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Transactions Costs Analysis of Agricultural Machinery Hiring Decision in Iraq

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Abstract

The hire of some agricultural machinery and equipment services to complete a specific process within the farm considers of an alternatives to owning these machines. The prefer ability between hire or ownership a machine is one of the most important decisions taken by the farmer, which particularly effect on the net income, which is the scale of the farm profitability level. This decision is better in some cases to achieve a particular job quickly while reducing costs, due to the lease does not need a large capital such as possession of machinery. Besides that, the hiring decision can be considered as a transaction, while a transaction occurs when a service is transferred across a technologically separable interface. In order to proceed with a transaction, farmer must search for information and monitor the ongoing process to ensure a positive deal. The costs involved in such transaction-related services are called transaction costs. Thus, the resulting transaction costs should be considered.

The objective of this research is to investigate the role of transactions costs theory in determination the optimal decision for using the agricultural mechanization services. The theoretical framework is based on transaction cost economics which was adapted and interpreted in this paper to deal with agricultural mechanization services. Descriptive statistics, independent sample *t*-test and a binary logistic regression model were used to analyze the hiring decision by using cross- section farm survey data in rice production farms in Alnajaf province. Results indicate that some transactions cost attributes such as a specificity, uncertainty, frequency and measurability of the services concerned are important determinants of hiring decision. The results also show significant differences in hiring decision related to some characteristics such as farm income, the desire in use of agricultural mechanization, farm size, and education level.

Key words: Agricultural mechanization; Hiring decision; Transactions costs economics; Binary logistic model; Rice farms; Alnajaf province.

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INTRODUCTION

Agriculture is one of the cornerstones of the national economy of Iraq because it is the main source that supplies the population with food as well as being the source which supplies manufacturing with raw materials, from here to be interest in this sector and development it to keep pace the increases in the population and the continued flow of manufacturing products. The agricultural sector development depends on two key elements which are the human element and what attributes of the preparations, the capabilities, and skills, and the physical element of the outcome of the scientific and technical progress in the field relevant to agricultural production. Technological progress is one of the main and important ingredients

in increasing and accelerating the rates of economic, social and cultural growth of the different countries, is the common denominator of the various economic development processes and in the forefront of agricultural development. Technological progress takes in the field of agriculture; different forms may be personified in the product work skill and in the agricultural machines with the appropriate technical and economic characteristics such as tractors, combine harvesters, and other agricultural equipment (AL-agedy, 2006).

Rural people in Iraq depend heavily upon agriculture either as farmers, casual labourers, workers in agro-based industries, traders in agricultural produce or as hire service providers. One of the principal causes of poverty among small scale farmers is the lack of farm power (labour saving tools and equipment, and mechanized power) and importantly access to it. Lack of availability and access to farm power by smallholder farmers is a key factor that leads to a decline in production and consequently farm output. Timeliness of farming operations can also have a critical effect on crop yields. Delays in planting after the optimal date can amount to yield penalties of up to one percent per day of delay (Ronald, 2008).

In the past, the Iraqi government imported the agricultural machinery from different countries and distributed them through its warehouse network on farmers of cereal crops especially wheat, barley, and rice, due to their economic importance in achieving national food security and the acquisition them on a large area of cultivated area on the level of Iraq. But these machines did not import based on the technical and economic studies, other than they were imported as a result of the experiment, where the private sector is dominant in agriculture and it was slowly growing technically. Therefore this bargain has been replaced by an agency coordination whereby the private sector is involved in the distribution process. Current estimates indicate that 30% of farmers purchase their spare parts requirement through the agency coordination and 70% from the local market, while 25% of farmers use their own equipment and 75% use a contractor for undertaking harvesting and seedbed preparation (Shukr, 2010).

Most farmers of cereal crops in Iraq did not have enough capital to buy the agricultural machinery that has been imported by the government by reasons of the high price, lack of spare parts, and lack of suitability to the conditions of agricultural work in Iraq. In addition, the small size of the field does not allow the use of these machines with economic efficiency where the cost of operation the machines is high, as well as the use of the machines needed to provide other services as repairs and these services can not present by farmers in Iraq because the use of agricultural machinery needed to set up workshops for the repair, facilities maintenance, and provision spare parts (AL-Tahan, 1991). These reasons leaded the farmers of cereal crops and of them rice farmers to make a decision of agricultural machinery and equipment hire from private sector to meet the requirements of agricultural production in access to appropriate agricultural mechanization services due to the specificity of agriculture in each province of the Iraqi provinces.

Before ninth April 2003 events hire mechanization services in southern and central Iraq were commonly provided by the private sector exclusively by farmers on a neighbour to neighbour basis. At present, a lot of issues of the hire services sector are its informality and spare parts acquisition for machinery. Since hire services are based mainly on farmer to farmer transactions they are not recognized or represented by an association. The supply of spare parts, which was once a problem for an aging fleet of Iraqi tractors, has partly been resolved by the intervention of the private sector which search for commercial profitability instead of social profitability.

The hire of some agricultural machinery and equipment services to complete a specific process within the farm considers of an alternatives to owning these machines. Besides that, the hiring decision also can be considered as a transaction while a transaction occurs when a good or service is transferred across a technologically separable interface (Williamson, 1985). Therefore the resulting transaction costs (TCs) should be considered. The TCs can be all kind of efforts that have to be done to enable machinery services on a farm. The TCs can also be divided into fixed and variable TCs. Fixed TCs are the setup costs of an institution that enable an alternative contractual choice to be offered. The variable TCs represent all expenditures occurring while using an existent short or long-term contractual choice for hiring machinery services. The main objective of this research is to examine the role of transactions costs and their attributes in determination the optimal decision for use of agricultural mechanization services.

Empirical studies on transaction costs exist for some areas, but there are only few trying to estimate transaction costs. Most studies recognize the existence and importance of transaction costs, but only a few try to measure them. Important contributions to measure transaction costs were done by Crocker and Masten (1996), Lyons (1994), and Shelanski and Klein (1995). The limited number of empirical studies on transaction costs is justified by the difficulty in measurement. Picot (1981), goes further, saying that it is very hard to value transaction costs, particularly ex-ante, e.g. cost for seeking, contract formulation and control. However, they are real and significant economic importance. Zylbersztajn (2005), discusses the relevance of the contract approach to the theory of the firm, presents the evolution of the studies of coordination in food chains in Brazil and abroad, and

concludes a research and educational agenda for applied agricultural economics.

The necessity to exploit economies of scale in the use of agricultural machinery and limitations in the capacity for large investment make it necessary to improve existing arrangements to provide mechanization services to small scale farmers. In Alnajaf province which located in the southern central region of Iraq, a lot of contractual bargains to hire agricultural mechanization services especially in scope of tractors, field sprayers, and rice combine harvesters have already appeared. Moreover, Alnajaf province is one of the agricultural provinces famous with cultivation of the rice crop; it takes the first rank of the production, cultivated area and yield on the level of Iraq. Therefore, this case is well suited to apply transaction costs economics for the study of hiring choice in provision of different machinery services.

1. MATERIAL AND METHODS

1.1 Sample and Questionnaire

In order to analysis the rice farmers' decision regression toward hire of agricultural machinery services, a simple random sampling by 10% (Greener, 2008) was used in this research and 391 respondents (from 3,910 sum of rice farmers in Alnajaf province of agricultural season 2015) were interviewed by using face to face a structured questionnaire. In this research was used data collected from a survey which was conducted for period two months from April 2016 until June 2016 in the eight agricultural branches of Alnajaf province, which are Qadisiyah, Abbasid, Alhurai, Mashkhab, Alhera, Manathira, Alhaidariya, and Kufa. A pilot study was carried out beforehand where 10 respondents were interviewed by using the planned structured questionnaire to ensure the questionnaire was easily understood by the respondents. Those respondents were employees at Alnajaf agriculture department and the same time they have farms of rice planting.

The questionnaire was divided into five sections and included 38 questions which were close ended questions for most sections and open questions for few questions which were related to costs account. Respondents were distributed according to the case of the use of the agricultural mechanization services commonly used in the place of study (tractors, field sprayers, and combine harvesters) of agricultural season 2015 into two main categories (Table 1). The first category includes the number of farmers who hire mentioned agricultural mechanization services and they represent 96% of the sample, while the second category includes farmers who own agricultural machinery and farmers who do not use agricultural mechanization services in agricultural operations, this category made up 4% of the study sample.

Table 1
Distribution of Respondents With Respect to the Use Case of the Agricultural Mechanization Services in Research Sample

The case	Frequency of farmers	Percentage
Hiring	377	96%
Others	14	4%
Total	391	100%

Source: Prepared by researchers based on data of questionnaires.

1.2 Conceptual Framework

In this research, a transactions costs theory (TCT) technique is used as the theoretical framework which can explain the farmers' decision towards hiring or outsourcing of agricultural mechanization services. The term "transaction cost" is frequently thought to have been coined by Ronald Coase, who used it to develop a theoretical framework for predicting when certain economic services would be performed by firms, and when they would be performed on the market. In 1937 the economist Coase introduced the theory of transaction costs in his famous paper ''the nature of the firm''. He suggested that the use of the market involves extra costs, such as the search and information costs, bargaining costs, and Policing and enforcement costs. These costs can be eliminated or decreased by organizing these services under the agent's own supervision. Transaction cost economics (TCE) is most commonly associated with the work of Oliver Williamson (1975, 1979, 1981, 1985, and 1996). The economist Williamson developed the theoretical foundations of the theory with respect to traditional industrial processes and goods, and applied it to different forms of contract.

Rooted in the economic theory, TCE theoretically explains why a transaction subject favors a particular form of transaction over others. The basic principle of TCE is that people like to conduct transactions in the most economic way. Williamson in 1981 assumed that firms pursued profit maximization, and that profit maximization required costs minimization. Implicitly, TCE is an equilibrium theory that assumes rationality on the part of owners and/or managers. In 1985 Williamson explained that the determinants of any transaction are uncertainty, specificity, and frequency. He indicated that insourcing will be preferred to outsourcing if three conditions are verified: (a) The degree of the transaction uncertainty is high, that is, if it's difficult to promise the carrying out of the contract—the supplier may have an opportunistic behavior that impairs the customers; (b) If the assets involved in the transaction are specific, if just a restricted number of suppliers possess the necessary equipment to the accomplishment of the activity, his bargaining power increases—affects negatively the price of the transaction; (c) If the transaction is the recurrent type, that is, if the firm has to buy regularly large quantities of the product to the suppliers these will be able to demand better conditions.

Other authors introduced complexity (Shelanski & Klein, 1995) and measurability (Barzel, 1982) as additional attributes for any transaction. These dimensions help to explain which contractual arrangements are most suitable for a certain type of transaction. In additional, farmers' decision towards the hiring may also is influenced by external factors such as socio - demographic and economic characteristics (Vernimmen, 2000) such as age, education level, experience years, household number, farm area, farm income level, and the desire in use of agricultural mechanization. All these factors will increase or decrease the farmer's decision probability towards outsourcing. Figure 1 shows the hypothesized relationship among transaction cost attributes and socio - demographic and economic factors, and outsourcing decision of agricultural mechanization services.

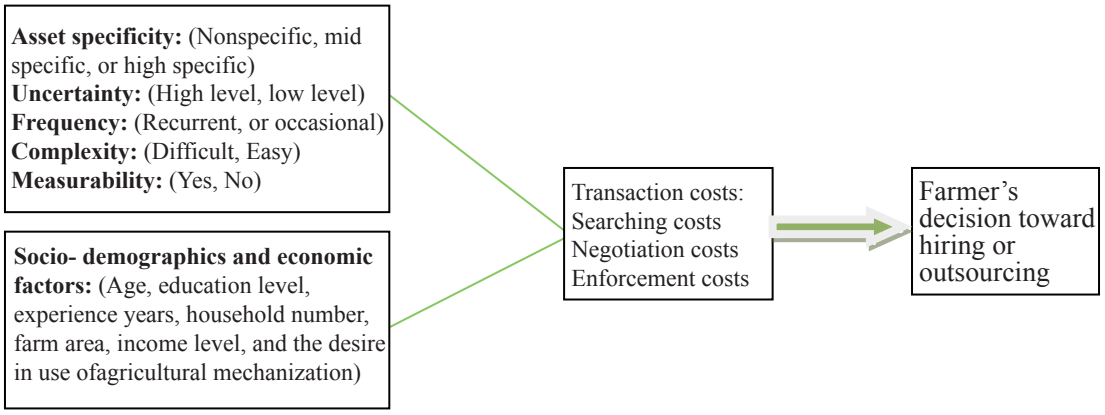

Figure 1
Flowchart Illustrates Transaction Costs Economics as a Theoretical Framework
Source: Prepared by researchers based on different economists' suggestions about TCT.

1.3 Hypotheses of Research

This research based on the following eight assumptions which were highlighted in figure 1 that was proposed based on previous studies:

H1: Uncertainty is positively related to transaction costs. It increases from the complexity in predicting the action of the other party in the transaction, due to opportunism and bounded rationality behavior.

H2: Machinery specificity is positively related to transaction costs.

H3: Hiring frequency is positively related to transaction costs.

H4: Complexity degree of transaction organization is positively related to transaction costs.

H5: Measurability of a transaction is negatively related to transaction costs.

H6: Transaction costs are negatively related to farmer's decision probability to hire agricultural mechanization services.

1.4 Methods of Data Analysis

To achieve the objectives of this research, descriptive statistics, *t*-test analysis, and a binary logistic model were used to analyze the data obtained from the questionnaires. Descriptive analysis was used to review the socio-demographic and transactions costs attribute data. Independent sample *t*-test was used to compare the mean values between two unrelated groups on the same explanatory variables and dependent variable. A binary logistic model was used to estimate the relationship between socio demographic and economic factors and transactions costs attributes, and farmers' decision towards hiring of agricultural mechanization services. All the explanatory variables in this model had the value of 0 or 1 (Table 2). The dependent variable in this research is derived from the question about the case of ownership (own, hire, or other) of the agricultural mechanization services which are used on the farm. The dependent variable, represented a hiring case which was split into two categories, that is farmers how hire agricultural mechanization services, coded as zero and otherwise was coded as one. The variable, *Xi* represents the socio-demographic and economic variables and transactions costs attributes which influence the hiring decision. In this regression model, the vectors, *Xi* consisted of the following variables: education level, farm area, farm income, asset specificity, uncertainty, frequency, complexity, measurability, and the desire in use of agricultural mechanization. In general, the binary logistic model which was used in this research can be presented as following (Qasim, 2011):

$$L = \ln (P_i /1 - P_i) = O_i = a + \Sigma bjXij + ei$$
$$(i = 1, 2, 3\ldots 391).$$

Where: *Pi* represents the probability of the hiring decision. So we have:

P_i = 0 if rice farmers hire the agricultural mechanization services,

P_i = 1 otherwise, if rice farmers own or do not use the agricultural mechanization,

L = Normal log of odds ratio.

The Ln of the probability ratio converts the probable value to the odds value. Therefore, the dependent variable

Oi represents the odds a rice farmer will choose the case of use for the agricultural mechanization services based upon various independent variables. *Xi* is a vector of independent transaction cost and farmer characteristics variables, *bj* represents an unknown vector of coefficients to be estimated associated with each explanatory variable, α is an intercept constant, and *ei* is a stochastic error term for case *i*.

Table 2
Coding Systems of Explanatory Variables to Estimate the Regression of Rice Farmers' Decision Toward Agricultural Mechanization Services Hiring

Explanatory variables	Coding systems
The desire in use of agricultural mechanization	1 = Strongly like 0 = Normally like
Education level	0 = Uneducated 1 = Read and Write 2 = Primary 3 = Secondary 4 = Diploma or Bachelor
Farm area	0 < 10 donims 1 = 10-29 donims 2 = 30-49 donims 3 ≥ 50 donims
Income level	0 = 5-40 million 1 = 55-90 million 2 ≥ 105 million
Specificity	1 Nonspecific 0 Otherwise
Uncertainty	1 Certain 0 Otherwise
Frequency	1 Some time 0 Otherwise
Complexity	1 Easy 0 Otherwise
Measurability	1 Yes 0 Otherwise

Source: Prepared by researchers based on data of questionnaires.

2. RESULTS AND DISCUSSION

2.1 Study of Socio-Demographic Profiles and Economic Factors of Respondents

Descriptive analysis such as frequency distribution tables was used in this research to describe the result of the respondents' socio demographic profiles and economic factors. Data values of the socio demographic and economic characteristics such as gender, marital status, age, education level, household number, occupation in rice farming, experience years, the desire in use of agricultural mechanization, farm ownership structure, total farm area, cultivated area with rice, and income level were analyzed using descriptive analysis. By using descriptive analysis, the frequency distribution table can show clearly how the data values can affect the variables in this research. Table 3 shows the result of analysis these characteristics. We can note most the respondents were male 382 (98%) and only 2% were male. Most the respondents were married (99.2%) and 0.5% of respondents were single. The largest age group was equal or more than 51 years category (50%) while only 10% of the respondents were 19-34 years category. Moreover, 41% of the respondents were uneducated (Ignorant), only a small amount of the respondents had received tertiary education (diploma or bachelor) (10%) and 17.5% had completed secondary stage. On the subject of family size, about 17.7% of the respondents have household number between 11-19 persons. The largest ratio of family number was 81% (2-10 persons), while the smallest ratios were 0.5% (< 2 persons) and 0.8% (≥ 20 persons). In this research, the majority of the respondents were full time farmer (80%) with respect to the occupation in rice farming while (20%) of them were part time farmer. The percentage of respondents who have average of experience years more than 35 years in rice planting was 19% while the respondents who have average of experience years equal or less than 35 years made up 81% of the sample. Regarding to the farm ownership structure, the percentage of respondents who own their farm was 44%, followed by contract with the government (40%), hiring (9%), and other cases (7%). Most the respondents were have farm size less than 50 donims (95.5%) and 0.8% of respondents were have more than 170 donims, while 8.7% of respondents have farm area between 50-169 donims. On the topic of cultivated area with rice, we divided this factor into four categories. The largest area group was less than 10 donims category (50%) while only 5.6% of the respondents were plant equal or more than 50 donims category, and about 36% of the respondents have cultivated area with rice between 10- 29 donims. About 96.2% of the respondents have annual income average of rice planting between ID5- ID40 million, a very smaller

percentage of the respondents (0.3%) have incomes above ID105 million, while 3.5% of respondents have an income between ID55-ID90 million. About 53% of the respondents have a strong desire in use of agricultural mechanization of rice planting, while 47% of them have a normal desire in use of agricultural mechanization.

Table 3
Respondents' Socio-Demographic and Economic Characteristics (*N*=391)

Characteristic	*F*	Percentage	Characteristic	*F*	Percentage
Gender:			Average of experience years:		
Male	382	98	≤ 35	316	81
Female	9	2	> 35	75	19
Marital status:			Farm ownership structure:		
Single	2	.5	Own	170	44
Married	388	99.2	Rent	36	9
widow	1	.3	Contract with government	155	40
			Others	30	7
Age:			Total Farm Area:		
19-34	40	10	< 50	354	90.5
35-50	157	40	50-169	34	8.7
≥ 51	194	50	≥ 170	3	.8
Education level:			Cultivated area with rice:		
Uneducated (ignorant)	160	41	< 10	196	50
Primary	123	31.5	10-29	140	36
Secondary	69	17.5	30-49	33	8.4
Diploma or bachelor	39	10	≥ 50	22	5.6
Household number:			Average of annual income:		
< 2	2	.5	5-40	376	96.2
2-10	317	81	55-90	14	3.5
11-19	69	17.7	≥ 105	1	.3
≥ 20	3	.8			
Occupation in rice farming:			The desire in use of agricultural mechanization:		
Full time farmer	311	80	Strongly like	206	53
Part time farmer	80	20	Normally like	185	47

Source: Prepared by researchers based on data of questionnaires and SPSS program.

2.2 Measurement of Farmers' Perceptions About Transactions Attributes

The relationship between farmers' perceptions about different transactions attributes and their decision towards hiring of agricultural mechanization services was considered by asking five questions about farmer's perception and knowledge towards transactions attributes which include asset specificity, uncertainty, frequency, complexity, and measurability. The importance of the attributes of any transaction for the different agricultural mechanization services that are related in the farmers' case in Alnajaf province are shown in Table 4. The results as can be seen in Table 4 asset specificity is more relevant for rice harvesting machines (98%) than for tractors and crop protection tackle. In addition to around 66%, 60%, and 48% of farmers have certainty about the action of the other party in the transaction with respect to the services of each field sprayers, tractors, and rice harvesters sequentially. The highest frequency of use can be observed for the tractor (59%), because this is a multipurpose machine. The degree of complexity of contract organization with the other party can be assumed to increase with the value of machinery involved in the transaction (Wander, 2003); therefore it is the highest for rice harvesters (31%), while the ratios of respondents who believed that the degree of complexity of contract organization for both field sprayers and tractors is difficult were 19% and 17% sequentially. Measurability of a machinery service is easier for crop protection with field sprayers (79%) and becomes more difficult for both services of tractors and rice harvesters (25%, 24%).

Table 4
Results of Measurement of Transaction Attributes for Different Hired Machinery Type in the Research Region

Attributes of transaction	Different hired machinery type					
	Tractor		Field sprayer		rice harvester	
	F	%	*F*	%	*F*	%
Asset Specificity: Specify the type of specificity of a hired service?						
Use in more than one production process (Nonspecific)	329	84	266	68	7	2
Use in one production process (High specific)	62	16	125	32	384	98
*Not sure	0	0	0	0	0	0
Uncertainty: Do you have perfect confidence about the behavior of other party that he will carry out all items of signed contract?						
Certain	234	60	260	66	186	47.5
Uncertain	117	30	101	26	161	41.5
*Not sure	40	10	30	8	44	11

To be continued

Continued

Attributes of transaction	Different hired machinery type					
	Tractor		Field sprayer		rice harvester	
	F	%	*F*	%	*F*	%
Frequency: Specify the type of Frequency of a hired service?						
Regular	232	59	13	3	8	2
Some time	116	30	272	70	257	66
*Not sure	43	11	106	27	126	32
Complexity: Specify the degree of complexity of a hired service transaction organization with the other party?						
Difficult	67	17	75	19	122	31
Easy	277	71	282	72	210	54
*Not sure	47	12	34	9	59	15
Measurability: Can you expect how much a hired service costs in advance?						
Yes	253	65	309	79	266	68
No	98	25	47	12	92	24
*Not sure	40	10	35	9	33	8

Note. *The ratios which are represented the respondents who couldn't identify the nature of transaction attributes for each type of them and therefore, do not need to be explained.
Source: Prepared by researchers based on data of questionnaires and SPSS program.

Given the farmers' background about transactions costs and their attributes, it is expected that the farmers will have a positive response towards hiring decision. On the other hand, being farmers' perceptions about transactions costs and their attributes are not enough in measuring farmer's positive decision towards hiring of agricultural mechanization services. Thus, other analyses need to be done in identifying the categories of the farmers that are really willing to hire the agricultural mechanizations services.

2.3 Results of Independent Sample *T*-Test

The results of the independent sample t-test indicate that some of the selected socio-demographic and economic factors have a significant relationship with different types of transactions costs which affect on the hiring decision of agricultural mechanization services (Table 5). The socio-demographic and economic Profiles which were chosen in this research include age (categorized into less than 50 years old and more than 50 years old), education level (uneducated or educated), experience years (categorized into less than 35 years and more than 35 years), family number (categorized into less than 7 and more than 7 persons), cultivated area with rice (categorized into less than 15 donims and more than 15 donims), income level (less than ID 10 million or more than ID 10 million), and the desire in use of agricultural mechanization (strongly like or normally like). The information presented in Table 6 shows the *t*-test analysis which was used to test the socio-demographic and economic characteristics and searching costs which affect on farmer's decision to hire the agricultural mechanization services. The farmers were asked about the time and effort used to search for relevant services information and compare prices or other attributes among different farmer contractors. From the results, it showed that family size and the desire in use of agricultural mechanization in rice farming were significantly different with the searching costs. It shows that farmers who have household number more than seven persons were more affecting on searching costs than farmers who have household number less than seven persons ($p < 0.10$) and respondents who normally like in use of agricultural mechanization were more affecting on searching costs than respondents who strongly like in use of agricultural mechanization ($p < 0.10$). In this case there are no significant differences between both farmers who old more than 50 years and farmers who old less than 50 years and respondents who were uneducated or educated and those who have experience years more than 35 years or less than 35 years and respondents who have farm area more than 15 donims or less than 15 donims and farmers who have farm income level more than ID10 million or less than ID10 million with regards to their knowledge about the searching and information costs.

Table 5 as well indicated that the t-test results which were used to test whether there is a significant relationship in the mean of selected socio-demographic and economic characteristics and negotiation costs which affect on farmer's decision to hire the agricultural mechanization services. The farmers were asked about the time and effort related to changes and buyer service and support during the period of contract. The results showed that significant interaction was found between age, education level, experience years, farm area, farm income, the desire in use of agricultural mechanization and awareness of the negotiation costs. In terms of age, few respondents (below 50 years old) have a more positive perception towards the negotiation costs where it makes them more responsive to the hiring decision than older respondents (above 50 years old) ($p = 0.01$). Furthermore, the results show that farmers who were educated agree that the negotiation costs are an important element to make the hiring decision ($p < 0.05$). Respondents who have experienced years of less than 35 years have a more positive perception than respondents who have experienced years of more than 35 years ($p = 0.10$). As well, the result of farm area indicates that the group means are statistically significant as the

value was less than 0.10 which was well within the area of significance. This indicates that farmers who have farm area more than 15 donims have a more positive affecting on negotiation costs than farmers who have farm area less than 15 donims. In addition, respondents who have higher income (ID 10 million and above) also agree that the negotiation costs can be helpful to get more information about the service and make them more responsive toward the hiring decision ($p < 0.10$). Moreover, farmers who normally like in use of agricultural mechanization were more affecting for negotiation costs than farmers who strongly like in use of agricultural mechanization in rice farming ($p = 0.002$). In this case, there is no significant difference between both farmers who have household number more than seven persons and farmers who have household number less than seven persons with regards to their knowledge about the negotiation costs.

Table 5 also showed the *t*-test analysis which was used to test the socio-demographic and economic characteristics and enforcement costs which affect on farmer's decision to hire the agricultural mechanization services. The respondents were asked about time and efforts used to ensure that the terms of the contract have been met. In Table 5, the group mean for education level was statistically significant at a high level (0.000). What is more, the mean for farmers who were educated was higher than the farmers who were uneducated. This indicates that farmers who were educated are more informed and have a more positive perception than other farmers towards enforcement costs. Moreover, the result shows that there

Table 5
Results of Independent Sample *t*-Test

Socio-demographic profiles	Transactions costs variables		Mean	Standard deviation	*T* value	Significant
Age	Searching costs	≤ 50	3.24	0.75	0.11	0.91
		> 50	3.23	0.84		
	Negotiation costs	≤ 50	3.80	0.62	2.46	0.01***
		> 50	3.64	0.66		
	Monitoring costs	≤ 50	3.81	0.70	0.44	0.66
		> 50	3.78	0.72		
Education	Searching costs	Uneducated	3.34	0.66	1.33	0.18
		Educated	3.21	0.82		
	Negotiation costs	Uneducated	3.58	0.59	-2.15	0.03**
		Educated	3.75	0.65		
	Monitoring costs	Uneducated	3.48	0.64	-4.5	0.000****
		Educated	3.87	0.71		
Experience	Searching costs	≤ 35	3.26	0.76	1.07	0.28
		> 35	3.15	0.92		
	Negotiation costs	≤ 35	3.75	0.59	1.62	0.10*
		> 35	3.59	0.84		
	Monitoring costs	≤ 35	3.84	0.67	2.14	0.03**
		> 35	3.61	0.85		
Family *N*.	Searching costs	< 7	3.14	0.78	-1.73	0.08*
		≥ 7	3.28	0.80		
	Negotiation costs	< 7	3.725	0.61	.09	0.93
		≥ 7	3.72	0.66		
	Monitoring costs	< 7	3.76	0.65	-0.63	0.53
		≥ 7	3.81	0.74		
Farm area	Searching costs	< 15	3.22	0.75	-0.47	0.64
		≥ 15	3.26	0.87		
	Negotiation costs	< 15	3.68	0.65	-1.86	0.06*
		≥ 15	3.81	0.62		
	Monitoring costs	< 15	3.71	0.68	-3.48	0.001****
		≥ 15	3.98	0.74		
Income level	Searching costs	< 10	3.26	0.73	0.83	0.41
		≥ 10	3.19	0.87		
	Negotiation costs	< 10	3.67	0.66	-1.88	0.06*
		≥ 10	3.79	0.62		
	Monitoring costs	< 10	3.68	0.69	-3.73	0.000****
		≥ 10	3.95	0.71		
The desire in use of agricultural mechanization	Searching costs	Strongly like	3.16	0.87	-1.86	0.06*
		Normally like	3.30	0.72		
	Negotiation costs	Strongly like	3.61	0.72	-3.2	0.002****
		Normally like	3.82	0.55		
	Monitoring costs	Strongly like	3.75	0.75	-1.2	0.25
		Normally like	3.83	0.67		

Note. * Statistically significant at the 0.10 level, ** at the 0.05 level, *** at the 0.01 level, and **** at a high level.
Source: Prepared by researchers based on data of questionnaires and SPSS program.

is a significant difference between experience years and farmers' perceptions towards enforcement costs ($p < 0.05$). Respondents who have experience years of less than 35 years have a more positive perception than respondents who have experience years of more than 35 years. In addition, the result for farm area indicates that the group means are statistically significant as the value was 0.001 which was well within the high level of statistical significance. This indicates that farmers who have farm area more than 15 donims have a more positive affecting on enforcement costs than farmers who have farm area less than 15 donims. Furthermore, respondents who have higher income level (ID 10 million and above) were a more positive affecting on enforcement costs and the mean of this group was statistically significant at a high level (0.000). In this case there is no significant difference between both farmers who old more than 50 years and farmers who old less than 50 years and farmers who have household number more than seven persons and farmers who have household number less than seven persons and respondents who strongly like in use of agricultural mechanization or respondents who normally like in use of agricultural mechanization with regards to their knowledge about the enforcement costs.

2.4 Analysis of Hiring Decision Regression

In the independent sample T-test results, some values did not vary much across the farmers. These could be dropped from the regression analysis even though they are important in theoretical expectations. They are the variables: age, experience years, and family number. The transaction cost attributes included in the analysis are: asset specificity, uncertainty, frequency, complexity, and measurability. There are a number of socio-economic variables which were expected to influence the dependent variable. They were: education level, the desire in use of agricultural mechanization, farm income, and farm area. Hence, five transaction cost variables and four social-economic variables were used in the study model formulation. The SPSS (Statistical Package of Social Sciences) software program, version 20, was used to do the logistic analysis and the obtained results were shown in Table 6.

Table 6
Results of Logistic Regression Model Analysis Related to Agricultural Machinery Services Hiring Decision

Variables	Estimated coefficient	Standard error	Wald stat	*df*	*P* value	Exp(B)
Tractors services: (*N* =391)						
SPEC	-1.976	0.852	5.375	1	0.02*	0.14
UNC	-2.236	1.304	2.938	1	0.08*	0.11
FRE	0.4050	0.754	0.289	1	0.59	1.49
COMP	-1.276	1.002	1.624	1	0.20	0.28
MEASU	1.5000	0.994	2.277	1	0.13	4.48
EDUC	0.7460	0.321	5.383	1	0.02*	2.11
DTU	-2.057	0.839	6.003	1	0.01*	0.13
INCOME	4.4010	1.345	10.703	1	0.001*	81.5
AREA	-1.827	0.742	6.061	1	0.01*	0.16
CONSTANT	-1.924	1.025	3.525	1	0.06	0.15
-2 Log likelihood = 69.41, Chi-square = 51.32, Sig = 000, Nagelkerke *R* square = 0.46, Hosmer and lemeshow test = 13.23 Sig = 0.11						
Actual values of P_i: 0= 377 1= 14 predicted values: (0); 0= 375 1= 2 (1); 0= 11 1= 3 total correct percentage = 96.7						
Field sprayers services: (*N* =391)						
SPEC	-2.14	1.02	4.437	1	0.03*	0.12
UNC	0.33	3.93	0.007	1	0.93	1.39
FRE	-3.00	1.37	4.757	1	0.03*	0.05
COMP	-3.675	3.72	0.975	1	0.32	0.02
MEASU	-3.549	2.68	1.757	1	0.18	0.03
EDUC	0.391	0.31	1.582	1	0.21	1.48
DTU	-1.999	0.98	4.168	1	0.04*	0.13
INCOME	5.840	2.39	5.978	1	0.01*	343.74
AREA	-1.240	0.73	2.862	1	0.09*	0.29
CONSTANT	0.698	1.30	0.288	1	0.59	2.01
-2 Log likelihood = 51.02, Chi-square = 69.70, Sig = 000, Nagelkerke *R* square = 0.62, Hosmer and lemeshow test = 0.19 Sig = 1.00						
Actual values of P_i: 0= 377 1= 14 predicted values: (0); 0= 373 1= 4 (1); 0= 9 1= 5 total correct percentage = 96.7						

To be continued

Continued

Variables	Estimated coefficient	Standard error	Wald stat	*df*	*P* value	Exp(B)
Harvesters services: (*N* =391)						
SPEC	-19.29	12958.64	0.000	1	0.99	0.00
UNC	0.52	1.57	0.108	1	0.74	1.67
FRE	-0.36	1.13	0.101	1	0.75	0.69
COMP	0.07	0.77	0.008	1	0.93	1.07
MEASU	-3.22	1.67	3.738	1	0.05*	0.04
EDUC	0.58	0.29	3.907	1	0.04*	1.78
DTU	-2.05	0.82	6.269	1	0.01*	0.13
INCOME	3.84	1.15	11.098	1	0.001*	46.35
AREA	-1.38	0.65	4.513	1	0.03*	0.25
CONSTANT	-2.32	0.92	6.342	1	0.01	0.09
-2 Log likelihood = 72.30, Sig = 0.35		Chi-square = 48.45,	Sig = 000	Nagelkerke *R* square = 0.44		Hosmer and lemeshow test = 8.93
Actual values of P_i: 0= 377 1= 14 predicted values: (0); 0= 377 1= 0 (1); 0= 13 1= 1 total correct percentage = 96.7						

Note. * Significant.

Before estimation, the independent variables were checked for multicollinearity and no substantial degree of co variation between any pairs of independent variables was found. The overall model predicts 96.7% of the case correctly (378 out of the 391 cases). The estimated model predicts 99%, 98.9%, and 100% of the zeros (hiring) and 21.4%, 35.7%, and 7.1% of the ones (no hiring) correctly with respect to the services of each tractors, field sprayers, and rice harvesters respectively. The Wald stat which follows a chi-squared distribution, presented in Table 6 tests for the null hypothesis that the appropriate parameter estimates equal zero, and the *P* value indicates the significance level below which the null hypothesis would be accepted. The log likelihood χ^2 statistic indicates that the composite effect of the independent variables differs from zero (*P* =0.000). The Nagelkerke *R* Square ($R^{2'}$) value measure of goodness-of-fit is 0.46, 0.62, and 0.44 with respect to the tractors, field sprayers, and rice harvesters model respectively, which for cross-section data is considered reasonable.

In order to display more detailed discussion, the agricultural mechanization services contracted in the province of Alnajaf had been divided into three main types which are: (a) tractor and machinery of soil prepare services, (b) field sprayer services, and (c) combine harvester services. The results in the Table 6 found that out of the nine selected variables, six, five, and five variables were statistically significant with respect to the tractors, field sprayers, and rice harvesters model sequentially. Thus, some variables were found to be relevant in determining farmers' decision to hire machinery services.

Based on the factors which had statistically significant coefficients, which are asset specificity, uncertainty, education level, farm income, farm area, and the desire in use of agricultural mechanization with respect to the tractors services were had different signs that would be in line with theoretical expectations. The results indicate that the high significance level of farm income of impact on hiring decision (*P* = 0.001), while the significance level of uncertainty variable was a little worse than 0.05 (0.08). The positive sign of education level factor means the higher the education level, the lower the probability that machinery services will be hired. This hypothesis belongs to that better educated farmers possess more skills and efficiencies in managing of the agricultural machinery services than less educated farmers. On the other hand, there was not significant confirm for each variables frequency, complexity, and measurability at any acceptable statistical level of influence on the decision of hire to agricultural tractors services.

With regard to the field sprayers services, the study factors such as asset specificity, frequency, farm income, farm area, and the desire in use of agricultural mechanization are important determinants for farmers' decision to hire these services and the effect is positive. Take income and area as example, shift farmers from low income categories to higher income categories will have a greater effect on increasing the proportion of the probability of owning the machines with amount 343.7 times due to increased purchasing power resulting from the increased income. Differently, move farmers from the possession of small areas to large areas will have a negative effect on the possibility of owning the machines with amount 0.3 times due to lack of sufficient capital for the purchase of machinery and the needing for large areas to mechanical processes to be configured for agriculture resulting in increasing the proportion of the likelihood of a hiring decision. On the other hand, there was not significant confirm for each variables uncertainty, complexity, measurability, and education level at any acceptable statistical level of influence on the decision to hire of field sprayers services.

With respect to the harvester's services model, we have made several tries on this model to get the best results than which were reported in Table 6. However, in all tries it has been observed lack of significant of the machine specificity variable and possibly this result was consistent with the descriptive analysis results on this variable, where the ratio of farmers' answers about the harvesting equipment specificity was 98% of the total sample, which means confirmation of farmers to high specificity for harvest machines and lack of they could be used in more than one production process. According to the theoretical prediction, increasing assets specialization can be insignificant factor in the decision to hire and consequent increased uncertainty about the behavior of the other contracting party especially if the service or transaction is the recurrent type during the growing season. In light of this, these three attributes of transactions costs have not been confirmed their statistical significance at the level of economically acceptable to influence on the decision to hire of harvesters services.

CONCLUSION

The hiring decision of agricultural mechanization services can be considered as a transaction while a transaction occurs when a good or service is transferred across a technologically separable interface. Therefore the resulting transaction costs (TCs) should be considered. The hiring decision also can be influenced by some socio-economic factors such as age, experience years, farm income, farm size, education level, and the desire in use of agricultural mechanization. The main objective of this research is to examine the role of transactions costs and their attributes in determination the optimal decision for use of agricultural mechanization services.

The study shows that Transaction Costs Economics is useful to better understand how and why farmers prefer to hire machinery services than buying their own equipment. Results indicate that some transactions cost attributes such as a specificity, uncertainty, frequency and measurability of the services concerned are important determinants of hiring decision. The results also show significant differences in hiring decision related to some characteristics such as farm income, the desire in use of agricultural mechanization, farm size, and education level.

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