Sudan University of Science and Technology

Collage of Graduate Studies

Economic Efficiency Analysis. A Case Study of Crops Production in the Rahad Agricultural Corporation

تحليل الكفاءة الإقتصادية. دراسة حالة: إنتاج المحاصيل فى مؤسسة الرهد الزراعية

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To my Lovely Mother and my Father

To my wife

To my brothers and sisters

To my relatives

To my friends

With best love

Khalid

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ABBREVIATIONS

AE : Allocative Efficiency

AOAD**:** Arab Organization for Agricultural Development

CE: Cost Efficiency

CD: Cobb-Douglas

CM: Cubic Meter

EE: Economic Efficiency

.FAO: Food and Agriculture Organization

(Fed.: Feddan(0.42 ha

FL :Family Labour

GDP: Gross Domestic Product

GN: Groundnuts

Hl :Hired Labour

IAS: Individual Account System

IFAD: International Fund for Agricultural Development

Kg :Kilogram

LP: Linear Programming

MOAF: Ministry of Agriculture and Forestry.

Md:Mandays

MFNE: Ministry of Finance and National Economy.

MVP: Marginal Value of product

OLS: Ordinary Least Squares.

PPF: Production Possibilities Frontier

RAC: Rahad agricultural cooperation

RARC: Rahad Agricultural Research Corporation.

RHS: Right Hand Side

SDG :Sudanese pound

SFA: Stochastic Frontier Analysis

SPF: Stochastic Production Function

SFPF: Stochastic Frontier Production Function

TE: Technical Efficiency

TL :Total Labour

UN: United Nations

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ABSTRACT

ECONOMIC EFFICIENCY ANALYSIS (CASE STUDY: CROPS PRODUCTION IN THE RAHAD AGRICULTURAL CORPORATION)

This study was carried out in The Rahad Agricultural Scheme. The main objectives of the study are to measure technical efficiency of produced crops, to determine the main factors that caused technical inefficiency, to assess the maximum farm's income level under optimum cropping patterns and to identify the socio-economic factors that affected the level of efficiency of farmers. The study shed light on the factors that constraint agricultural production as well as yield efficiency in Rahad agricultural scheme. Production and yield have deteriorated and the income of tenants has consequently declined. Moreover the scheme was suffered from its own deficiency of adopting a proper cropping patterns. As a consequence, average yield of the main crops in the scheme since 19977-1978 were decrescent. The study mainly depended on Primary data which were collected from a survey conducted in season 2006/2007, through a multi-stage stratified random sampling technique using structural questionnaire after pre-testing. The study also used secondary data collected from the relevant institutional sources. Descriptive statistics, stochastic production frontier model of the Cobb-Douglas form, gross margins and linear programming were emploed to analyze the collected data. The results of descriptive statistics showed that: 32 % of the tenants interviewed were in the active age group (20-50). Most of tenants were

married, had formal education. The average of tenant's family size was 9 persons. 36% of the

sample tenants were engaged in such off- farm activities.. The majority of the farmers depend on traditional implements.

Groundnuts, dura and cotton crop each of them had two peaks period of Labour requirements. Cotton had high cost followed by groundnuts. Sunflower had a higher gross margin followed by groundnuts.

Most of the estimated β co-efficient of the SPF model for crops production had the expected signs, and significant. The mean technical efficiency was 70%, 79%, 76% and 71% for groundnuts, dura, cotton and sunflower, respectively. Accordingly there was a scope for increasing crops production in that order, by 30%, 21%, 24% and 29%. The variance ratio parameters γ was large and significant and has a value of 0.99, 0.99, 0.97 and 0.99 forgroundnuts, dura, cotton, and sunflower. Tenancy location, off-farm income, farm income, sowing date, labour number, irrigation number and weeding number,were significant variable for improving technical efficiency. age group, sex, education level, family size and extension contact were significant in explaining technical inefficiency in RAC.

The LP results cleared that the real cropping plan was different from the basic model cropping pattern, most of the land was allocated to groundnuts (9.66 feddans), followed by sunflower(9.61 feddans), while dura and cotton were entered in the optimal plan with small areas 1.22 , and 1.5 feddans respectively. In the real situation, the crops occupied 5.5 feddan for each . The optimal net farms was (SDG 5799.01) exceeded the actual net farms (SDG 4544.16) by 27.61% .

Many scenarios were tried by developing the parameters of the free LP model to reflect a range of production options. The scenarios reflected the effects of productivities, Restricting production area, prices, cost of inputs, more participation of family labour in cotton picking, using machines and improving technology.

The study recommended to improve technical efficiency for crops production in the RAC, The main recommendations was concentrated and oriented to sowing date, peak demands for labour, more participation of the family labour, problem of irrigation, extension education, and expanding in promising crops .

خلاصة الأطروحة

تحليل الكفاءة الإقتصادية. دراسة حالة: إنتاج المحاصيل فى مؤسسة الرهد الزراعية

أجريت هذه الدراسة فى مؤسسة الرهد الزراعيـة. وكـان الهـدف الأساسـي من هذه الدراسة قياس كفـاءة الإنتاجيـة للمحاصـيل ، تحديـد العوامـل الـتي تسبب عدم الكفاءة التقنية،تحديد أعلى مستوى دخل مزرعى فى ظل توليفة محصـولية مثلـى ومعرفـة العوامـل الاقتصـادية والاجتماعيـة الـتي تـؤثر علـي مستوي الكفاءة الفنية الانتاجيه للمزارعين .الدراسة ألقت الضـوء علـي أهـم معوقات الإنتاج و الإنتاجية فى مشروع الرهد الزراعـى. لقـد تـدهورت كفـاءة الإنتاج و الإنتاجية فى المشروع و تناقص تبعـاً لـذلك دخـل المزراعيـن. فضـلاً عن ذلك فإن المشروع يعانى من قصوره فى تبنى تركيبـة محصـولية مثلـى. تبعـاً لـذلك كـانت انتاجيـة المحاصـيل متناقصـة مـن موسـم 1977/1978. اعتمدت الدراسة بصورة أساسية علـي البيانـات الأوليـة و الـتى جمعـت مـن

المسح الميـدانى فـى مشـروع الرهـد الزراعـى للموسـم 2006/2007 عـن طريـق عينـة عشـوائية طبقيـة متعـددة المراحـل بواسـطة إسـتبيان مصـمم للدراسة و ذلك بعـد تجريبـه ، كمـا اسـتخدمت الدراسـة المعلومـات الثانويـة والتي جمعت من المصادر ذات الصلة .

التحليل الإحصائى الوصفى,دالة الإنتاج المجالى العشوائى (بشكل دالـة إنتـاج كوب ـ دوغلاس), تحليل هامش الربح و تحليـل البرمجـة الخطيـة, أسـتخدمت هذه الطرق المختلفة لتحليل بيانات الدراسة .

أظهرت نتائج التحليل الإحصائى الوصفى أن 32 % من عينة المزارعين تقـع فى المدى العمرى النشط 20- 50. معظم المزارعين متزوجين و تلقو تعليم رسمى منتظم وتتراوح خبرتهم فى الزراعة ما بين أكثر من 20 و أقل من 30 سـنة. متوسـط حجـم الأسـرة 9 أفـراد. 36 % مـن العينـة ينخرطـون فـى نشاطات غير مزرعية بعد الموسم, غالبية المزارعيـن يعتمـدون علـى أدوات بدائية فى الزراعة.

يصل الطلب على العمالة الى الذروة مرتين فى الموسم لكـل مـن محصـول الفو ل السودانى, الذرة و القطن.

كشـف تحليـل هـامش الربـح أن محصـول القطـن كـان الأعلـى تكلفـة يليـه محصول الفو ل السودانى, و أن محصـول زهـرة الشـمس أحرزأعلـى ربحيـة يليه محصول الفو ل السودانى.

أوضح تحليل دالة الإنتاج المجـالى العشـوائى أن معظـم عوامـل الإنتـاج الـتي تؤثر علي الكفاءة الفنية ذات تأثير معنوي . وتؤثر ايجابيـاً علـي إنتـاج الفـول السودانى، الذرة، القطـن و زهـرة الشـمس . وان متوسـط الكفـاءة الفنيـة الذى حصـل عليـه المزارعـون 70%ـ 79 %ـ 76 % و 71 % لكـل مـن محصــول الفــو ل الســودانى، الــذرة ، القطــن و زهــرة الشــمس علــى التوالى.وفقا لذلك هنالك مجال لزيادة إنتاج المحاصيل بنسبة 30%، 21 %،

24 % و 29 % للمحاصيل بذلك الترتيب. قيمة المعامل لندا كبيرة و معنوية و وصلت الى 0.99 ،0.99 ،ـ 0.97 و0.99 لكل من محصول الفو ل السودانى، الذرة ، القطن و زهرة الشمس على التوالى.

موقع الحواشة من قناة الرى، الدخل المزرعى، الدخل غير المزرعى، تاريخ الزراعة، عدد العمال، عدد الريات، و عدد الحشات تمثل العوامل المعنوية بمستويات مختلفة لتحسين الكفاءة الإنتاجية الفنية.

الخصائص الاجتماعية للمزارعين ممثلة في(الفئات العمرية، الجنس، المستوى التعليمى، حجم الأسرة) و الخدمات الإرشادية كانت عوامل ذات اثر معنوي في تفسير عدم الكفاءة الفنية فى المشروع بمستويات مختلفة.

أظهرت نتائج البرمجة الخطية أن التركيبة المحصولية تختلف فى الخطة الفعلية عن تلك المتحصل عليها فى النموذج الحر أو الأساسى و هي أن معظم الأرض مخصصة للفول السودانى 9.66 فدان و زهرة الشمس 9.61 فدان، بينما الذرة والقطن فدخلتا فى النموذج بمساحة 1.22 فدان و 1.5 فدان بذلك الترتيب. صافى دخل المزرعة الأمثل (5799.01) يفوق صافى دخل المزرعة فى الواقع (4544.16) بنسبة 27.61 %.

أجريت عدد من السيناريوهات بتغيير معاملات النموذج الحرللبرمجة الخطية لعكس مدي خيارات الإنتاج . السيناريوهات عكست تأثيرات الإنتاجية، وتقييد المساحة المزروعة بما يكفى الإستهلاك فى الذرة، الأسعار، وتكاليف المدخلات، و مزيد من مشاركة العمالة الأسرية فى لقيط القطن و إستخدام الا˜ليات و التقانات المحسنة .

أخيرا أوصت الدراسة بتحسين الكفاءة الفنية الإنتاجية بمنطقة الدراسة.
التوصيات الأساسية وجهت نحو تاريخ الزراعة و ذروة الطلب على العمالة والمزيدمن مشاركة العمالة الأسرية و مشاكل الرى و الاهتمام بالتعليم الإرشادى و التوسع فى زراعة الحاصيل الواعدة.