack of extension services, limited information regarding modern farming systems, market based production, and capital limitations.

Large investors are individuals with sufficient capital to reclaim and develop land. They mainly utilize a high level of technology and forego public extension services.

Squatting is a common way of acquiring a land title. Squatters occupy from very large to small parcels of land. According to Egyptian law, it is expected that after cultivating the land the government will contract the land for a small price.

1.2.2 Obstacles hindering the land reclamation process

The land reclamation process often encountered natural, financial, technical, and managerial difficulties. Moreover, productivity of the newly reclaimed lands varies from area to area and among the different categories of settlers. The variation depends mainly on the type of soil, availability of water, and the cropping pattern (Zalla & Fawzy, 2000). The problems can be organized under three categories: physical, economic and institutional difficulties (Hanna & Osman, 1995).

Physical problems

a) Inappropriate soil textures and compositions.
b) Uneven soil surfaces.
c) Poor fertility of both organic matter and macro- and micro-nutrients.
d) The influence of salts such as calcium carbonates and gypsum.
e) Vulnerability to wind movement.
f) The presence of Boron and Selenium and other unfavourable elements.
g) Lose of humidity and nutrient elements due to sandy texture.

Economic problems

a) Inadequate investments in infrastructural projects.
b) Lack of the investments allocated to establishing new communities in the new lands.
c) Credit constraints for youth graduates and smallholders.

Institutional problems

a) Poor coordination among the institutions concerned with land and water management.
b) Incomplete implementation of the irrigation and drainage projects which results in a delay of the development of the reclaimed area.
c) Lack of beneficiaries' participation in the planning and management processes.
d) Overlap among the different pillars concerning land reclamation and the contradiction of jurisdiction areas.
e) Absence of an accurate data base with the executive authorities, and a lack of identification of the reclamation projects.

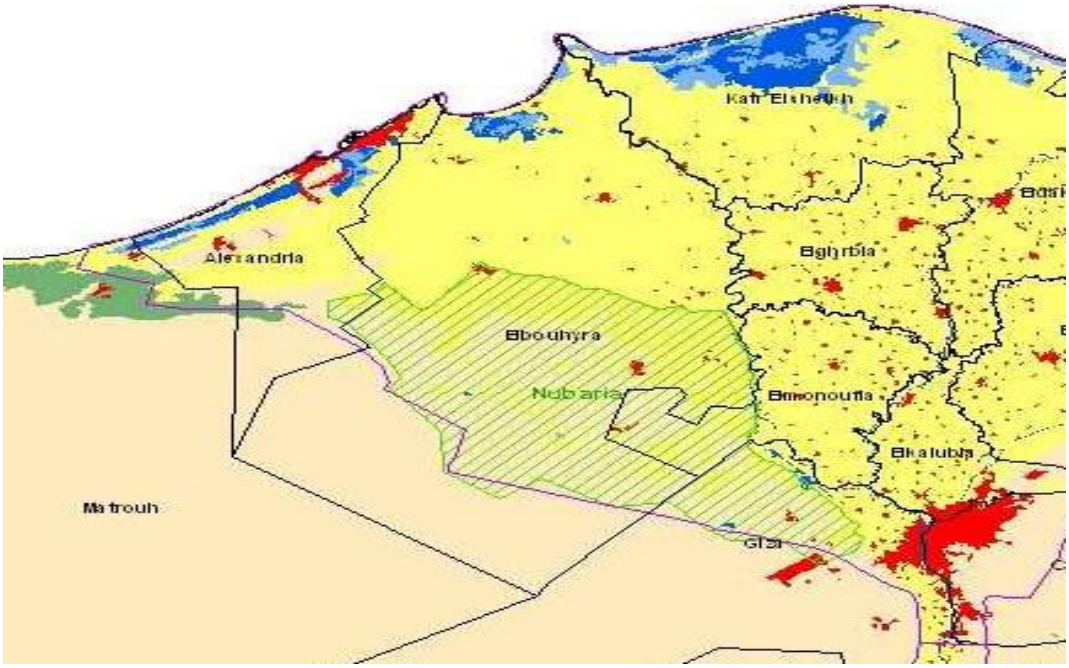
New settler's background also considered one of the obstacles, e.g. some settlers moved soil from the old lands to the new ones to improve its texture and fertility. Accordingly, the new lands infested with pests and weeds (Metz, 1990). Some others applied the same agriculture systems in the old lands, such as cropping patterns which do not take into account the fertility weakness, in addition, adopting flood irrigation systems and traditional ploughing methods which are not suitable for such fragile soils (Egyptian Environment Affairs Agency, 2005).

1.3 The region of Nubaria

The Nubaria contains some of the new lands. It is located in North West of the Delta 47 km south of Alexandria (see Figure 1). The total area of the region is around 5670 km². It lies at longitudes 30° 10' and latitudes 30° 52'. The area of Nubaria is distributed among four governorates: El Beheira, Alexandria, El Monoufia, and Giza with total areas of 4195, 70, 561 and 844 km², respectively (Abou-Hadid, Abdrabbo, Khalil, & Hassanein, 2010).

Nubaria is composed of the following six districts: Bangar Al-Sukkar, Al-Hammam, West Nubaria, Taiba, Al-Entelak and Al-Bustan. Each district has a number of small villages, with one of those villages considered the central village. The villages contain between 200 and 800 beneficiaries (Ghanima & El-Amary, 1997).

Figure 1 Map of Nubaria region



Source: Abu-Hadid, et al, (2010)

1.3.1 Farming system in Nubaria

A wide range of crops and horticulture crops are grown in Nubaria, however, farmers tend to cultivate cash crops such as: fruits, vegetables, aromatic plants and flowers to compensate for land reclamation investments rather than traditional grain crops (Hamza & Mason, 2004). Total area of permanent crops is 1899 km^2, cropland 985 km^2, greenhouses 120 km^2, and woodland 52 km^2 (Abou-Hadid, et al., 2010). The main fruits and vegetable crops are citrus, grapes, apples, olives, bananas, peaches, tomatoes, watermelons, potatoes, squash, peppers, and eggplant (Zalla & Fawzy, 2000). The cultivated area of sugar beet was estimated at 8130 feddans in 2008-2009 (Central Adminstration of Agricultural Extension Service, 2009).

Agricultural cultivation of the new lands takes a different approach than the traditional farming methods of the old lands. Yet the high level of technology is only used for water saving purposes. Normal, labour based patterns are applied for the rest of the farming activities and, accordingly, both skilled and un-skilled labourers are employed. Moreover, the growers are used to transporting organic fertilizers (manure) from the old lands to the newly reclaimed lands without applying composting regulations to eliminate weeds, diseases and pests. Consequently, such soil is adversely infected by many diseases (Egyptian Environment Affairs Agency, 2005). Four types of land holders, graduates, smallholders, squatters and investors (small and large), can be characterized by varying backgrounds and investment volumes (Zalla & Fawzy, 2000). Nearly all of the area in the Nubaria region has achieved the maximum potentiality, that is most of farms are above the break-even point (with revenue recorded above marginal costs), which is why researchers name it a New-Old Lands (Ghanima & El-Amary, 1997).

1.3.2 Irrigation and soil characteristics of Nubaria

The Nubaria canal is the principal source of irrigation water with a discharge of 23 million m^3/day (Donia & Farag, 2010). In some cases underground water is used to compensate for water shortage. These lands require efficient, expensive irrigation systems such as drip or sprinkler irrigation in order to cope with the situation of water scarcity. Even though, surface irrigation systems are the main system used in this area (Zalla & Fawzy, 2000).

There are two main types of soils in Nubaria. First, calcareous soil composes the main type of soil in Bangar Al-Sukkar, Marut, North Tahrir, and Nahda. Second, sandy soils

compose around 60% of the Nubaria region located in El-Bustan, South Tahrir and West Nubaria (Nubaria Agricultural Research Station, 2011).

1.3.3 Educational and developmental services in the Nubaria region

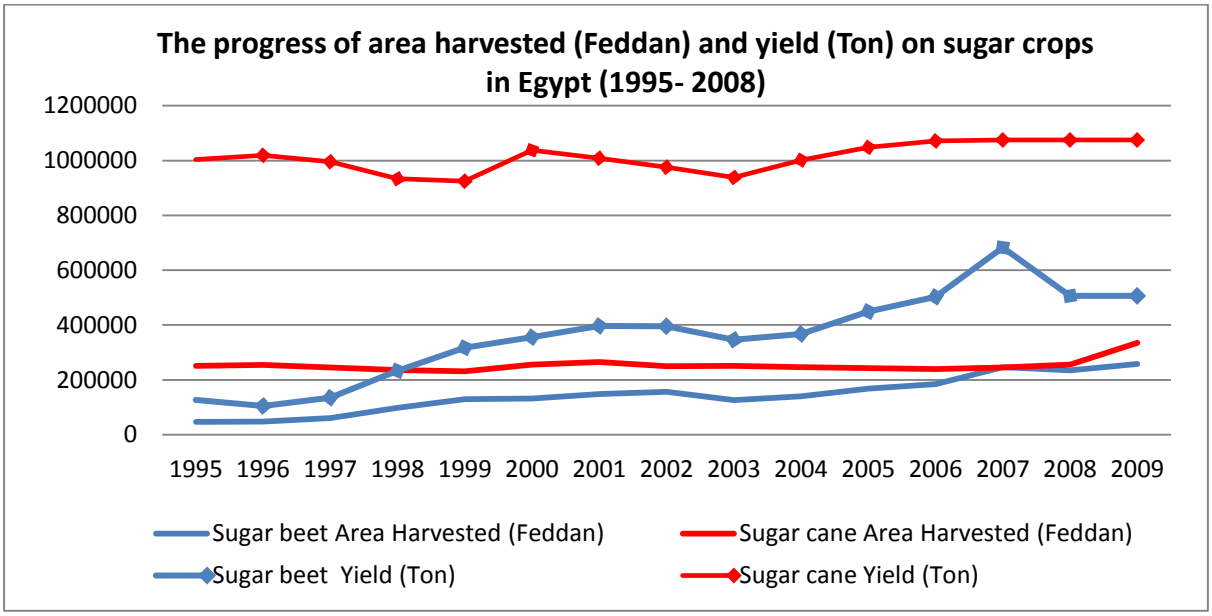
A large number of organizations have developmental interests in the Nubaria region (see Appendix 4). The main focuses of these organizations are to improve the agricultural systems and to improve the lifestyle of the new settlers in the communities established in the desert. For this purpose, they provide a number of services, for example, research and extension, financial, veterinary, and mechanization services. Moreover, many development projects have taken place in the region, e.g. Youth Graduate Project (YGP), and Al-Bustan Project for Agricultural Development

However, these organizations, as found in Appendix 4, are poorly represented regarding covering are of 420.000 ha. Accordingly, new settlers do not have permanent equal access to the provided services. Nevertheless, the basic services (hospitals, schools, police stations, bakeries, markets, and postal services and telephones) are available in all villages (Donia & Farag, 2010; Minstry of Agriculture and Land Recamation, n.d.; Youth Grduate Project, 2000).

1.4 Sugar production in Egypt

Sugar is considered a strategic commodity in Egypt. Sugar consumption has been driven by population growth associated with changes in consumption patterns. Per capita sugar consumption has been growing fast since 1972 in Egypt and was recorded at 16.6 kg/capita in 1972, 28.2 kg/capita 1982, and 34 kg/capita in 2009. Sugar cane is the basic source of sugar production in Egypt. In 1982 the government adopted the cultivation of sugar beet. The crop has proven good for both old and new lands. Thus, beet area has grown gradually since its adoption (Figure 2). In 2008/2009, sugarcane production totaled 1.075 million tons, while sugar beet production was recorded at 0.507 million tons in total, yielding 1.5 million tons in total. This amount represents 60% of total sugar consumption in Egypt which is estimated at 2.6 million tons. Egypt relies on imports to cover the shortage in sugar supply, which is mostly raw sugar to encourage domestic industry (Sugar Crops Council, 2009). So that, the government has imposed dumping fine of 500 EP per ton on raw sugar, which is in addition to the current import tariff on white and raw sugar which currently is 10 and 2 percent, respectively. Brazil and Europe are the main exporters, supplying 1.238 and 143 million tons, respectively (Guven & Ibrahim, 2009).

Figure 2 Cultivated area and production of sugar cane and sugar beets in Egypt (1995-2008).



Source:(Sugar Crops Council, 2009).

1.4.1 A comparison between sugar cane and sugar beets

The Egyptian government policy supports increasing sugarcane yields, with an overall objective of decreasing the total area planted, while it tends to promote both sugar beet yields and area planted (Siam & Moussa, 2003). Hence, Egypt ranks (2009) worldwide as first for sugarcane productivity (121.4 tons/ha) while it is 22nd for sugar beet productivity (44.6 tons/ha) (FAO, 2011). Actually, the amount of sugar produced from one feddan of sugar beet is approximately half of the amount of sugar produced from one feddan devoted to sugar cane production (Table 1). Nonetheless, the sugar produced from one cubic meter of water for sugar cane production is approximately three-fourth of the sugar produced from one cubic meter of water for sugar beets (Sugar Crops Council, 2009). Moreover, sugar beets excel in the newly reclaimed lands, and are thus considered an improving soil crop. They provide a number of by-products such as beet tops, pulp, and molasses. The by-products increase the value added by up to 10% of the value of the sugar. These by-products can be used to establish dairy farms in the new lands. Beets have a short growing season of 6-7 months (FAO, 2009).

Table 1 Comparison between sugar cane and sugar beet in Egypt.

Characteristics	**Sugarcane**	**Sugar beet**
Area harvested (feddan)	335063	257667
Production (tons)	1.075.184	0.507.115
Yield (tons/feddan)	51.235	20.420
Sugar produced (tons/feddan)	4.2	2.2
Water consumption (m^3/feddan)	9000	3500
Sugar produced from water unit (tons/ 1000 cm)	0.466	0.616
Season length (months)	12	7
Net profit per year (EP/feddan)	4836	3053

Source: (Sugar Crops Council, 2009).

1.4.2 Price policies

Beet prices are determined based on conciliation between sugar companies (SCs), and the Sugar Crops Council (SCC), in collaboration with the SBGs. The delivery price for sugar beets in 2008/09 was set at 200 EP for 16% sugar content, plus 50 EP to underpin the beet competitiveness with other winter crops. Moreover, two kinds of incentives were provided. First, a bonus for sugar content, which is a progressive price based on the sugar percentage as shown in (Table 2). Second**,** an early bonus, which is a regressive value based on the delivery date was also applied. The bonus provides 100 EP for a delivery during January and 80 EP for the first ten days of February, which is then regressed by 10 EP for every 10 days thereafter. The accepted impurity proportion is 8%. In case it increases by more than 8%, the grower should be paid for the net weight only excluding mud weight, additionally freight costs are to be accounted for as well. The seed price is equal to 300 EP and is totally free of charges for the delivery during Jan and Feb, while it is only free of 50% of price during March (Nubaria Sugar Company, 2008).

Table 2 Sugar prices according to sugar percentage.

Sugar percentage	**13 – 14**	**14 - 15.5**	**15.5 - 16**	**16**	**16 - 19**	**19<**
Price change (%) of 200 EP	-1.8	-1.0	-0.9	200	+0.9	+0.5
Changes (EP)	- 3.6	- 2.0	- 1.8	+ 50	+1.8	+1.0

Source: (Nubaria Sugar Company, 2008).

1.4.4 Sugar beet extension program

Sugar beets are grown on a contract basis. Both public extension and SCs provide guidance services for beet growers.

First, the Central Administration for Agricultural Extension (CAAE) conducts a number of national campaigns. Each campaign concerns one crop or a group of crops such as sugar crops (sugar cane and beet). Such campaigns include comprehensive extension activities. The selection of these crops is based on the government priorities. Sugar is one of the strategic agricultural commodities in Egypt and includes both sugar cane and beets. SCC is the umbrella organization which plans and supervises the implementation of the campaign activities. Many organizations contribute to the campaign activities: SCs, Soil Improvement Service (SIS), CAAE, and Sugar Crops Research Institute (SCRI) (Sugar Crops Council, 2009). The Sugar Beet Program (2008/2009) was applied in 15 agricultural administrations, including Nubaria. Each administration selected one village to be a demonstration plot where intensive extension activities are applied (one activity every week). Some other villages apply regular extension activities (one activity every month). The remaining villages are not covered by the program but, still, they could be covered by other programs (see Appendix 3).

Second: The agricultural administration in Nubaria Sugar Company (NSC) is responsible for the guidance activities. It has trained 25 agronomists for sugar beet applications. Each agronomist supervises from 3 to 4 agents. The agent covers an area range (200-700 feddans) or around 250 beet growers. The agricultural administration is liable for contracting and guiding beet growers at the village level. They also arrange the harvesting process according to the delivery time table. In addition, they should be represented in the public extension activities. NSC provides growers with a number of incentives such as soft loans of 1000 EP per feddan and free dose of pesticide during the early stages, and planters for land parcels which are wider than 10 feddans (Head of the Agricultural Administration of the NSC, personal communication).

1.5 Problem Statement

National extension services programs require long and medium-term planning of the agricultural extension programs. These programs could be carried out annually, focusing on the economic importance of the crop and the limits of available funding. The implementation of outreach programs in desert areas as a part of the central planning nationwide, plus an absence of target group participation, are key challenges for effective extension programs. It is very important that problems which limit extension effectiveness are identified in order to establish these programs according to priorities reflecting actual needs, using appropriate methods and aids. These problems brought about the following questions to be answered by this study: How successful are these programs at bringing about the behavioural changes desired for the beneficiaries in the desert areas? Are such programs appropriate/ relevant for the specific context of the production patterns in the desert areas?

The study results will provide information which can be used to explain the strengths and weaknesses of the program according to when, where, and how the program was planned, implemented and evaluated. These results could help extension policy makers design more effective future programs that are focused on the real needs of the learners.

1.6 Objectives of the study

The objectives of this study are:

1. To explore the conditions of the extension services in the new lands.
2. To identify the main shortcomings that hinder sugar beet growers from benefitting from the agricultural extension activities in the desert areas and their suggestions to overcome it.
3. To identify the degree of effectiveness of the Sugar Beet Program from the beet growers' point of view.

1.7 Evaluation of extension programs

1.7.1 The need for evaluating extension programs

Despite the high returns and the growing demand for extension services in developing countries such as Egypt, national extension systems face many interrelated barriers. First, financial constraints, i.e. a continuing shrinking budget allocated to public extension as a result of structural adjustment programs. This can be witnessed by inadequate operating funds, poor equipment, and very low salaries. Second, a lack of qualified extension staff

exists. Third, a weak linkage among research, extension staff, and growers; the poor linkages between research and extension activities influences the generated innovations and technology transfer process. The fourth problem is the absence of grower participation in designing extension programs and the lack of feedback from farmers to research and extension personal (Swanson, 1989). To be more responsive for these circumstances, extension planners have been motivated to develop more efficient and effective programs (Contado, 1997). Therefore, they tend to evaluate different development program ideas and approaches, trying to understand how they function in practice, as well as the advantages and disadvantages of each approach (Cristovao, Koehnen, & Portela, 1997).

1.7.2 Developing a conceptual framework of evaluation criteria

Evaluation includes a systematic and objective assessment of an on-going or completed project, program, or policy. The subject of the evaluation process could be the design, implementation, or results (United States General Accounting Office, 1998). Program evaluation should provide credible and useful information to enable decision-makers to improve their programs in the future. Accordingly, it requires applying empirical research methods and social science (Langbein & Felbinger, 2006). Relevance, effectiveness, efficiency, impact and sustainability are the more frequent criteria for the evaluation of extension programs (Christoplos, Sandison, & Chipeta, 2011)**.**

Relevance is the extent to which the intervention program is consistent with priorities of a target group, as well as national and donor interests (OECD, 2002)..

Effectiveness is defined by IFAD (2009) as "the extent to which the development intervention's objectives were achieved, or are expected to be achieved, taking into account their relative importance".

Efficiency assesses outputs produced from a program at a given amount of inputs (Christoplos, et al., 2011). Inputs are the resources invested in the program, money, expertise, and time (IFAD, 2009).

Impact assesses the both the positive and negative net effect attributed to development intervention, directly or indirectly, intended or unintended. Positive results are, for instance, better food security and nutrition, as well as a creation of more jobs. Negative results are, for example, environmental effects, an increased workload or risks that smallholders face (Christoplos, et al., 2011; IFAD, 2009). Impact assessment requires either an experimental or quasi-experimental design (International Initiative for Impact Evaluation, 2011).

Sustainability measures a program's ability to operate for a longer time particularly after development assistance has been completed. Sustainable programs should be able to meet the recurrent costs of the activities and do not have a harmful impact on land and water resources (Christoplos, et al., 2011; IFAD, 2009).

There is a difference between monitoring and evaluation. Monitoring provides information to help maintain or accelerate the progress of implementation according to the plan. Evaluation inspects whether the plan is fit for a program's objectives and circumstances. Thus, evaluation concerns more long-run effects and a more comprehensive assessment in comparison to monitoring. In addition, it makes judgements on the output and impact of a program in terms of its objectives (Touwen, 2001).

1.7.3 Purpose of evaluation

A wide range of focuses can be included in an evaluation. However, it is hard to meet the interests of all stakeholders involved (farmers, extension staff, administrators, funders). Hence, it is appropriate to focus on the high priorities of the program characteristics that meet stakeholders' expectations. There are various potential focuses for evaluating agricultural extension programs, such as explaining the linkages between program inputs, activities, outputs, and outcomes, or measuring the changes at the individual, organizational, and community levels (Knox, 2002; Rajalahti, Woelcke, & Pehu, 2005). Eventually, assessing the impact can be done through estimating what would have likely happened in the absence of the program implementation, or comparing the effectiveness of alternative programs which have similar objectives (United States General Accounting Office, 1998). Incorporating stakeholders in the evaluation process is very important for successful identification of the evaluation focus and the drawing of the evaluation design (Knox, 2002; Rajalahti, et al., 2005).

1.7.4 Data type

Data type is determined according to the evaluation purpose. Similarly, the design of tools and methods can be drawn up according to the data type. Most evaluations studies integrate both quantitative and qualitative data to produce valuable contributions.

Quantitative data is information which can be accounted or expressed numerically. Quantitative data analysis helps to identify the associations among model variables. Furthermore, it provides validation of quantitative variables and helps to interpret the findings. Frequency distribution is used to discover variation among responses. Cross-

tabulation is utilized to discover associations between two variables displayed in a matrix. Tests of significance to indicate whether research findings are probably true or due to chance, while multivariable analysis tests investigate more complex relationships (Knox, 2002).

Qualitative data includes, for example, beneficiary interviews, stakeholder meetings, focus group discussions, observation, and reports. The data covers stakeholders' views, opinions, and experiences (Rajalahti, et al., 2005). Qualitative data brings about an explanatory understanding of patterns and themes. Any interpretation should then be in light of the background and circumstances of the object of evaluation (Knox, 2002).

1.7.5 Levels of evaluation

The W.K. Kellogg Foundation (2004) and the Swedish International Development Cooperation Agency (2007) have classified evaluation into three levels:

Program level evaluation focuses on individual development programs which are designed to achieve specific objectives with specified resources and implementation schedules. The program level includes various methods and tools for data collection. Further, it involves analysis and interprets the data in order to establish agreements on the meanings of the findings, and to help decision-makers improve program performance. Program level evaluation focuses on program development and measures program outcomes related to stakeholders' interests.

Cluster level evaluation is conducted for groups of similar or relevant activities or programs. Cluster evaluation is more relevant to policy reforms than program level evaluation. It provides information about how far an aggregation of projects could potentially contribute to achieving an overall goal. Cluster evaluation looks across a group of projects to identify a common understanding and provides feedback to improve program design.

Policymaking level evaluation is the most macro level evaluation; it focuses on the formulation of policies for a broad sector. It utilizes synthesized information gathered from both project-level and cluster evaluations to draw conclusions about program performance. The three levels are not alternatives for each other, but the findings of each level can serve the evaluation design at the other levels.

All together, these types of evaluation provide an overview and comprehensive data from which improving individual and groups of projects can be assessed. The expected interaction across the three levels inspires the evaluators to find an integrated design leading to secure, sustained and positive change at the community level.

1.7.6 Types of evaluations according to its location in a project cycle

Evaluations can be classified by location in a project cycle using the following stages:

Ex-ante evaluation includes a comprehensive analysis of the potential impact of program intervention activities. The evaluation procedures take place before program implementation, when little information is available about the costs and benefits of a proposed intervention. Methods used are expert reviews, checklists, and scoring models, as well as cost–benefit analysis. Thus, many evaluation procedures can be done so as to determine a baseline, which involves describing the situation prior to a development intervention, identifying target groups and out lining the intended progress. Moreover, determining the indicators is suitable to assess such progress. Stakeholder participation is essential for a more effective ex-ante evaluation. Ex ante designs enable random assignment and baseline data from both treatment and control groups. Consequently, it's considered more advantageous than ex-post evaluation designs (International Initiative for Impact Evaluation, 2011).

On-going evaluation is conducted while the intervention development program is in progress. It is more useful for management than ex-ante and ex-post designs since it addresses day-to-day management problems. It also reviews activities to decide if they should be continued, modified or aborted. Moreover, it monitors the utility of resources and the delivery of outputs. Additionally it provides feedback from the target group (Ponniah, Puskur, Workneh, & Hoekstra, 2008)

Ex-post evaluation design covers program performance from the beginning to end but after the completion of a program. It requires extensive data collection and for this purpose many tools can be used e.g. interview questionnaires, field visits, observations, and reports analysis.

A good ex-post evaluation depends on a well managed ex-ante assessment, since it defines the baseline and target groups. In addition, it determines relevant data and indicators required for an ex-post evaluation. Various topics could be the focus of an ex-post evaluation, e.g., effectiveness, efficiency, cost benefits and degree of satisfaction of program activities. Ex-post evaluation also tries to explore both the internal and external factors affecting the outcome of a project with regard to beneficiaries' socio-economic variables, besides addressing the attribution question. Moreover, it provides a basis for improving the R&D process, comparison designs, methodologies, and approaches (Ponniah, et al., 2008).

1.7.7 Evaluation design

Objective-based evaluation assesses the worth of a program based on the extent to which the stated objectives of the program have been achieved (Dart, Petheram, & Straw, 1998).

Periodic evaluation is a periodic review of program's goal, strategy and work plan. The main purposes are to document progress as well as problems. The findings contribute to improving the planning of the following phases or the next programs. It is mostly conducted by internal staff using a variety of methods. A process evaluation focuses on a variety of aspects: program priorities, relationships between program staff, beneficiaries, management and the organization's goals and structure (Touwen, 2001).

Needs based evaluation involves measuring program outcomes based on the extent to which a program meets beneficiaries' needs. Different from an objective-based design, needs-based evaluation takes the probability that the objectives do not meet the actual needs of participants into consideration. This presents a variation to objective-based evaluation, and makes the assumption that the objectives of a program do not necessarily represent the needs of the participants (Dart, et al., 1998).

Goal-free evaluation, as the name suggests, does not require goals to be addressed and it considers what is assumed to be emphasized and valued to be open-roomed (Knox, 2002). It involves assessing the intended and unintended outcomes of the program. Goal free evaluation covers both positive and negative unintended outcomes with a broader indication. Thus, it requires more comprehensive data and methods (Owen, 2007).

Impact evaluation deals with the assessment of outcomes of a program after the completion of the project at the last stage of a project cycle. In addition, it measures the extent of achieving objectives and the impact on the participants. Impact evaluation is always conducted by an independent team.

The focus of assessment is to determine the common interests of stakeholders. Stakeholders include donor agencies, the international organizations and in-country representatives and the local program organizations. Equal representation and participation of the beneficiary community should also be sought.

Impact evaluation is more objective than routine reporting. It requires extensive data collection and analysis of socio-economic factors using several methods including case studies, cost-benefit analysis, and rapid rural appraisal. Impact evaluation is a form of ex-post evaluation; therefore, it is less useful as a management tool. However, it helps policy

makers and international organizations to make decisions to allocate more resources for research and extension (Touwen, 2001).

On the whole, since the early 1980s, Egyptian policy has focused on the desert area as more than just land reclamation, but as community development as well. Accordingly, land reclamation process was expanded to cover the development of village communities and hence became more linked with development programs (Adriansen, 2007). With this intention, the extension agencies focus on reviewing farm systems in the new lands so as to adjust any negative practices, develop the agricultural extension programs and link research work with extension and technology transfer in both old and new lands (Siam & Moussa, 2003). Knowledge and information are critical inputs for advancing the agricultural systems in the new lands. But for better performance knowledge and information must be effectively communicated to farmers (World Agricultural Information Centre, n.d.)

2 Subjects and Methods

2.1 Sample design

The subjects of this study were divided into two categories as follows**:**

First: Sugar beet growers

A random sample was selected from Al-Huda (the demonstration plot village) and Belal which receives regular extension activities and contains the largest amount of sugar beets grown, and, consequently, the most sugar beet growers. 28 and 89 SBGs were selected from the villages of Al-Huda and Belal, respectively, as shown in Table 3.

Table 3 Sugar beet area, No. of SBGs, and No. of interviewees in the selected villages.

Village	**Extension type**	**Beet area (feddan)**	**No. of SBGs**	**No. of interviewee**	**%**
Al-Huda	Detonation plot	350	92	28	30
Belal	Regular Extension	750	300	89	30

Source: (The agricultural administration, Nubaria Sugar Co. personal communication)

Second: Extension staff (ES)

All twenty two ES in Nubaria agricultural administration were involved in the study.

2.2 Tools of data collection

The research relied on two sources of information: primary and secondary data.

First: Primary data

Two forms of interview questionnaires were designed in Arabic based on an analytical review of existing literature and discussions with experts working in agricultural extension services and sugar beet production in Nubaria.

The first questionnaire was designed for beet growers (Appendix 1). It was divided into seven parts as follows:

1 Socio-economic characteristics of beet growers

2 Participation and satisfaction levels of the received extension activities

3 Costs and revenue elements of sugar beet farming

4 External factors affecting sugar beet production at the district and farming spheres

5 The problems and shortcomings that hinder SBGs' benefiting from extension activities and their suggestions to overcome them

6 SBGs' suggestions regarding the favorable topics to be covered in the next season's program

7 SBGs' knowledge, applications and profit

The second questionnaire was designed for the extension staff (Appendix 2). It was divided into three sections as follows:

1 Demographic and job characteristics

2 Report writing

3 Training achievement during the last two years

Second: Secondary data

This includes both published and unpublished data and concerns the description of the study area and beet program activities. The data was collected from annual reports of sugar crops published by the SCC, and reports of the extension activities provided by the NSC, the Nubaria Agricultural Administration (NAA) and the YGP. NSC provided a number of 36 reports covering three types of activities, extension meetings, field days and farm visits. There were no available reports concerning demonstration fields and bulletin dissemination. That is, there are no particular reports for bulletins which are disseminated during other extension activities. While, demonstration fields have special files fulfilled by the ES and were inaccessible.

2.3 Data treatment and quantification

Both the socio-economic variables of SBGs and the socio-economic variables and job characteristics of ES are shown in appendix 1 and appendix 2, respectively. Nonetheless, the three variables, outputs, external factors, and outcomes are explained below.

2.3.1 Output variables

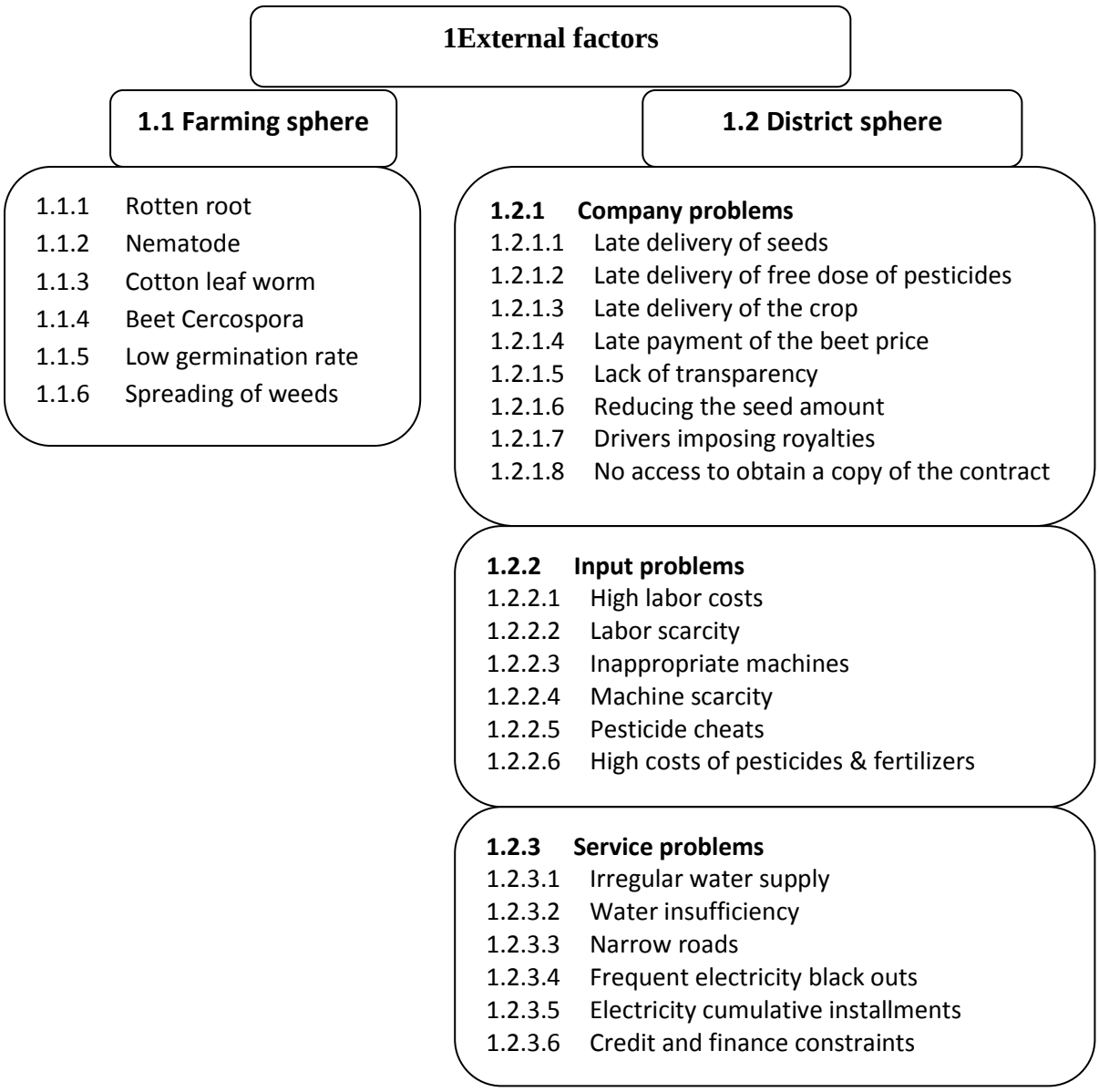
For SBGs' participation in the beet program activities, they were asked about the following: pamphlet reading, appearing at field days, farm visits, demonstration fields and extension meetings. The responses were Yes or No yielding either a 1 or 2, respectively. The subjects were classified into four levels according to the level of participation in an extension activity: no participation, participation in one activity, participation in two activities and participation in three activities or more. For the satisfaction of the beet program activities five

measures were developed with each measure made up of a number of phrases. Each phrase figures out one of the criterion of this activity. The responses were scaled to three degrees: satisfied, neutral or dissatisfied, coded 1, 2 or 3 respectively.

2.3.2 External factors

External factors describe the environmental problems at the farm and the district spheres. Two open ended questions were designed. The growers were then asked to rate each problem as either mild, moderate or severe (1, 2 or 3). According to the SBGs' responses, there were six problems at the farming sphere, while there were twenty at the district sphere. These twenty problems were categorized into three groups as shown in Figure 3.

Figure 3 External factors at the district and farming spheres.



2.3.3 Indicators of outcomes

To estimate beet growers' knowledge and applications, thirty measurements were applied. They were categorized into 6 groups: the optimal plant density (7), irrigation control (4), fertilization (7), weed control (7), treatment of Cercospora leaf spots (2), symptoms of ripening (2) and disadvantages of leaf defoliation (1). Twenty-four items assessed both the knowledge and the application of the agricultural processes. The other six items concerned knowledge.

To compute profit, beet growers were asked about the costs and revenue elements of their production. Cost elements encompassed labour, irrigation, seed price, fertilizers, pesticides, mechanization and rent costs. Revenue elements comprised of the beet root and beet top price. The root price is calculated according to the sugar content, the degree of impurity and the bonus of early delivery.

All items within both costs and revenues vary except for the price of the beet tops and the rental costs. The beet top price is fixed at 300 EP/feddan and the rental cost at 750 EP/feddan/6 months.

2.4 Analytical methods

The research can be described as an ex-post assessment designed to explore the effectiveness of sugar beet program as a case study of the extension programs of the desert areas. The overall purpose is to elaborate on the knowledge regarding such programs and provide practical suggestions for diagnosing and improving similar programs. For these purposes, three analytical methods were applied: Content Analysis (CA), Path Analysis (PA) and an Evaluation Logic Model (ELM), as shown below.

2.4.1 Content Analysis

36 reports covering three types of activities, extension meetings, field days and farm visits, were reviewed. CA involves data classifying and screening to identify the common criteria of such reports for coding and quantification purposes (Marczyk, 2005).

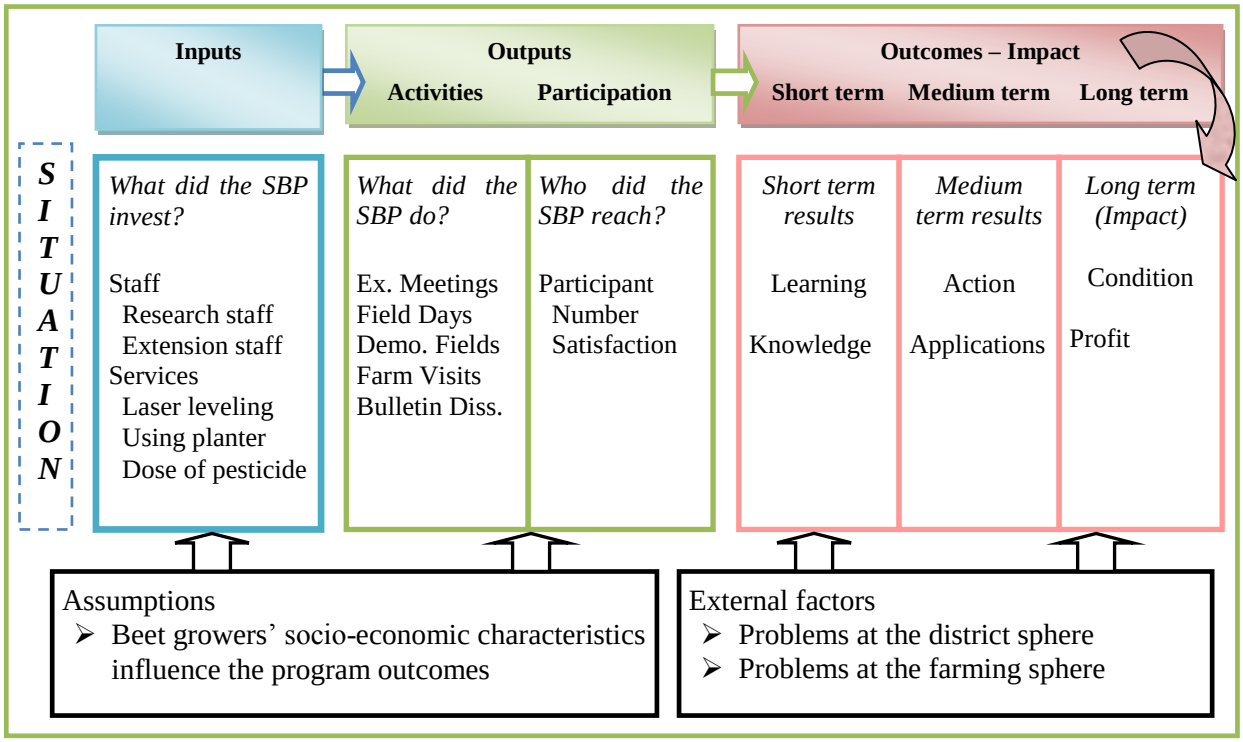
2.4.2 Evaluation Logic Model (ELM)

ELM represents systematic and visual descriptions of logical relationships among **program resources** (inputs), **activities** (outputs), i.e. number of the activities that were carried out, and the number of people who participated in such activities, as well as their satisfaction degree of **the intended results** (outcomes), i.e. short, medium, and long-term

outcomes (McCawley, 1997). It is often presented as a diagram chart, table or a chain of "if then" statements to illustrate the hypothesized cause-effect relationships (Israel, 2010).

Developing ELM starts by articulating the ultimate goal based on a clear problem identification of what the program is assumed to deal with. Subsequently, a convenient plan of action (activities) is designed to achieve this goal as well as estimate the required resources (inputs) to implement these activities. An ELM can be divided into six components (Barkman, 2000; Innovation Network, 2008; Taylor-Powell & Henert, 2008) as shown in figure 4.

Figure 4 Logic model of sugar beet program.



Source:(Taylor-Powell, Jones, & Henert, 2003)

First: Situation

Information about the situation or conditions prior to program planning declares the need for a program intervention. For the beet program, the problems were routinely reported earlier during the season before. This can be done by reports of beet program activities and observations of the research staff. Such observations were assembled together in the final report (2007-2008) to reform the situation for the next season (2008-2009). The situation is indicated in the program plan as shown in Appendix 3.

Second: Inputs

Resources were allocated for the program implementation such as:

1. Human resources: Time invested by extension and research staff.
2. Services: Free dose of pesticides at the early stage, laser levelling and cultivating using planter.

Third: Outputs

The number of sessions or educational activities, such as: extension meetings, field days, demonstration fields, farm visits and bulletin disseminations, as well as the number of SBGs involved in the program activities and their level of satisfaction.

Fourth: Outcomes

The changes that occurred for beet growers as a result of attending beet program activities. Outcomes can be short, medium, or long-term, as follows:

Short-term (learning level): knowledge gained through program activities

Medium -term (action level): application of knowledge gained

Long-term (impact level): economic impact (profit)

Fifth: Assumptions

Assumptions are the beliefs about the program and the key stakeholders, as well as the expectations about the rationale behind program theory or the essential conditions for the program success. The assumption that was designed for beet program is "beet growers´ socio-economic variables influencing the program outcomes".

Sixth: External factors

Includes environmental factors wherein the program is implemented and those which influence program performance. The external factors of the beet programs can be classified into problems at the district sphere and particular problems at the farming sphere as mentioned before.

2.4.3 Path Analysis (PA)

PA is relevant to the current study in terms of exploring the casualty. PA is considered as an extension of multiple simultaneous regression analyses (Bryman & Cramer, 2005). It is conducted based on an order of relationships predetermined according to a theory or model (Schumacker & Lomax, 2004). More than one dependent variable can be integrated into the model. The same variable can be considered as dependent for a set of variables while for the others it is independent (Bryman & Cramer, 2005).

PA is convenient for depicting causality when only manifested variables are the focus of the study (Mackinnon, 2008). It separates out direct and indirect effects among variables. A direct effect is the impact of one variable on another directly without any mediated variable(s). An indirect effect is the influence of one variable on another through mediated variable(s). The total effect is the sum of both direct and indirect effects. The causal direction is one way, from left to right (non recursive) (Bryman & Cramer, 2005; Foster, Barkus, & Yavorsky, 2006)

PA relies on a two visual illustration called the path diagram. The input diagram explains the proposed relationships based on the ELM. The output diagram displays the actual results of statistical analysis (Singh, 2007). Both diagrams have a common convention to help in drawing and understanding the model. Within the model, the terms exogenous and endogenous are used instead of independent and dependent.

Exogenous variables are influenced by variables outside the model (Norman & Streiner, 2003) and have no measurement error (Raykov & Marcoulides, 2006). Paths come from exogenous variables but do not point at them.

Endogenous variables can be predicted by one or more variables inside the mode (Norman & Streiner, 2003). They contain measurement error which represents the unexplained part of the endogenous variables. The direction of the arrows shows the course of the effect (Jackson, Dezee, Douglas, & Shimeall, 2005). Bold arrows indicate significance at the 1% level and non bold arrows at the 5% level. All variables are represented by rectangles.

Variables manipulation

Binary or dichotomous variables were coded with numerical codes 0 or 1 (Petrie, Bulman, & Osborn, 2002). Similarly, qualitative explanatory variables (three levels of responses) were treated as numerical variables. For each variable, two dummies were created, coded 0 or 1.

Path model procedures

Four logical steps to apply PA, model specification, model identification, model estimation, and model fit.

First: Model specification

PA does not include an approach for model specification. Rather, the model is specified based on the theoretical background. The theoretical background provides guidelines for determining the pertinent variables and relationships (Schumacker & Lomax, 2004). In this study, ELM was implemented to draw conclusions about the proposed model (see Figure 4). Consequently, three regressions were depicted. The endogenous variables were knowledge, applications and profit. Correspondingly, the exogenous variables were SBGs` socio- economic variables, external factors and participation as well as satisfaction of beet program activities. Additionally, the effect of the endogenous variable on the following one was included based on the logical relationship; i.e. knowledge is regressed on applications and applications on profit

To simplify the model, three procedures were performed. First**,** each endogenous variable was scatter plotted against the relevant exogenous variables according to homogeneity, significance, direction and outliers (Foster, et al., 2006). Secondly, a series of stepwise regression were performed. Every endogenous variable was regressed with the variables which met the previous conditions. Thirdly, the output of the stepwise regression outlined the variables which were regarded in the PA. Accordingly, the model can be specified using the following regression equations:

Where, (Exp) experience in the new lands, (Family L) is family labour contribution to the farm work, (Inv) refer to grower's category is an investor, (Agric) refer to grower has an agricultural education, (Cum I) is electricity cumulative instalments, **(**Credit C) is credit constraints, (Water I) is water insufficiency, and (Nem) is infection of nematodes.

Second: Model identification

Every parameter should be identified to be free, fixed, or constrained. The free parameter is estimated from the model itself. The fixed parameter value is set to equal a given constant of 1 or 0. A constrained parameter is assumed to be equal to another parameter. In the beet program path model, all manifested variables are free. Covariance between exogenous variables is fixed to 0. For better model identification, the free parameters must be

less than or equal to the number of the observations. Besides, the model design should maintain the non recursive condition (Schumacker & Lomax, 2004).

Third: Model estimation

The standardized regression coefficient (beta weight) represents the path coefficients. It measures the effect in terms of standard units. In other words, the number of Standard Deviations (SD) changes for endogenous variables, when one SD has changed in the exogenous variable. Standardization is preferable when the exogenous variables have different units in nature (Norman & Streiner, 2003; Tarling, 2009). The standardized beta represents the direct effect. The indirect effect is obtained by multiplying the path coefficients while taking the mediate variable(s) into consideration. The total impact equals the direct and indirect effects (Stage, Carter, & Nora, 2004). For model fitting, both the adjusted R^2 and root mean square error were used (Petrie, et al., 2002). The Variance Inflation Factor (VIF) was utilized for multicollinearity diagnostic. SPSS 18 was used for descriptive analysis and model specification procedures. Stata/SE 10.1 for windows was used for the PA assessment.

Fourth: Model fit

Model goodness of fit assessment should be based on the aim of the modelling (Simpson et al., 2004). Model fitting tests determine whether the model under estimation should be accepted or needs to be adjusted. In the same way, it helps to decide which variables should be included in or excluded from the model (Raykov & Marcoulides, 2006). Accordingly, there are two levels of model fitting, first: the global measure of the model fit, which assess the proportion of the explained variance (adjusted R^2), as well as the assessment of the proportion of unexplained variance ($1-R^2$). Second is the individual assessment of every path coefficient (statistical significance, direction, and strength). All free parameters should have the expected sign, and make practical sense (Schumacker & Lomax, 2004). Multicollinearity typically enlarges the regression coefficients. Moreover, it reduces the stability of the estimated model (Bryman & Cramer, 2005). The ideal VIF value is 1. The closer the value is to 10, the more concern should be given for multicollinearity among the model variables (Foster, et al., 2006; Raykov & Marcoulides, 2006).

3 Results

117 sugar beet growers took part in this study. Their socio- economic characteristics are displayed in (Table 4)

3.1 Socio-economic characteristics of beet growers

Table 4 Socio-economic characteristics of SBGs (n=117).

Items	**Characteristic**	**Freq.**	**%**
Age (year)	32- 43	35	29.9
	44-54	55	47.0
	55-65	27	23.1
Category	Smallholder	68	58.1
	Graduates	33	28.2
	Investors	16	13.7
Level of education	Literate	47	40.2
	School education	40	34.2
	Higher education	30	25.6
Specialization	Agricultural	17	14.5
	Non-agricultural	100	85.5
Origin	Urban area	28	23.9
	Rural area	89	76.1
Experience in new lands (year)	4 – 10	29	24.8
	11 – 17	60	51.3
	18 – 25	28	23.9
Family labor members (No of Persons)	No participation	42	35.9
	One person	23	19.7
	Two persons	39	33.3
	Three persons	13	11.1
Attitude towards public extension	Negative attitude	77	65.8
	Moderate attitude	25	21.4
	Positive attitude	15	12.8
Irrigation type	Modern irrigation	62	53.0
	Surface irrigation	55	47
Soil type	Calcareous soil	29	24.8
	Loamy soil	50	42.7
	Sandy soil	38	32.5

Total farm area (feddan)	≤ 5	77	65.8
	5.1 – 10	27	23.1
	≥ 10.1	13	11.1
Sugar beet area (feddan)	≤ 5	104	88.9
	5.1 – 10	11	9.4
	≥ 10.1	2	1.7
Achieving services	Free dose of pesticides	21	17.9
	Cultivating using planter	12	10.3
	Laser leveling	18	15.4
Plant density	≤ 20000	4	3.4
	21000 – 25000	52	44.4
	26000 – 30000	51	43.6
	≥ 31000	10	8.5
Cultivation date (Stage)	Early stage (Jul : Aug)	43	36.8
	Moderate stage (Sep)	41	35.0
	Late stage (Oct : Nov)	33	28.2
Delivery date	March	54	46.2
	April	34	29.0
	May	29	24.8

More than half of SBGs are smallholders. Around 40% are literate, 34% have a basic primary education and 26% have a higher education. Almost 15% have an agricultural education. Moreover, 76.1% grew up in rural areas. SBGs' experience in cultivating the new lands ranges from 4-25 years. The majority of the growers' families contribute to the farming activities. Two-third of the SBGs have a negative attitude towards public extension. Regarding the farming characteristics of the SBGs (Table 4), nearly half of the sampled farmers do not use modern irrigation techniques. Three soil types were identified: calcareous 24.8%, loamy 42.7% and sandy 32.5%. Most of the growers 65.8% have less than 5 feddans (2.1 ha) of farm area. Similarly, 88.9% of the sugar beet area is less than 5 feddans in size. Most of the SBGs' reported plant density is less than the recommended level (30000 - 35000 plants/feddan).

3.2 Knowledge, applications and profits of beet growers

In the Nubaria area, SBP was applied in 2008/2009. SBGs were asked about their knowledge (30 items) and applications (24 items) of beet program recommendations. Additionally, their profits were calculated (Table 5). The question here is whether the,

participation in the beet program activities had an impact on SBGs' knowledge, applications and profit.

Table 5 Knowledge, applications and profits of beet growers (n=117).

Items	**Characteristic**	**Freq.**	**%**
Knowledge	Low (1 – 10)	0	0
	Moderate (11 – 20)	49	41.9
	High (21 – 30)	68	58.1
Applications	Low (1 – 8)	0	0
	Moderate (9 – 16)	43	36.7
	High (17 – 24)	74	63.3
Profit EP/feddan	≤ 1000	21	17.9
	1001 - 2000	30	25.6
	2001 - 3000	40	34.2
	3001 - 4000	23	19.7
	4001 - 5000	3	2.7

SBGs in this study show moderate to high levels of knowledge and applications. The profits show a remarkable variation (≤1000:5000 EP). Close to half of the SBGs have profits that are less than 2000 EP. Beet growers were asked about the barriers of applying their knowledge (Table 6). Irregular water supply 40.2% and scarcity of farm labor 36.8% are the most frequent obstacles interfering with the application of their knowledge.

Table 6 The barriers to applying knowledge (n=117).

Item	**Problem**	**Freq.**	**%**
Irrigation recommendations	Irregular water supply	47	40.2
The third hoeing	Scarcity of farm labor	43	36.8
Fertilization	High costs of fertilizers	29	24.8
Weed control	High costs of herbicides	25	21.4
Optimal plant density	Infection of pests and low germination rate	23	20.0
Optimal plant density	Reducing the seeds from 4.0 to 3.5 kg/feddan	13	11.1

3.3 Shortcomings and suggestions of the extension activities

SBGs were asked about the problems which hinder what they derive from the extension programs in Nubaria and their suggestions to solve these problems. Eleven problems were found (Table 7). The most frequent problems were a lack of extension activities, a lack of extension staff.

Table 7 Shortcomings of the extension activities and the suggestions to solve them from the sugar beet growers' point of view (n=117).

No.	Subjects	Freq.	%
Shortcomings			
1	Lack of extension activities	63	54
2	No extension personal at the village level	45	38.5
3	Insufficient advertisements regarding the extension activities	38	32.5
4	Absence of practical aspects in the extension activities	35	29.9
5	The information doesn't meet the needs or solve the problems	35	29.9
6	The extension activities don't apply to the cultivated crops	28	23.9
7	The extension activities are provided during working hours	27	23.1
8	Lack of qualified extension personal	26	22.2
9	Inequality distribution of the extension activities among the villages	16	13.7
10	No accountability regarding the extension personal	13	11.1
11	Lack of monitoring (follow up)	11	9.4
Suggestions			
1	Provide field supervision	63	53.8
2	Provide systematic extension activities	45	38.5
3	Better advertising for the extension activities	39	33.3
4	Supply with subsidized inputs	39	33.3
5	Intensifying the extension activities	36	30.8
6	Offer credit resources	34	29.1
7	Collaboration between extension and irrigation administration	26	22.2
8	Choose a more convenient time which considers farm work farm	20	17.1

3.4 External factors affecting sugar beet production at both the district and farm spheres

To determine the external factors influence sugar beet production, SBGs were asked two open ended questions, one for production problems at the district sphere, and the other for production problems at farm sphere. Additionally, they rated each problem as mild, moderate or severe.

First: Agricultural problems at the district sphere

The problems at the district sphere were grouped into company, service and input problems (Table 9). At the company level, not being able to obtain a copy of the contract, reducing the seed amount and late payment were the most frequent problems. SBGs mentioned a shortage of six services. An irregular and an insufficient water supply were the most predominant problems. Six problems related to the inputs were identified. Labor scarcity and costs were the most frequent.

Table 8 Agricultural problems at the district sphere (n=117).

No.	Problems	Problem degree							
		No		Mild		Moderate		Severe	
		Freq	%	Freq	%	Freq	%	Freq	%
Company problems									
1	No access to a copy of the contract	67	57	12	10	12	10	26	22
2	Reducing the seeds amount	44	38	12	10	40	34	21	18
3	Late payment	53	45	13	11	30	26	21	18
4	Lack of transparency	73	62	12	10	17	15	15	13
5	Late delivery of seeds	72	62	5	4	26	22	14	12
6	Late delivery of the free pesticide dose	89	76	9	8	8	7	11	9
7	Late delivery of the crop	84	72	19	16	7	6	7	6
8	Drivers imposing royalties	88	75	11	9	12	10	6	5
Service problems									
1	Irregular water supply	28	33	26	22	30	26	33	28
2	Insufficient water supply	39	33	16	14	32	27	30	26
3	Credit constrains	72	62	12	10	10	9	23	20
4	Electricity frequently black out	70	60	12	10	18	15	17	15
5	Narrow roads	86	74	7	6	11	9	13	11
6	Electricity cumulative installments	76	65	11	10	18	15	12	10
Input Problems									
1	Labor scarcity	48	41	7	6	9	8	53	45
2	High labor costs	39	33	20	17	20	17	38	33
3	High costs of pests and fertilizers	42	36	8	7	44	38	23	20
4	Pesticides cheats	63	54	15	13	21	18	18	15
5	Machine scarcity	50	43	26	22	26	22	15	13
6	Inappropriate machines	83	71	14	12	13	11	7	6

Second: Agricultural problems at the farming sphere

Six problems were identified at the farming sphere (Table 8). Spreading of weed and nematodes were the major problems. A low germination rate, cotton leaf worm and beet Cercospora seem to be less present. This could be due to; such problems prevailed during the early stage of planting.

Table 9 Agricultural problems at the farming sphere (n=117).

No.	Problems	Problem degree							
		No problem		Mild		Moderate		Severe	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Spreading of weed	42	35.8	9	10.3	31	26.5	35	29.9
2	Nematode	33	28.2	39	33.3	24	20.5	21	17.9
3	Low germination rate	81	69.2	7	6.0	13	11.1	16	13.7
4	Cotton leaf worm	59	50.4	15	12.8	32	27.4	11	10.3
5	Beet Cercospora	68	58.1	16	13.7	19	16.2	14	12.0
6	Rotten root	86	73.5	7	6.0	22	18.8	2	1.7

3.5 SBGs' suggestions of educational content for future programs

Nearly half of the sample requested all agricultural processes to be included in future education content. The particular processes mentioned which should be included were pest management 37.6%, fertilization based on soil analysis 29.9%, and weed control 26.5%.

Table 10 The suggested education content for next season's program (n=117).

No.	The education content	Freq.	%
1	All agricultural processes	54	46.2
2	Pest management	44	37.6
3	Soil and water analysis for irrigation and fertilization	35	29.9
4	Weed control	31	26.5
5	Row spacing	24	20.5
6	Fertilizing	17	14.5
7	Post-harvest treatment	17	14.5
8	Nematodes control	12	10.3
9	Slippers and patching	5	4.3
10	Beet Cercospora control	5	4.3

3.6 Characteristics of extension staff

The twenty-two ES of Nubaria Agricultural Administration were asked about their socio-economic and job characteristics (Table 11), the use of aids (Table 12), and methods (Table 13).

Socio-economic and job characteristics are displayed in table 11. On the one hand, half of the ES are more than 50 years old. On the other hand, 40.9% have less than ten years experience of extension work and 63.6% have up to five years of experience in guiding beet growers. Concerning their educational background, 72.7% have a high school education. Moreover, 18.2% have a non-agricultural education. Almost 90% of the ES view their salaries as insufficient and half of them have an extra job to earn additional income. Regarding the jurisdiction area, half of the ES supervise less than 1000 feddan.

Audio-visual aids are essential for demonstrating the agricultural practices (Table 12). ES were asked about how many times and the source of the educational aids. Findings show very poor usages of the educational aids. Additionally, these aides were provided by the NSC and YGP, and not by the extension organization.

SBP took part in different types of extension methods (Table 13). Five extension activities were conducted during the sugar beet program. From the ES's point of view, farm visits and field days were the most useful methods which contributed to disseminating sugar beet recommendations, while bulletins were the least efficient. The shortcomings of the bulletins were also mentioned, for examples, being out of date and containing unnecessary and compressed content. For other activities, growers not being interested in the extension activities and a lack of extension staff were the common shortcomings**.**

Table 11 Extension staff's socio-economic and job characteristics (n=22).

Item	Characteristics	Freq.	%
Age (years)	≤ 40	7	31.8
	41 – 50	4	18.2
	51 – 60	11	50.0
Experience in extension work (years)	≤ 10	9	40.9
	11 – 20	6	27.3
	21 – 30	7	31.8
Experience in the new lands (year)	≤ 10	10	45.4
	11 – 20	11	50.0
	21 – 30	1	4.5
Experience in guiding beet growers (year)	≤ 5	14	63.6
	6 – 10	4	18.2
	11 – 15	4	18.2
Jurisdiction area (feddan)	≤ 1000	10	45.4
	1001 - 5000	6	27.2
	5001 - 10000	2	9.1
	≥10001	4	18.2
Salary (EP)	≤ 400	8	36.4
	401 - 800	9	40.9
	801 - 1200	5	22.7
Rewards per month (EP)	No rewards	15	68.1
	1 – 50	4	18.2
	51 – 100	3	13.6
Salary sufficiency	Insufficient	19	86.4
	Fair	2	9.1
	Sufficient	1	4.5
Job satisfaction	Unsatisfied	8	36.4
	Neutral	15	68.1
	Satisfied	1	4.5
Level of education	High school	16	72.7
	University degree	6	27.3
Specialization	Non Agric	4	18.2
	Agric.	18	81.8
Origin	Rural	19	86.4
	Urban	3	13.6
Housing	Non governmental	12	54.5
	Governmental	10	45.4
Extra job	No	11	50.0
	Yes	11	50.0

Table 12 Usage amount and sources of educational aids.

Aids	**Video tab**	**Bulletin**	**Projector**	**Blackboard**	**Mic.**
Times/season	2	63	5	5	3
Source	NSC		YGP		

Table 13 Extension activities contributing to the extension work.

Methods	**Contribution rate**			**Growers less interested**	**Lack of extension staff**	**Incontinent time**	**Out of date content**	**Unnecessary content**	**Compressed content**
	Low	**Fair**	**High**						
Demonstration fields	1	5	3	5	2	1	-	-	-
Field days	2	1	7	3	2	2	-	-	-
Farm visits	0	2	9	2	1	1	-	-	-
Extension meetings	3	3	4	4	1	2	-	-	-
Bulletins dissemination	1	5	0	-	-	-	5	5	5

3.7 Report writing

Public extension work uses administrative reports as a monitoring approach. ES are involved in writing three kinds of reports: extension activities, crop monitoring and emergency cases reports. For their importance as an ongoing assessment, two methods were involved regarding reporting activities: an interview questionnaire for the ES and a content analysis of 36 reports.

First: ES were asked about their reporting activities (Table 14) to explore how often they apply it and how satisfied they were from the administrative reactions, as well as who the person is assumed to receive it. Most of the ES are involved in writing the three types of reports on a regular basis: extension activities 86.4%, crop monitoring 90.1%, and emergency cases 63.6%. Roughly more than 80% of reports were presented to the direct manager. Only one quarter of the ES were unsatisfied with the administrative reactions for the problems mentioned in the reports.

Table 14 Reports of extension activities, crop monitoring and emergency cases (n=22).

Item	Characteristics	Freq	%
Reports concerning the extension activities		19	86.4
Time interval	Every week	5	26.0
	Every month	4	21
	Every season	1	5.2
	After every activity	9	47.0
Reports concerning crop monitoring		20	90.1
Time interval	Every week	6	30.0
	Every month	8	40.0
	Every season	2	10.0
	After every activity	4	20.0
Reports concerning emergency cases		14	63.6
Cases of emergency problems	Low germination rate	7	50.0
	Irrigation problems	2	14.0
	Sever insect infections	3	21.0
	Growers left the crop on the road	2	14.0
	Reducing the seeds from 4 to 3.5 kg	2	14.0
To whom reports are presented?	Direct manager	18	82.0
	Subject matter specialist	3	14.0
	Researcher	1	4.0
Satisfaction of reaction	Unsatisfied	5	23.0
	Neutral	13	59.0
	Satisfied	4	18.0

Second: content analysis of the reports shows that reports almost had the same form, i.e., participant list, topics, technical problems, and recommendations (Table 15).

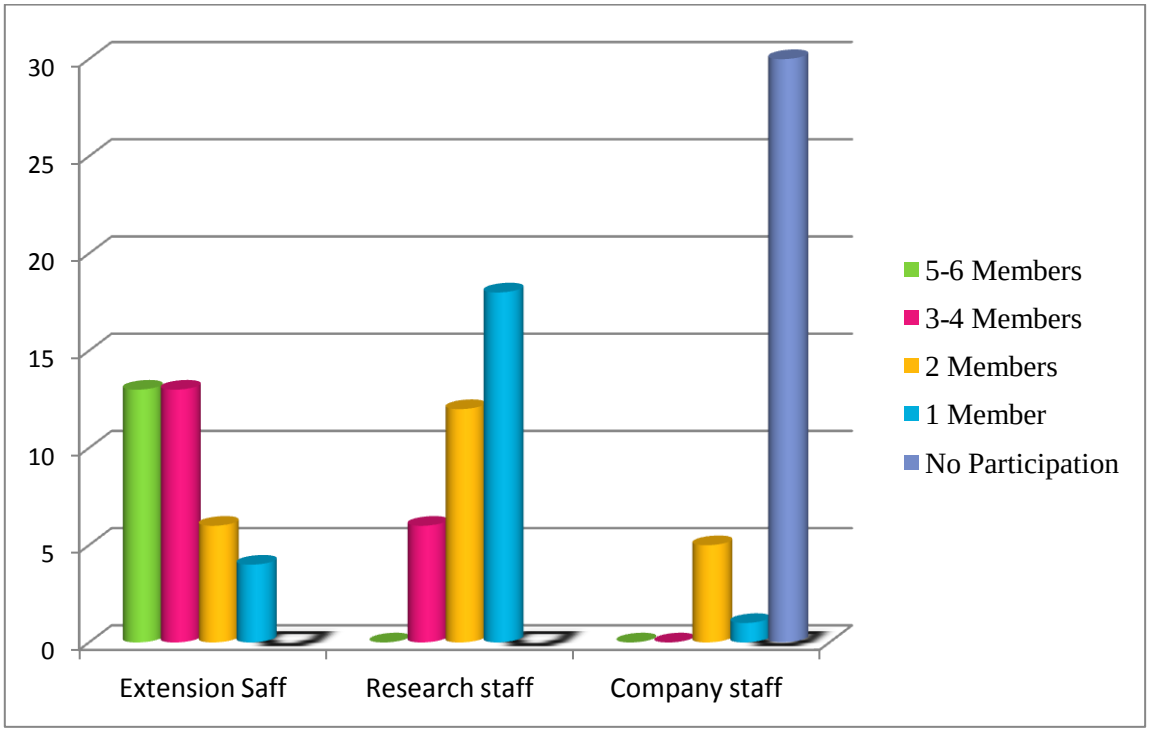
Concerning topics, the most repeated topics are irrigation control 61.1%, fertilization 44.4%, and preparing the seed bed 36.1%. Regarding technical problems, more than sixty percent of the reports stated previous problems, which means the same problems as mentioned before, which are high costs and low efficiency of inputs. Both problems are beyond the extension capability and required community interventions. Nevertheless, researchers recommended alternative fertilizers as a way to relieve the economic burden of SBGs, as well as the use of machines and herbicides to overcome the lack of farm labor, while, farm labor was proposed to avoid herbicides' low efficiency.

Table 15 Topics, problems and recommendations of 36 reports.

No.	Activities	Freq	%
The agricultural processes (topics)			
1	Irrigation control particularly before the harvest	22	61.1
2	Fertilization	16	44.4
3	Preparing the seed bed (tillage, leveling, and plant density))	13	36.1
4	Ripening symptoms, harvest and post harvest	11	30.5
5	Hoeing and weed control	10	27.8
6	Early detection of infections	6	16.7
7	Cercospora symptoms and treatment	6	16.7
8	Slippers and patching	6	16.7
9	Time table of the agricultural processes	5	13.9
10	Characteristics of convenient soil for beet planting	4	11.1
11	Discussing the problems with the factory	4	11.1
12	Warning of leaf removal for feeding the farm animal	1	2.8
13	Beet profitability compared to the other crops	1	2.8
Problems			
1	The previous problems	22	61.1
2	High costs of fertilizers	14	38.9
3	High costs of farm labor	11	30.6
4	Low efficiency of both pesticides and herbicides	3	8.3
Recommendations			
1	The previous recommendations	22	61.1
2	Using alternative fertilizers (foliar fertilizers, compost)	14	38.9
3	Using machines to overcome the high costs of farm labor	6	16.7
4	Using herbicides to overcome the lack of farm labor	7	19.4
5	Deliver the problems to a higher administrative level	3	8.3
6	Using farm labor to avoid herbicides' low efficiency	1	2.8

Regarding the participant list, as shown in (Figure 5), twenty-six of the thirty-six reports indicated that more than three persons of the ES participated in the extension activities, while 30 reports referred to no participation from company staff at all. However, the results pointed to a moderate, even contribution from the research staff range (1–2) persons in most of the activities.

Figure 5 Numbers of participants of partners in the extension activities.



3.8 Extension staff training courses during the last two years

In-service training is very important for refreshing ES's knowledge and to keep them up to date. Moreover, it can be a channel for feedback on the problems facing ES in the field. Of the 22 ES in the study, fifteen received training courses during the last two years (Table 16). The findings show that the number of training days ranged from 1 to 12 days. All 15 ES view the training timeliness as either convenient or fairly convenient for the implementation of the agricultural processes. Regarding other characteristics, 80.0% indicated receiving bad hospitality. Two-thirds of the ES pointed to insufficient exercise and 60% cited a fair degree of using methods and aids during the training course. Finally, 46.6% indicated a fair degree of utility of the educational content, while 40.0% recorded a high degree of utility.

Table 16 Characteristics of the training courses from extension staff's point of view(n=15).

Item	Characteristics	Freq.	%
Course title	Sugar beet agricultural processes	7	46.6
	Sugar beet diseases	4	26.6
	Improving sugar beet production	3	20.0
	Subject matter specialist course	5	33.3
Training time long	≤ 5 days	8	53.3
	5 – 8 days	5	33.3
	9 – 12 days	2	13.3
Innovations or new skills	Nematodes control through crop rotation and nutrients	14	93.3
	Pests, early detection and control	11	73.3
	Fertilization time table	9	60.0
	Optimal spacing between plants	8	53.3
	Land leveling	6	40.0
	Sugar beet mechanization	4	26.6
	Extending the foliar nutrients to 120 days	4	26.6
	Post harvest treatments	3	20.0
	New pesticides	3	20.0
Training time	Insufficient	2	13.3
	Fair	10	66.6
	Sufficient	3	20.0
Timeliness within the season	Inconvenient	0	0
	Fair	8	53.3
	Convenient	7	46.6
Hospitality	Bad	12	80.0
	Fair	3	20.0
	Good	0	0
Utilization of the education content	Low	2	13.3
	Fair	7	46.6
	High	6	40.0
Exercises	Insufficient	10	66.6
	Fair	5	33.3
	Sufficient	0	0
Methods and aids	Inappropriate	6	40.0
	Fair	9	60.0
	Appropriate	0	0

The extension staff was asked about their suggestions for improving the training efficiency. Five suggestions were provided in table 17. Three suggestions concerned training content: increase the practical training 45.5%, establish specific courses 31.8%, and update the educational content 22.7%. Two suggestions signified training quantity: increase the amount of training courses 40.9% and increase the training hours 18.2%.

Table 17 The suggestions for improving training courses (n=22).

No.	The suggestions	Freq	%
1	Increase the practical training	10	45.5
2	Increase the amount of training courses	9	40.9
3	Establishing specific courses	7	31.8
4	Update the educational content	5	22.7
5	Increase the training hours	4	18.2

3.9 Effectiveness of sugar beet program based on a path model

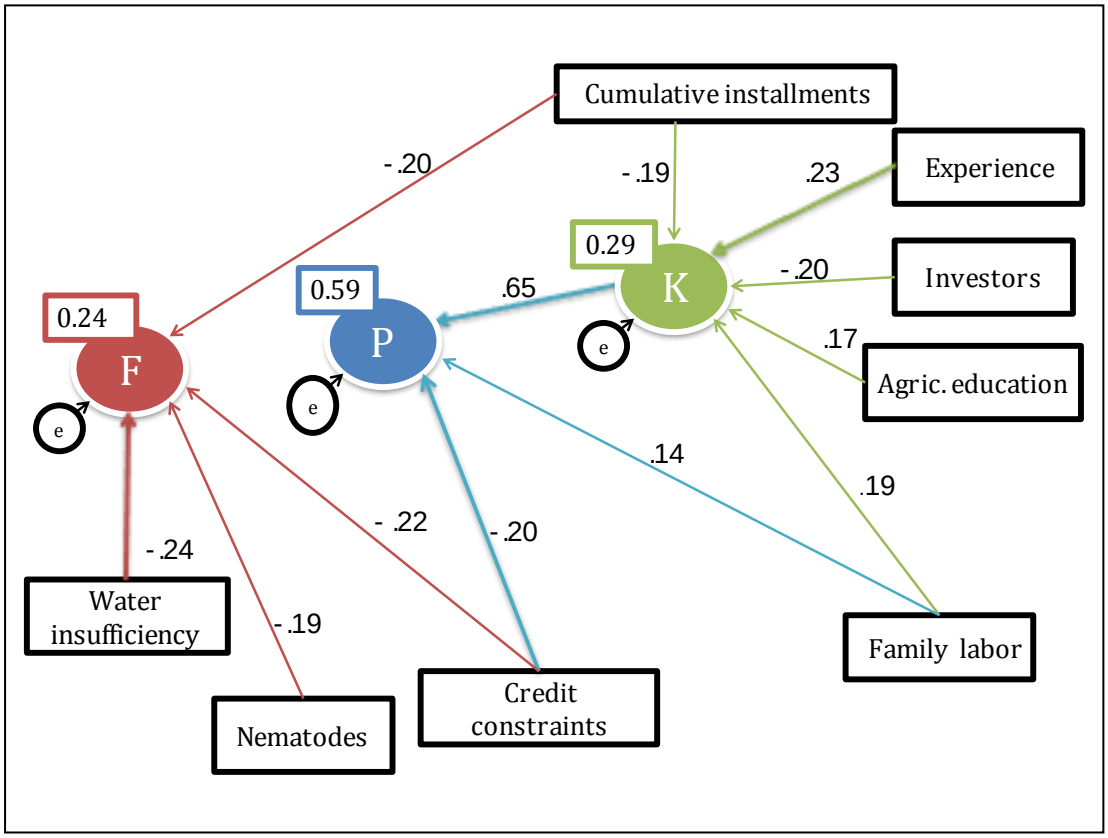
PA was used to identify the program activities' impact on SBGs' knowledge, applications, and profits (Figure 6). The numbers close to the paths are the standardized regression coefficients (Beta) as path coefficients. They indicate the contribution of the exogenous variable to the changes in the endogenous variables whenever the other exogenous variables remain constant. The numbers close to endogenous variables are the adjusted R^2, which represents the proportion of variance explained by the model as follows:

Knowledge: The model explained 29% of the variance of knowledge. Knowledge is predicted to increase by 0.23, 0.19 and 0.17 SDs when experience and family labor contribution goes up by one SD and when the beet grower has an agricultural education, respectively. Knowledge is expected to decrease by 0.19 and 0.20 SDs when the beet grower suffers from a severe problem with cumulative electricity installments and when he is an investor, respectively. Knowledge is predicted to be equal to 47.81 when all exogenous variables are equal to zero.

Applications: the path model indicates that 0.59% of the variance in applications was explained by the model. Applications is predicted to increase by 0.65 and 0.14 SD when knowledge and family labor contribution, respectively, go up by one SD. It is also expected to decrease by 0.20 SD if the subject suffers from severe credit constraints. Applications are predicted to be equal to 15.25 when all exogenous variables are equal to zero.

Profit: path model indicates that 0.24% of the variance in profit was explained by the model. Profit is predicted to decrease by 0.20, 0.22, 0.19 and 0.24 SD if the beet grower suffers from severe problems regarding cumulative electricity installments, credit constraints, nematodes and water insufficiency, respectively. Profit is predicted to be equal to 3312.79 when all exogenous variables are equal to zero.

Figure 6 The path model of the sugar beet program



Only family labor contribution was found to have both direct and indirect effects on applications; the direct coefficient is 0.14 and the indirect effect has two components: first, from family labor contribution to knowledge, second from knowledge to applications. The strength of the indirect effect was calculated by multiplying the two relevant coefficients, 0.19 and 0.65, to give 0.12. The total effect of family labor contribution on applications is given by adding the direct and indirect effects, so in this case it equals 0.14+ 0.12= 0.26. To conclude, the following equations determine the relationships of the proposed model based on the findings of path analysis:

Table 18 The total effect, significance, and residuals.

Model	Adj. R^2	Variables	VIF	St. error (SE)	Beta weights		
					Direct	Indirect	Total
Knowledge	0.29	Cumulative installments	1.11	0.78	-0.19*	0.00	- 0.19
		Experience	1.11	0.20	0.23**	0.00	0.23
		Investors	1.09	1.11	-0.20*	0.00	- 0.20
		Agric. education	1.07	1.06	0.17*	0.00	0.17
		Family labor	1.05	1.26	0.19*	0.00	0.19
N = 117, Constant = 47.81, R^2 = 0.32, Square root (1-R^2) = 0.83, Mean VIF 1.09							
Applications	0.59	Knowledge	1.11	0.05	0.65**	0.00	0.65
		Family labor	1.14	0.12	0.14*	0.12*	0.26
		Credit constraints	1.07	0.54	-0.20**	0.00	0.20
N = 117, Constant = 15.25, R^2 = 0.60, Square root (1-R^2) = 0.63, Mean VIF 1.11							
Profit	0.24	Cumulative installments	1.21	242.00	-0.20*	0.00	- 0.20
		Credit constraints	1.14	323.37	-0.22*	0.00	- 0.25
		Nematodes	1.23	216.66	-0.19*	0.00	- 0.18
		Water insufficiency	1.21	259.38	-0.24**	0.00	- 0.22
N = 117, Constant = 3312.79, R^2 = 0.25, Square root (1-R^2) = 0.88 Mean VIF 1.20							

* Significance at 0.05 level; ** significant at 0.01 level

4 Discussion

Agricultural extension policies should be designed and developed to be consistent with given production patterns, socio-economic and environmental conditions (Swanson, 1989). The application of such fact is more obvious in new lands in order to develop more specific programs for the farming system (Siam & Moussa, 2003). This can be done through M&E process which provides the basis for reviewing and improving public extension. Assessing the effectiveness of the extension programs should recognize the context of farmers and their farming systems. This includes variables related to the external factors particularly agro-ecological conditions and community services such as agriculture extension. Nevertheless, most of evaluation studies use indicators such as adoption rate, yields, and farm income (Misra, 1997; Purcell & Anderson, 1997; Swanson, 1989).

The current study was designed to provide an overview about the extension work in newly reclaimed lands. Its main objective was to explore the current conditions of the extension work in the new lands and the factors affecting it.

4.1 Beet growers' socio economic variables

One hundred seventeen beet growers from Nubaria region were asked about their socio-economic conditions. Findings in table 4 indicate that 58.1% of them were smallholders and 76.1% originally came from rural areas. Furthermore, 40.2% of them were literate and only 14.5% have an agricultural education. Additionally, although 75.2% of them have more than 10 years experience in cultivating new lands, this work experience was based on using traditional farming patterns of old soil production. This circumstances reflected on their agricultural background, i.e. they have been applying the conventional agricultural patterns. This indicates the need for these farmers to receive proper instruction and training in more modern farming systems through the extension programs. Concerning farm areas, 65.8% of the farm areas is less than 5 feddans (2.1 ha), and 88.9% of sugar beet area are less than 5 feddans (2.1 ha). Such conditions impose SBGs to apply labor-based production patterns. Still, 35.9% of beet growers have no contribution from family members in the farm work and they have an urgent demand for agricultural labor.

Sugar beet growers were also asked about their knowledge (on 36 items) and of their applications (on 24 items). All SBGs have a moderate to high degree of knowledge and of applying this knowledge (Table 5). Inconsistent however, with these particular findings, profit showed a remarkable variation, ranging from less than 1000 to as much as 5000 EP.

Such variability could be due to the fact that many factors affect profit in the case of sugar beet in the new lands, i.e. the price of sugar beet being based on the delivery date and of the sugar percentage, as well as the yield which is influenced by the physical circumstances of the new lands (i.e. different levels of soil quality and water scarcity). Half of the SBGs realized profits of is less than 2000 EP (the estimated profit average in Nubaria is 1675 EP (Nubaria Agricultural Adminstaration, 2009), and around three-fourths of beet growers' profits are less than the national average, which is estimated at 3000 EP (Sugar Crops Council, 2009).

4.2 External factors affecting sugar beet production

An open ended question was designed to identify the external factors that affect sugar beet production. Beet growers' responses were divided into two types: problems in the farming sphere and problems in the district sphere (figure 3). The later was divided into three categories: community services, inputs, and company problems.

Nematodes and spreading of weed were the most frequent problems in the farming sphere. These problems result in the use of traditional production patterns in the new lands as previously mentioned.

The availability of community services is one of the most important factors affecting new settler's stability in newly reclaimed lands. (Ghanima & El-Amary, 1997). These services are important to agricultural development. For instance, sufficient and continuous water supply is imperative for economic production in dry areas, particularly on sandy and calcareous soil. Nevertheless, 67% of SBGs suffer from both irregular and insufficient water supplies (table 9). There are two important problems which result in water shortage. First, half of the study sample applies surface irrigation. Second, farmers tended to abuse and damage the irrigation infrastructure to overwater their farms to reduce with the future risk of water shortage (Malashkhia, 2003).

Moreover, close to one-third of SBGs mentioned frequent electricity blackouts and credit constraints. Both services are important since electricity is necessary for water pumping and financial credit help farmers to apply modern irrigation systems.

High costs and lack of farm labor, pesticides, and fertilizers are the main problems of around half of the beet growers. These problems, as well as the lack of access to financial credit prevent farmers from adopting more complex farming methods.

Furthermore, beet growers face many problems with the NSC. It reduced seeds amount from 4.0 to 3.5 kg/feddan. Seeds reduction is a serious problem during the early cultivation, when beet plants are more prone for pest infection. Moreover, NSC increased SBGs financial constraints by the late payment of the beet production.

Farmers also reported they had no access to copies of contracts and complained about the lack of transparency, i.e. the lack of accountability regarding laboratory tests and weights. Both problems draw a clear picture about the current relationship between beet growers and the NSC. For instance, the NSC adjusted the starting date of the delivery season from the 1st of February to the 3rd of March, regardless of beet grower's interests of bonus of early or their plan for the next season (Head of the agricultural extension department personal communication).

To conclude, the circumstances related to external factors are grounded in financial shortage and limitations of opportunities in modernizing production methods. Moreover, there is no significant improvement in the Nubaria region regarding community services, as indicated by the lack of improvement in current results in comparison to the results of previous studies (Abd El-Ghany, 2005; Ghanima & El-Amary, 1997; Zalla & Fawzy, 2000).

4.3 Human and financial resources invested in sugar beet program

Human and financial resources allocated to the extension organization influence its impact on target groups (Swanson, 1989). Yet, no data was available regarding the financial resources invested in the program. Regarding human resources, all 22 of Nubaria extension staff were asked about their socio-economic conditions and job characteristics. In order to, draw a conclusion about the human and financial resources invested in the SBP and link it to the program's outcomes. The findings (Table 11) show that half of ES are 50 years old or more, which could be due to being hired at later age or being transformed from other jobs into the extension administration. Equally important, statistics of their educational background show that 72.7% of them have only a school education and 20 % of them have a non-agricultural education. Above mentioned results refer to the poor general education of ES.

Regarding in-service training, 15 out of 22 received training during the last two years (Table 16). The training days ranged from 1 to 12 days. Half of the ES have even less than 4

training days. The training was conducted at convenient times during the season and provided useful theoretical information; however it did not provide sufficient practical experience.

Concerning the jurisdiction area, the ES responses were divided into four uneven categories in order to deal with the wide range of ES responses (Table 11). Generally speaking in Egypt, the coverage area is not set by number of agents working with farmers, but rather, they designated to a specific area of a certain crop (The Agricultural Extension and Rural Development Reseach Institute, 1998). Furthermore, there are no formal rules regarding the distribution of ES amongst villages in Nubaria. As a result, only 22 ES must cover one million feddans (420,000 ha) with an average of around 50.000 feddans (21.000 ha) per ES. Hence, there are very few villages which have Village Extension Workers (VEW): the findings in table 11 indicate ten of ES have a jurisdiction area of less than 1000 feddans (420 ha) with a total area of 10.000 feddans (4.200 ha) which represents only 1% of the total area of Nubaria. While remained 99% of the total area have no VEW.

More importantly, the NAA doesn't provide them with proper transportation (Head of the agricultural extension department personal communication).

Audio-visual aids are essential in the extension work in order to demonstrate new applications of the agricultural methods. The findings (Table 12) indicated very poor usage of educational aids which provided by other organizations i.e. NSC and YGP, while no aids were provided by the extension organization at all.

About 90% of the ES feel their salary is insufficient and 50% of them have second job to improve their income. Furthermore, the wide jurisdiction area as well as the lack of transportation cost them both time and money. Such findings indicate the difficulty of doing their jobs properly. Nonetheless, most of them have a fair degree of satisfaction with the extension work itself. Such contradictions could be due to the fact that they perceive their jobs on a part-time basis. In reality extension work offers health insurance and pension plan, on the other hand, additional sources of income are necessary.

The mentioned above findings indicate the lack of standardization in the extension work. Since, the coverage rate assumed to be estimated by the ratio of extension personal to farmers, the outreach ratio, or the time allocated to extension activities (Swanson, 1989) Moreover, it indicates that poor pay and lack of well-trained staff are main problems (Rivera, Elshfie, & Aboul-Seoud, 1997). Furthermore, it raises the question about their understanding of the importance of the agricultural extension. This study seems to indicate that extension work is more bureaucracy than practical work which would bring real results.

4.4 Shortcomings and suggestions

Beet growers were asked about what exactly was hindering them from benefiting from extension activities and what suggestions they had to overcome it (Table 7). Regarding the amount of the extension activities, the beet grower not only referred to the lack of the extension activities, but also indicated its irrational distribution. In regard to its educational content, one-third of the growers mentioned both the absence of practical aspects and that the general theoretical information did not provide practical solutions to their individual problems. This is most likely due to the lack of the practical component as well as the poor usage of audio-visual aids, as mentioned above.

Concerning ES, SBGs mentioned absence of VEW as a quantitative indicator, and lack of qualified extension personal as qualitative one, with a proportion of 38.5% and 22.2% respectively. Besides the mentioned shortcomings, there are two organizational problems: insufficient advertisements and most of the extension activities are provided during the working hours. Both problems limit the outreach ratio of the extension activities.

Regarding the M&E process, the responses refer to: the absence of the accountability of the extension personnel 11.1%, and the lack of monitoring (follow up) 9.4%. These low proportions could be due to the scarcity of the extension activities itself.

To conclude, this study determined that 65.8% of beet growers have negative attitudes towards agricultural extension (table 4). This result as well as the shortcomings mentioned above lead to the fact that many farmers don't consider public extension as the best source of information (Abd El-Ghany, 2005).

Regarding SBGs' suggestions to solve the shortcomings of the public extension (Table 7), the findings show three suggestions concerning the intensification of the extension activities: providing field supervision, providing more systematic extension activities, and intensifying the extension activities, with proportion of 53.8, 38.5, and 30.8% respectively. Two suggestions were related to the organizational issues: better advertising and choosing suitable time for farm work.

Relevant to the external factors, beet growers have three suggestions: the collaboration between extension and irrigation administration, offering financial resources, and supplies with subsidized inputs. Such suggestions do not only indicate the growers' concerns about the physical and financial aspects, but also demonstrate high expectations from the extension organization. It also indicates the absence of farmer associations who can speak for them.

4.5 Report writing

The pilot study confirmed how essential the writing of reports is as an administrative duty. At the moment, public extensions do not include self-monitoring or evaluation instruments. The current study dealt with the writing of reports in two ways: firstly, as an indicator of the proportion of the administrative work and secondly, using the content analysis of the reports as a self monitoring tool (36 reports in all).

The findings in (Figure 5) show that most of the ES are involved in writing reports on a regular basis, with three types of reports: extension activities 86.4%, monitoring of crops 90.1%, and emergency reports 63.6%.

The reports included information regarding participants, topics, problems, and recommendation. The research staff participants ranged from 1 to 2 researchers per activity. Contribution from company staff seemed to be absent. In the meantime, extension staff participation ranged from 3 to 6 persons in 26 of the 36 reports, despite the limited number of extension staff (22 people). Such results reflect an unrealistic contribution, as the ES tend to appear by name in these reports in order to obtain rewards or to avoid other duties. Regarding problems and recommendations, close to two-third of the reports mentioned both the previously mentioned problems and recommendations. This indicates a continuation of the problem, and that an intervention is required at the national level in order to improve the physical and financial circumstances on new lands.

4.6 Effectiveness of sugar beet program based on path model

To identify the degree of effectiveness of the sugar beet program, ELM was used to provide a clear understanding of the causal relationship between program's inputs, outputs, and outcomes (Figure 4). It also regarded the impact of the external factors and the model assumption (Beet growers' socio economic variables influence beet program outcomes). Path analysis was used to explore the causal relationship between the participation in SBPs' activities and beet growers' behavioral changes: knowledge, applications, and profit.

The path diagram includes eight endogenous and three exogenous variables (Figure 6). Experience, investors, agricultural education, family labor, and electricity cumulative installments explain 29% of the variance of knowledge. Experience has a significant impact on SBGs' knowledge at 0.01 level, while no significant impact can be verified for origin (rural or urban) on SBGs' knowledge. This result highlights the specific knowledge required to farm on new lands. Other variables such as age, farm size, and attitude towards extension

etc. have no significant impact on any of the beet program outcomes (knowledge, applications, and profits).

Considering SBGs as investors had negative significant impact on knowledge at 0.05 level, which indicates the notable knowledge gap in this category. Moreover, there is no regular extension programs specifically designed for investors. Investors are mostly covered by the private extension (The Agricultural Extension and Rural Development Reseach Institute, 1998).

Contribution of family members to farm work allows beet growers the time to gain more knowledge and adopt other farming methods. Consequently, a positive significant relationship can be verified between family labor and both beet growers' knowledge and applications at 0.05 level.

A negative significant relationship can be verified between electricity cumulative installments and both beet growers' knowledge and profit at 0.05 level. That is, electricity cumulative installments are mostly due to financial deficit.

However, no significant impact can be verified of experience, education, and category type on their applications. The model also indicated negative significant impact of credit constraints on both beet growers' applications and profit at 0.01 and 0.05, respectively.

Likewise, the findings show that the physical conditions have a negative significant impact on profit; at 0.05 level for the severe degree of the infection of nematodes and 0.01 level for severe degree of water insufficiency.

Most of the findings of this study confirm our expectations. Yet, no significant impact can be verified for applications on profit. There are three possible explanations for this result: first, the influence of the applications is intangible in comparing with the environmental conditions and the shortcomings of community services effects in new lands. Second, some farms are still underdeveloped, so farmers tend to add plenty of manure to improve the chemical and structural characteristics of the soil in the long run. Accordingly, marginal costs increase with the decrease in the net income. Third, profit is counted not only based on the yield, but also based on sugar percentage and the early delivery. So that, some beet growers tend to rational their applications particularly the costly ones, and focus their applications on increasing sugar percentage and adopting early production.

Similarly, the findings show that the water insufficiency contribution in interpreting the variances of profit which was less than expected 24%, particularly in the arid area. This result could be due to the fact that beet prices are largely dependent on its sugar percentage

and the delivery date. Cconsequently, beet growers tend to maximize the price to compensate for low productivity, as well as to diminish the impact of water insufficiency on the net profit.

Finally, no significant impact can be verified of the participation in the extension activities on beet growers' knowledge, applications, and profit. Socio-economic variables explain the variance in knowledge, while economic variables explain variance in the applications. Also, both economic variables and physical conditions explain the variations in profit**.**

4.7 Study limitations

Lack of accessibility and availability of data were the main limitations of this study. Hence, it was hard to draw conclusion about the financial resources invested in SBP due to lack of access to financial data at both national and regional levels. Additionally, the first sample design for this study was to select two villages according to the applications of SBP's activities. One applies regular extension activities (not demonstration plot) as an experimental village and the other doesn't receive any extension activities of SBP as a control village. Consequently, acquiring the relevant data was the biggest limitation to apply this design, i.e. no data were available about sugar beets' area and growers' number at the village level. Furthermore the study dealt with three sources of information for sample design: NSC, YGP, and NAA. Every source has its unique criteria of administrative classification and villages´ names (NAA give numerical identification e.g. the first, the second, etc., and YGP give names, e.g. Belal, Al-Huda. Furthermore, NSC has divided the whole region into four aggregates of villages instead of six administrations). So, it became difficult to follow or integrate all data resources. Accordingly, the sample design was adjusted to select the demonstration plot village Al-Huda and one of the villages that apply regular extension activities based on personal information from the SMS of sugar beet of Nubaria during data collection process. These data were confirmed by agricultural administration of NSC through personal communication. The research design was adjusted also from receiving (experimental village) or non-receiving (control village) of SBP´s activities to the degree of receiving the extension activities: one activity, two activities, three activities, and more than three activities. Experimental design provides an accurate causal inference on program results. Yet, in practice it was hard to meet the experimental design's conditions of equivalent villages and control of the environmental factors on program outcomes. Intervention program is almost operating in open system together with multiple players to bring about favourable changes in target categories. Accordingly, quasi-experimental designs could be used such as pre-post

assessment, time series, ex-post facto designs, and multiple levels of the same treatment (Treasury Board of Canada, 1998). These designs rely only on experimental group without control one. The results of the experimental treatment is usually compared with a pre assessment of the experimental treatment against some standard base or computed from recognized population data, model or theory (Kish, 2004) Multiple levels of treatment estimates the impact of the intervention treatment by comparing the average outcomes with the level of treatment, considering that every level represents a distinct group (Gertler, Martinez, Premand, Rawlings, & Vermeersch, 2011; World Bank, IFC Advisory Services, GTZ, & DFID, 2008).

5 Conclusions and Recommendations

New settlers in the newly reclaimed land in Egypt face many challenges, e.g. poor soil, water scarcity, lack of community services, and either lack of agricultural background or a background that is based on production patterns in the old lands. Agricultural extension applies many programs to provide new settlers with an appropriate knowledge for new lands. Nonetheless, most previous studies found these programs are inefficient. This study aimed at exploring work conditions of public extension in new lands and its degree of effectiveness. An ex-post assessment was designed to explore the effectiveness of sugar beet program in Nubaria region as a case study of the extension programs in the desert areas. Two groups of respondents: sugar beet growers and extension staff were covered in this study. Three analytical methods were applied, firstly: content analysis of a number of 36 reports covering the extension activities. Secondly: an evaluation logic model to visualize the logical relationships among program resources, activities (outputs), and outcomes. Thirdly: path analysis to explore causality between the growers' participation in Sugar beet program activities and changes in their knowledge, applications, and profit.

The main findings of this study indicate that the extension personnel were generally inadequate, not very qualified, and poorly equipped. Only 22 extension personnel cover one million feddan (420.000 ha). Half of the extension personnel are about 50 years old, yet nearly half of them have less than 10 years experience. Moreover, only one-quarter of them have a university degree.

Regarding the effectiveness of Sugar beet program, the findings reveal that SBP has limited outreach. Path analysis of the program, according evaluation logic model, explains 29%, 59%, and 24% of variance of knowledge, applications, and profit, respectively. Furthermore, no significant impact could be found concerning SBGs´ participation in the program activities on their knowledge, applications, and profit. The results also show that socio-economic variables of SBGs explain the variability of their knowledge and application, while, both economic and physical variables explain the variability of their profits. Applications have no significant impact on profit.

To sum up, the impact of SBP on SBGs in newly reclaimed lands is influenced not only by its poor performance but also by environmental factors and availability of community services, in addition to SBGs` socio-economic conditions.

Consequently, improving public extension should go hand in hand with integrating new actors, e.g. non-governmental organizations, farmers' associations, and private sector to

transform extension services towards more pluralistic services based on accountability, transparency, decentralization and subsidiary. Additionally, involving different organizations with different interests would increase services provided to new settlers and enable public extension to apply collective action plans.

Moreover, the results of this study suggest the following recommendations:

- Budget allocation to extension organization should be increased. Extension staff should be motivated through better pay. They should also be provided with necessary means of transportation and audio-visual aids.
- Recruitment policy and in-service training should be adjusted to ensure competent and highly qualified persons with relevant university degrees.
- Farmers' participation in the programs' planning process should be encouraged and increased. Support should be provided to SBGs to establish farmer associations and NGOs through which contractual high quality extension services could be provided.
- Finally, regular training programs should provided to investors to enhance their knowledge and skills in the areas of the best fitting practices in the new lands.

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Appendices