

## APPLICATION OF ISLAMIC MODES FOR MICROFINANCE IN SUDAN: A CASE STUDY OF RAHAD SCHEME

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### Abstract

Microfinance has become one of the most important mechanisms to fight poverty and economic development in the world. Sudan like other developing countries is depending on microfinance to achieve poverty alleviation and economic development. The Central Bank of Sudan has adopted microfinance programs since it is one of the appropriate mechanisms that help banks to perform their social and economic role. The idea of solidarity groups (SGs) started in Bangladesh as a solution of the warranty problem that cannot be secured by small farmers. In Sudan solidarity groups are primarily introduced by the Agricultural Bank of Sudan (Fau branch) to help small farmers in the Rahad agricultural scheme who lack the sufficient guarantee to acquire loans needed to fulfill their agricultural production obligations. The aim of this paper has two folds, first to outline microfinance environment and policies of Sudan under Islamic modes, second to synthesize empirical study on the case of Rahad scheme as an example for microfinance with Islamic modes to identify socioeconomic factors affecting farmer's decision to join solidarity groups. The study used secondary data to review the general environment of finance through Islamic forms in Sudan, for the case under study, a primary data were collected using structured questionnaire, a sample of 120 farmers (60 farmers joined solidarity group and 60 of self-financed farmers) were selected randomly from the scheme. A binary logistic regression model (*Logit*) was used to estimate the correlation between the dependent variable of joining of the solidarity groups, and independent variables namely, educational level, farm location, machinery possession, marital status, land ownership, animal's ownership, risk exposure and financial ability. A paired samples (T) test used to examine and estimate the difference between two paired samples means of costs and returns. The reviewed policies of Islamic microfinance modes in Sudan showed a positive environment for credit including devoting 12 percent of the total investment portfolio of each bank to microfinance credit, in addition to introducing guarantee services via the insurance companies, and suitable repayment period with low interest. The empirical results of the *Logit* regression showed that four variables were statistically significant in affecting the farmers' decision of joining SGs namely are educational level, machinery ownership, financial ability and the type of land tenure. While the factors of farm location, risk exposure, and animal ownership are not significant. The paired samples (T) test used to examine and estimate the difference between two paired samples means (solidarity group and self-financed), the results showed that there are no significant differences between the means of cost and returns for the two groups, which indicate that the bank finance has no financial burden on the SGs farmers. The study recommends generalization of the solidarity group's finance in the irrigated sector of the Sudan.

**Keywords:** Islamic Finance, Solidarity Groups, Rahad Scheme, Sudan

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## تطبيق صيغ التمويل الإسلامية على التمويل الأصغر دراسة حالة لمشروع الرهد ملخص

أصبح التمويل الأصغر من أهم الآليات لمكافحة الفقر في العالم والسودان كأحد الدول النامية يعتمد على التمويل الأصغر في مكافحة الفقر وتحقيق التنمية الاقتصادية. تبنى البنك المركزي السوداني (بنك السودان) برامج التمويل الأصغر كأحد الآليات الملائمة والتي تساعد البنوك في لعب دورها الاجتماعي والاقتصادي. أن تجربة مجموعات التمويل المتضامنة بدأت في بنغلاديش كأحد الحلول لمشكلة الضمانات التي لا يستطيع صغار المزارعين توفيرها عادة. في السودان تم استحداث هذه التجربة بواسطة البنك الزراعي فرع الفاو للمساعدة المزارعين بالمشروع باعتماد صيغ التمويل الإسلامي. لهذه الورقة هدفان، الهدف الأول محاولة استعراض بيئة وسياسات التمويل الأصغر تحت ظل التمويل الإسلامي في السودان، الهدف الثاني محاولة استقصاء العوامل المؤثرة على المزارعين في اتخاذ قراراتهم للانضمام الى مجموعات التمويل المتضامن لمشروع الرهد الزراعي. تستخدم هذه الدراسة أولاً بيانات ثانوية لدراسة بيئة التمويل والسياسات المتبعة فإدارة التمويل الإسلامي في السودان كما تستخدم بيانات أولية لعينة من 120 مزارع (60 مزارع من المجموعات المتضامنة و 60 مزارع تمويل ذاتي) تم اختيارهم عشوائياً من المشروع. تم استخدام نموذج الانحدار المنطقي Logistic Regression Model لدراسة العوامل المؤثرة على اتخاذ المزارعين قرار الانضمام للمجموعات المتضامنة، كما تم استخدام اختبار (T) لدراسة الفروق المعنوية بين المتغيرات. أظهرت النتائج الاستقصاء أن التمويل الأصغر عن طريق التمويل الإسلامي يعمل في بيئة مشجعه عموماً حيث يتم تخصيص 12% من إجمالي محفظة التمويل من جملة تمويل البنوك. كما يتم التمويل بهوامش منخفضة وفي فترة سداد ميسره. أوضحت نتائج نموذج الانحدار ان هناك أربع عوامل تؤثر على قرارات المزارعين للانضمام في المجموعات المتضامنة، أهمها مستوى التعليم، امتلاك الآلات والمقدرة المالية بالإضافة إلى نوع حيازة الارض. كما أوضحت اختبارات المعنوية عدم وجود فروقات معنوية بين متوسطات التكاليف والفوائد بين المجموعات المتضامنة والمزارعين العاديين مما يوضح حقيقة أن التمويل عن طريق المجموعات لا يؤثر سلباً على المزارعين. توصى الدراسة بتعميم تجربة التمويل عن طريق المجموعات المتضامنة حيث تتوفر العوامل التي تؤدي الى نجاح هذه التجربة في معظم المناطق الزراعية وخاصة المشاريع المروية.

## 1. Background:

Islamic banking system started at the early 1990s in Sudan. The system was totally based on Islamic Sharia which abandons the interest rate principle in money transactions of the standard banking system and has defined the interest rate as Riba<sup>1</sup>. The first Islamic bank began operations in 1978. As from 1990 onward, the entire financial system of Sudan has been planned to follow the Islamic principles of finance. After the full adoption of Islamic banking principles and easing of bank branches licensing policy in the 1990s, some banks have been merged, however the number of bank branches nearly doubled from their 1990 total of 320, with many of the new branches being established in rural areas. By the year 2014 the number of banks reached 37 with 650 branches distributed throughout the country (Bank of Sudan, 2014).

Microfinance became one of the most important mechanisms to fight poverty in the world. Sudan like other third world countries is depending on microfinance to achieve economic development. The Sudanese banks have adopted microfinance programs since it is one of the appropriate mechanisms that help banks to achieve their social and economic role. In addition to the banks (commercial and specialized), microfinance services are offered in the Sudan through wide range of social programs, local and global non-governmental and governmental organizations and other social funds.

Microfinance started in formal framework through Faisal Islamic Bank in the eighties, and this has led to the establishment of a specialized unit of microfinance. After that, the bank of Sudan decided in its monetary and funding policy to allocate share to the producing families in form of small loans started with interest rate 10% in 2002. Then the microfinance sector was included in Sudanese government's strategy to fight poverty. The Central Bank of Sudan in 2006 launched a microfinance program in Sudan, and created microfinance unit in March 2007, which is administratively and financially independent, to achieve specific goals such as community development, reducing poverty among sectors of society and raising living standards and encourage production activities to achieve balanced economic development in Sudan.

Agricultural credit provision in Sudan has faced many constrains, such as relatively complicated loan processing procedures and collateral, high profit margins, insufficient finance, delay of the loan received and short repayment period of the loans which means repayment directly after harvest (Abdelmula, 1999). Some projects have resorted to others means of finance within the Islamic principles to avoid these problems, one of the new forms is solidarity finance which has been introduced to avoid the problem of the collateral proved by farmers; it is a kind of group finance.

The aim of this paper has two folds, first to outline microfinance environment and policies of Sudan under Islamic modes, second synthesize empirical study on the case of Rahad scheme as an example for microfinance with Islamic modes to evaluate the impact of solidarity groups (SGs) finance with *Murabaha* and *Salam* modes on farm income in Rahad scheme, and to

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<sup>1</sup>It is often used as an Islamic term for interest charged on loans

identify the socio-economic factors affecting the farmers' decision to join the solidarity groups, along with problems that face the experience of solidarity group finance.

The second part of the paper outlays the methodology, then the results and discussion and finally the conclusion and recommendations.

## 2. METHODOLOGY:

The study used secondary data to review the general environment of microfinance through Islamic forms in Sudan, for the case under study a primary data were collected using structured questionnaire. The random sample was selected from the 6<sup>th</sup> and 7<sup>th</sup> agricultural sectors of the scheme. A binary logistic regression model (Logit) was used to estimate the correlation between the dependent variable of joining of the solidarity groups, and independents variables namely, educational level, farm location, machinery possession, marital status, land ownership, animal's ownership, risk exposure and financial ability. A paired samples (T) test used to examine and estimate the difference between two paired samples means of costs and returns.

The study has implemented a random sampling technique in the selection process of the respondents. Out of the scheme ten blocks; two blocks were selected randomly. From each block two villages were also randomly chosen, and, then 30 farmers were randomly selected from each village resulting in a total sample size of 120 farmers. Sixty farmers of the sample are self-financed and the other 60 are members were in a the solidarity groups. To fulfill the objectives of the study, two main analytical techniques were used for data analysis and results presentation. First, a logistic regression analysis (Logit) was used to identify the main factors which influence farmers' decision to join the solidarity groups. Second, paired samples (T) test was used to examine the difference between two paired samples means, that is the means of costs and returns of sorghum and groundnut for the two groups of farmers under study.

### 2.1 Solidarity Groups' Formation in Rahad Agricultural Corporation:

The idea of solidarity groups started in Bangladesh as a solution of the warranty problem that cannot secured by small farmers. The experiment was successful, and as a result farmers' capital has increased and accordingly their income and living standards have improved.

In Sudan solidarity groups are primarily introduced by the Agricultural Bank of Sudan (Fau branch) season (2008-2009) to help small farmers in Rahad scheme who lack sufficient guarantee to acquire loans needed to fulfill their agricultural production requirements, The main objective of the solidarity group is to help farmers providing the collateral which is necessary to obtain loans from formal financial institutions.

In order to initiate a solidarity group, applicants have to follow the following three steps. First at least a group of (20-25) farmers should gathered together optionally to construct a solidarity group. Secondly, the group members should select two farmers, one farmer to be the head of the group and the other to be the deputy of the group head. Thirdly, a list of the group is then formulated including farmers name, their tenancy size and the area to be financed. The information on the list should be signed or stamped by all member farmers. The authenticity of information regarding tenancy size and ownership stated on the list should be checked and confirmed by the farmers union in the area and by the administration of Rahad Agricultural Corporation. After that the list will be submitted to the Agricultural Bank of Sudan in order to

obtain finance, and this is done as follows: The bank opens special financial account for the head of the group, and takes from him a signed cheque as a guarantee. Then, a special account is also opened to the deputy of the President, to guarantee the head of the group. The groups will be financed according to the agricultural operations flow starting from land preparation, planting, fertilizers application and each group will be financed separately. The financing formulas usually used to provide funds to the solidarity groups members from the agricultural bank are the *Murabha* and the *Salam*.

## 2.2 Logistic Regression Model (Logit)

Logistic regression analysis is a multivariate technique which allows for estimating the probability that an event will occur or not, by predicting a binary dependent outcome from a set of independent variables. A Logit model was employed to identify the main factors influencing farmers' decision to join the solidarity groups to get finance for their agricultural activities. The Logit regression computer package was used to derive the maximum likelihood estimates of the farmers' decision process. The status of the respondents level of joining solidarity groups was classified in groups and with respect to each socio-economic variable, a contingency table was drawn up.

For this study in Rahad Agriculture Corporation, the Logit model was used because it reflected the empirically observed source of agricultural finance of a particular respondent farmer. Such observations reflect a dichotomous variable: self-financed or a solidarity group financed. This 'adoption behavioral model' with dichotomous (or binary) dependent variables can be used as a conceptual framework to examine variables associated with the adoption of technology. Although least square estimates can compute binary models, the error terms are likely to be heteroscedastic leading to inefficient parameter estimates; thus classical hypothesis tests, such as the t-ratios are inappropriate (Pindyck and Rubinfeld, 1981). The use of Logit, which gives the maximum likelihood estimates, overcome most of the problems associated with linear probability models and provides estimators that are asymptotically consistent, efficient and Gaussian so that the analogue of the regression t-test can be applied. The Logit model based on the cumulative logistic probability function is computationally easier to use than the Probit and Tobit models and was used in this study (Pindyck and Rubinfeld, 1981). Conceptually, the following is the general adoption behavioral model used to examine the factors influencing the farmer's decision to join the solidarity groups.

$$P_i = F(Z_i)$$

$$Z_i = \beta_0 + \sum_{j=1}^n \beta_j X_{ji}$$

Where:

$P_i$  = The probability that an individual will adopt a given resource base (the binary variable,  $P_i = 1$  for solidarity group member, and  $P_i = 0$  for a self-financed farmer)

$Z_i$  = Estimated variable or index for the  $i^{\text{th}}$  observation

F = The functional relationship between  $P_i$  and  $Z_i$

$i = 1, 2, \dots, m$  are observations on variables for the adoption model. They are defined in Table 1 for this analysis,  $m$  being the sample size 120

$X_{ji}$  = The  $j^{\text{th}}$  explanatory variable for the  $i^{\text{th}}$  observation,  $j = 1, 2, \dots, n$

$B_j$  = A parameter,  $j = 0, 1, \dots, n$

$j = 0, 1, \dots, n$  where  $n$  is the total number of explanatory variables.

The logit model assumes the underlying index;  $Z_i$  is a random variable that predicts the probability of the farmer's source of finance from the two sources under investigation.

$$P_i = \frac{1}{1 + e^{-Z_i}}$$

(The probability that an individual will adopt a given resource base)

$$1 - P_i = \frac{1}{1 + e^{Z_i}}$$

(Probability that an individual will not adopt a given resource base)

Therefore:

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}}$$

$$L_i = \ln \frac{P_i}{1 - P_i} = \ln \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} = \ln e^{Z_i} = Z_i = \beta_0 + \sum_{j=1}^n \beta_j X_{ji}$$

This is the logit model (Engelman, 1981 and Gujarati, 1988 in Lwayo and Maritim, 2003).

### 2.2.1 The Empirical Logistic Model:

Within this study, the logistic regression model was developed to define factors affecting farmer's decisions on the finance mode for their crop production. It has become very popular in describing choice behavior in econometrics and in modeling risk factors in agriculture economics. The preference order can depend on the individual (e.g. socioeconomic characteristics as in attributes of the choice).

If we let  $y = 1$  represents choosing solidarity group versus  $y = 0$  for choosing self-financed group, where,  $\beta_0, \beta_1, \beta_2 \dots \beta_k$  are unknown constants analogous to the multiple linear regression model. The independent variables for our model would be:

$x_1 \equiv$  Education (Farmer's education status schooling years)

$x_2 \equiv$  Marital status

$x_3 \equiv$  Farm location (To water source )

$x_4 \equiv$  Risk exposure (Water shortage)

$x_5 \equiv$  Animal ownership

$x_6 \equiv$  Machinery ownership

$x_7 \equiv$  Financial ability (Household income level)

$x_8 \equiv$  Land tenure (Owner, Rent)

### 2.3 Paired Sample (T) Test Model:

The paired sample (T) test is used to examine the difference between the two samples means. This analysis was employed to test the significance of the differences between the means of costs and returns of sorghum and groundnut produced by the two groups of farmers under investigation. Sorghum and groundnut are the two crops financed by the Agricultural Bank in the Rahad area through the solidarity groups' microfinance method. The formula of calculating the T-statistics is given as follow:

$$T = \frac{\bar{X}_1 - \bar{X}_2}{Sp \sqrt{1/n_1 + 1/n_2}}$$

Where,

$$Sp = \sqrt{\frac{(n_1 - 1) S_1^2 + (n_2 - 1) S_2^2}{n_1 + n_2 - 2}}$$

Where,

$\bar{X}_1$  = mean of the first sample (self-financed group of farmers).

$\bar{X}_2$  = mean of the second sample (solidarity group farmers).

$n_1$  = size of the first sample 60 farmers.

$n_2$  = size of the second sample 60 farmers.

$S_1^2$  = variance of the first sample. And  $S_2^2$  = variance of the second sample.

## 2. RESULTS AND DISCUSSION

### 3.1 Review of Islamic Finance and Microfinance

The Sudan banking system is totally operating under Islamic principles. The main feature of this system is that; it is not applying interest rate as a base for money transactions; instead it is applying many tools based on sharing gain and loss for both creditors and investors. The main challenge facing the Central bank of Sudan (CBOS) was to find an alternative and more flexible ways that could replace the interest rate for applying its monetary policy as a tool for transmission and incentives for both depositors and investors.

To attract deposits the CBOS provide three types of fund raising tools including demand deposit, saving deposit and investment deposit. Demand deposits are parallel to current account deposits of standard commercial banks. They bear no returns, but their holders receive a range

of services including checking facilities. Saving deposits slightly differ from demand deposits in that they carry no service charges, their holders may be permitted to special borrowing facilities, and they earn profit/loss subject to certain maturity limitations. Investment deposits are held for capital income returns. Banks restricted withdrawal of investment deposits to the lapse of certain period normally one year. Investment deposits work as enterprise stocks due to the fact that their returns are not fixed and variable, however the banks announce depositors an indicative rate of return on which depositors can decide on provide savings. Banks from its side accept deposits and invest it using different available Islamic modes, in many cases depositors decide on which mode to deposit their funds (Alhiraika, 1998).

The CBOS have used a variety of Islamic lending instruments including *Murabaha*, *Musharka*, *Mudaraba*, *Salam*, *Ijara* and *Istisna*. The first lending instrument is the *Murabaha*, it is a purchase and resale contract with the resale price determined based on cost plus profit gain. The *Murabaha* is working in all sectors of the economy including the agricultural sector. The bank purchases the commodities ordered by the client and resell them to him at an agreed price, usually on deferred payment basis. This method satisfies Islamic legal requirements since the lender takes physical possession of the goods being financed and the mark up is related to the length of the period over which the transaction is to be completed which is intermediate term one to four years. The COBS determines a maximum profit of 12% this could be reduced to 10% for some sectors especially the agriculture sector and microfinance. *Musharakais* the second lending instrument which is a partnership contract in which the bank is sharing the capital and returns by contributing to a new or existing projects. Instead, it may contribute to the ownership or specified assets on permanent or a non-permanent basis provided that the profits and losses are to be shared according to the respective capital contribution of each party. The *Moradaba* is a joint venture contract between the bank and an enterprise or a company for a pre-agreed period. The bank can either invest in an existing company or a new company. The profit percentage to be received by the bank on its investment is determined in advance. It has traditionally been confined to commercial activities of short period. The third instrument is The *Salam*, is used only to finance agricultural operations; it is a purchase contract with delayed delivery of agricultural commodities. Farmers receive cash advances on the promise of selling a certain amount of their future products to the banks at an agreed price and time. The Banks pays the farmer the full assigned price of the contracted product (IMF, 1999). The duration of contract is less than one year. The fourth sort of lending is the *Ijara*, it is an effective and practical financing tool that allows businesses to acquire their equipment / machinery through leasing instead of outright purchase, thus reducing the heavy burden of capital expenditure. The renting period normally ranges from 3 to 7 years with the lessee having the right to purchase the leased asset at the end of the *Ijara* period. Finally, the *Istisna*, this is a sales contract whereby banks enter into a contract to deliver a commodity or an asset at a defined future time at an agreed price. *Istisnais* widely used in financing constructions.

Special attention should be given to the development of Islamic credit, money, and government Sukuk markets, as well as to the design of effective sterilization policies and liquidity management frameworks (Rasheed et al, 2016). For more flexible monetary policy, the CBOS

has launched certificates for stock markets transactions, these are Government Musharaka Certificates (GMCs) and Government investment certificates (GICs), The GMCs are equity based financial securities backed by the government shares in certain public companies. while (GICs are medium term securities, based on various contracts financed by the Ministry of Finance via the Istisna', Murabaha and Ijara modes of finance whereby, the Ministry of Finance and National Economy acts as the originator in the issuance of these sukuk. The CBOS controls money supply through selling or buying these certificates in the stock markets (Bank of Sudan, 2016).

**Table (1): Share of Islamic Finance Modes, 2005-2014, Sudan**

Year	Murabaha	%	Musharaka	%	Mudaraba	%	Salam	%	Others	%	Total
2005	1,652,975	39	1,372,382	32	246,250	6	126,533	3	892551	21	4,290,691
2006	3,010,283	43	2,143,049	31	292,321	4	145,157	2	1362873	20	6,953,683
2007	5,559,119	53	2,116,468	20	532,040	5	132,993	1	2054300	20	10,394,920
2008	7,315,101	58	1,631,380	13	497,619	4	81,715	1	3061470	24	12,587,285
2009	6,899,680	47	1,769,329	12	876,420	6	290,650	2	4845215	33	14,681,294
2010	8,186,340	52	1,641,402	10	956,036	6	349,618	2	4526390	29	15,659,786
2011	11,474,102	52	1,981,884	9	1,480,020	7	257,586	1	6913846	31	22,107,438
2012	14,312,933	61	1,548,468	7	1,424,744	6	174,806	1	5868236	25	23,329,187
2013	12,021,906	50	2,636,883	11	1,296,315	5	459,838	2	7687901	32	24,102,842
2014	18,012,731	53	3,740,711	11	1,772,902	5	665,257	2	9630887	28	33,822,488

Source, Bank of Sudan, Values in Sudanese pound (SDG) million

The *Murabaha* is the most common form of finance used among other Islamic modes, it represents more than 50% of the total finance (table,2), this is because of its familiarity and flexibility since it works in all economic sectors including the agricultural sector, and it is used by both individual and companies. The *Musharaka* and *Mudarba* are ranked second in their shares from total finance, this joint venture normally common between banks and companies. The share of the *Salam* in total finance is low because it is restricted to only finance the cost of agricultural operations, while other costs of agriculture especially material and inputs are financed through the *Murabaha* (table, 1).

The CBOS considered micro finance within its general policy of financial inclusion in order to upgrade banking awareness, development of supervision frameworks that categorize banks into comprehensive banks which provide all the banking services and specialized banks which provide medium and long term financing to agricultural, industrial sectors and microfinance. Through microfinance policies, the CBOS aimed at contributing to achieve economic and social development by increasing the share of microfinance projects in the national income, jobs provision, poverty alleviation and achieving social justice besides the continuous efforts to

allocate 12% of total banks financing portfolio to microfinance along with the finance with social dimension (Bank of Sudan, 2014).

**Table (2) Funds for Microfinance, (2011-2012)**

Finance	2011	2012	2013	2014
Total finance by Banks	22867.1	30483	37622	44320.7
Allocate to microfinance (12%)	3456	3652	4515	5718.5
Actual microfinance	938	1496	1546	2055
% of microfinance from total finance	4.1	4.9	4.1	4.6
% of actual microfinance from allocated	27.1	41.0	34.2	35.9

Source, Bank of Sudan, Values in SDG Million

Total funds for finance from banks have been doubled between 2011 and 2014; it has increased from 22,867.1 SDG million to 44,320.7 million in 2014, accordingly, banks allocated funds for microfinance (12%) has increased from 3,456 in 2011 to 5,718.5 SDG million in 2014. However, throughout the period 2011 to 2014 the actual funds utilized by microfinance credit have not exceed 5% of total funds and its ratio ranges between 27% to 40% from total allocated funds to microfinance (table, 2). The reasons behind this low utilization of microfinance credit are attributed to the low awareness of people about the microfinance system, the complicated process of getting banks account for dealers in addition to the geographical distribution of banks which is not covering remote areas where target groups are located.

### 3.2 Logistic Regressions Results

In this section we present the results of the logistic regression. The binary dependent variable takes 1 for the solidarity group financed farmers and 0 for the self-financed group of farmers. While, the independent variables for the two groups are including education, marital status, farm location, risk exposure, animal ownership, machinery ownership, financial ability and land tenure.

**Table (3) Factors Affecting Farmer's Decision to Join Solidarity Groups**

Variable	$\beta$	S.E	df	Sig	Exp ( $\beta$ )
Education	0.387	0.323	1	.018	*7.679
Marital status	0.032	1.229	1	.979	1.033
Farm location	0.178	0.242	1	.460	.837
Risk exposure	0.763	0.732	1	.297	.466
Animal ownership	0.412	0.441	1	.350	1.510
Machinery ownership	-0.915	0.465	1	.049	*.401
Financial ability	0.734	0.397	1	0.041	*2.084
Land Tenure	1.630	.767	1	0.033	*5.106

Source: From Field Work (2014)

Table (3) revealed that four variables were found to be statistically significant at level %5, namely are education, machinery ownership, financial ability, and the land tenure type.

The logit model indicated a positive significant relationship between adoption of join SGs finance and education. This accord with Lwayo and Maritim (2003) who showed formal education as a vital aspect in the farmer's decision and the fact those literate farmers would be adopters. Formal education would therefore be a critical factor in influencing the effectiveness of the farmer's decision to join solidarity groups. The positive coefficient of the availability of capital indicates that the members of the SGs have no enough and no other sources of finance compared to the self-financed group. This is consistent with previous study by Rasheed et al (2016) that income level from farming activities determined the demand for microfinance. Similarly, the positive significant coefficient of the land tenure type means that individuals who owned their farms are more likely to join the solidarity groups. The lack of land ownership restricts the farmers' access to credit that are required for improved land practices (Tenaw et al, 2009). Finally, the negative coefficient of the machine ownership indicates that the self-financed farmers have more machines than the solidarity group farmers. The value of Exp (B) for education revealed that those who were educated are (7.679) times more likely to join solidarity groups than those who were not. The value of Exp (B) for machine ownership shows that non owners of machines are (2.49) times more likely to join solidarity groups than those who owned farm machines. The value of Exp (B) concerning the availability of needed capital shows that, those who haven't enough finance are (2.084) times more likely to join solidarity groups than those who are able to secure some private sources to get the funds necessary to carry out the farm operations. The value of Exp (B) for land tenure type shows that those who owned their farms are (5.106) times more likely to join solidarity groups than those who rent the farm or make a partnership with their farms.

### 3.3 Paired Sample(T) Test Results

**Table (4) Means Differences of Groundnut Total Costs between Self-Financed and Solidarity Groups**

Type of finance	Sample size	Mean (SDG)	STDEV	T	Pvalue
Self- financed	60	368.97	69.935	4.043	0.21
Solidarity groups	60	431.12	96.349		

Source: Author calculation (2014)

Table (4) depicts that the mean of the total production costs of groundnut for the self-financed groups was (368.97) SDG, which is lower than the mean of the solidarity groups (431.12) SDG. Since the *P* value is more than the level of significance (0.05), therefor, there is no significant difference between the mean of total cost of production of groundnut between the two groups (self-financed and solidarity group).

**Table (5) Means Differences of Sorghum Total Costs between Self-Financed and Solidarity Groups**

Type of finance	Sample size	Mean (SDG)	STDEV	T	Pvalue
Self- financed	60	384.6	82.8	1.227	0.143

Solidarity groups	60	448.1	392.0		
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Source: Author calculation (2014)

The total costs of production of sorghum for the self-financed group of farmers was (384.6) SDG, which is lower than that for the solidarity groups, (448.1) SDG. As the *P*value of 0.143 is greater than the level of significance (0.05), thus there is no significant difference between the means of the total costs of production for sorghum for the two groups of farmers under study.

**Table (6) Means Differences of Groundnut Revenue for Self-Financed and Solidarity Groups**

Type of finance	Sample size	Mean (SDG)	STDEV	T	<i>P</i> value
Self-financed	60	4381.2	10800.4	1.117	0.266
Solidarity group	60	2785.1	2424.1		

Source: Author calculation (2014)

Table (6) shows that the means of the total revenue of groundnut for the self-financed groups was (4381.2) SDG, which is more than the mean of the total revenue of groundnut for the solidarity groups farmers (2785.1) SDG, where *P*value.0.266 is more than the level of significance. Thus, there is no-significant difference between the means of the total revenue of groundnut for the two groups.

**Table (7) Means Differences of Sorghum Revenue between Self-Financed and Solidarity Groups**

Source: Author calculation (2014).

Type of finance	Sample size	Mean (SDG)	STDEV	T	<i>P</i> value
Self-financed	60	1864.41	1096.4	0.553	0.581
Solidarity groups	60	1975.8	1108.5		

The mean of the total revenue of sorghum for the self-financed groups was

(1864.4) SDG, which is lower than the mean of the total revenue of sorghum for the solidarity groups, which was (1975.8) SDG. The *P*value is (0.581) more than the level of significance (0.05), which explains no significant difference between the means of the total revenue of sorghum for the two groups.

### 3. CONCLUSION AND RECOMMENDATIONS

The aim of this paper has two folds, first to outline microfinance environment and policies of Sudan under Islamic modes, second synthesize empirical study on the case of Rahad scheme as an example for microfinance with Islamic modes to measure and evaluate the impact of solidarity groups (SGs) finance with *Murabaha* and *Salam* modes on farm income in Rahad

scheme, and to identify the socioeconomic factors affecting the farmer's decision to join the solidarity groups.

Data have been collected from secondary sources to review the general environment of microfinance through Islamic forms in Sudan, while primary data were collected using structured questionnaire. A binary logistic regression model (Logit) was used to estimate the correlation between the dependent variable of joining of the solidarity groups, and independents variables namely educational level, farm location, machinery possession, marital status, land ownership, animal's ownership, risk exposure and financial ability.

The result of reviewing the environment of the Islamic finance revealed that the *Murabah* is most common mode used in credit transactions because of its familiarity and flexibility. The actual microfinance used in credit is lower than the allocated funds for microfinance due to the less awareness about microfinance culture and complicated banking process.

The Logit analysis revealed that four variables were found to be statistically significant and could affect farmers' decision, namely are education, machinery ownership, financial ability, and the land tenure type. The paired samples (T) test used to examine and estimate the difference between two paired samples means (solidarity group and self-financed), the results showed that there are no significant differences between the means of cost and returns for the two groups, which indicate that the bank finance has no financial burden on the solidarity groups farmers.

The study recommendations call for increasing the awareness about microfinance for optimal utilization of available funds, there is a need to decrease the *Murabah* margins (*Hamish Murabaha*) to attract more farmers to solidarity groups, in addition disseminate this finance experience for more agricultural projects and finally, to provide Loans to the farmer on time and in sufficient amount to enable them applying the cultural practices at the recommended time.

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