Risk Aversion and Incorporation of Information Technology in Agribusiness

Track: Information Technology Management

Keywords: Risk Aversion, IT incorporation, Agribusiness

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Abstract

This research paper examines the relationship between risk aversion and the decisions to incorporate information technologies. Particularly, this paper studies agribusiness firms where it has been observed significantly less incorporation of IT compared to other industries on average. Sixty two senior managers of agribusiness firms participated in this study. Using a previously developed and validated instrument to measure risk aversion and a survey to measure the level of incorporation of information technologies, we observed there is a significant relationship between the level of risk aversion of the senior managers and the level of incorporation of information technologies.

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Introduction

Information technologies are important for the organizations because they not only allow managing the operations but also allow generating competitive advantages. The main challenge is to align the information technologies with the strategy of the organization (Applegate, L., Austin, R., McFarlan, F., 2004).

Although the use of information technologies within the organization is widely acknowledged, there is no evidence of their incorporation within the agribusiness sector (Santana 2012). This is one of the main drivers to invest efforts in this study particularly in agribusiness companies.

The goal is to provide some insight about the reasons why there is a relatively small level of investment to incorporate information technologies in this particular sector. Therefore, this research focuses specifically in one potential factor: risk aversion of the senior managers who make decisions about investments to incorporate information technologies.

Implementation of information systems implies a series of risks that organizations will have to take (Luftman, 2001) in order to generate value and become competitive, but some of these organizations would prefer to maintain their status quo to avoid facing unknown conditions.

Therefore, the research question is stated as follows: Is risk aversion of senior managers related to the level of investment in information technologies in the agribusiness companies?

Literature Review

Risk Aversion

Risk aversion has been studied previously in the business environment (O'Neill, 2001; Cohen, 1995; Montesano, 1991; Meyer, 2006) and there is agreement in defining it from an economic perspective as: the attitudes that individuals have when facing decision making tasks characterized by uncertainty and some level of probability of obtaining an outcome with no earnings. Behavior is what people do and can be observed directly, and the mental processes are the thoughts, the feelings or the drivers experimented by the individuals privately and cannot be observed directly.

In order to measure risk aversion, there are a number of instruments using lottery panels (Holt & Laury, 2002; Georgantzís & Sabater-Grande, 2002) that take into account the empirical evidence of the past regarding the fact that risk aversion should consider the domain and the context. Thus, there is a method to assess risk attitudes from an economic perspective which analyzes the attitudes of individuals who face investments involving gain or loss with an uncertain probability. Because of the relevance and accessibility to the instrument to assess the risk aversion we chose one of the methods that uses lottery panels (Georgantzis & Sabater-Grande, 2002) in this study. This instrument measures the overall risk aversion, involving investments of money with uncertain probability of profit or loss. There is also the psychological perspective of risk aversion, which distinguishes itself from the economic perspective by evaluating people risk aversion considering three paradigms: the perceived magnitude of risk (size attached to the contingency), the attitude when facing risk (orientation to avoid or not the risk), and the behavior in relation to risk. This means acceptance or rejection of the risk and how much risk could be accepted as an individual or social aspect in a specific situation. This is called the psychometric paradigm or a psychometric scale (Chicaíza, Garcia, & Romano, 2011).

We have considered the first method (Georgantzis & Sabater-Grande, 2002) precisely because we seek the economic outlook. Additionally, other authors have used this method of measuring risk aversion in different contexts but always with the economic outlook in decision-making (Chicaíza, Garcia, & Romano, 2011).

Additionally, we considered that the chosen measure is the easiest to apply in the context of this study and therefore reduces the risk of erroneous measurements.

The selected instrument has been applied in studies to measure risk aversion in men and women in order to identify two different dimensions in decision-making under uncertainty: one dimension is related to the level of risk aversion, and the second dimension is related to the sensitivity to the rewards. Figure 1 below shows the four lottery panels that were applied to 668 decision makers.

Figure 1: Decision Lottery Panels

Panel 1

Prob.	1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1
Euros	1.00	1.10	1.30	1.50	1.70	2.10	2.70	3.60	5.40	10.90
Choice			X							

Panel 2

Prob.	1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1
Euros	1.00	1.20	1.50	1.90	2.30	3.00	4.00	5.70	9.00	19.00
Choice				X						

Panel 3

Prob.	1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1
Euros	1.00	1.70	2.50	3.60	5.00	7.00	10.00	15.00	25.00	55.00
Choice								X		

Panel 4

Prob.	1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1
Euros	1.00	2.20	3.80	5.70	8.30	12.00	17.50	26.70	45.00	100.00
Choice									X	

Source: Georgantzís et al., 2012:59

The rewards of the lottery panels are based on a mathematical equation and the rewards amounts may vary, as it has happened when it was implemented in one of the previous studies (Chicaíza, Garcia, & Romano, 2011). Each lottery panel

focuses on big profits, small losses, great losses and small profits. The study results showed that women are more risk averse than men and are less sensitive to price increases. A choice more to the right means there is lower risk aversion, i.e., the decision maker is willing to face higher risk (Garcia-Gallego, Georgantzis, & Jaramillo-Gutiérrez, 2009).

Incorporating Information Technologies

Companies tend to be strategically misaligned by nature, and there is need to achieve a strategic alignment with the business, in order to meet the planned objectives. Venkatraman & Henderson (1993) proposed four models that enable organizations to align information technology to the organization's strategy according to the type of company considering four key aspects: business strategy, information technology infrastructure, information technology strategy, and organizational infrastructure. Luftman (2000) defines Strategic Alignment Maturity as a model to measure the maturity in using information technology strategically within an organization. Based on the identified level of the organization it is possible to determine what aspects need to be improved to achieve a target maturity level. This assessment model considers six evaluation criteria: Communications Matuity, Competency/Value Measurement Maturity, Governance Maturity, Partnership Maturity, Scope & Architecture Maturity, and Skills Maturity.

Based on the Strategic Alignment Model (Luftman, 2000), we adapted a model of Incorporation of IT in the Organization. This model presents five levels of incorporation: Basic, Initiated, Intermediate, Advanced, and Emergent. With this classification it is possible to establish and organization's level of incorporation of information systems and technology in its processes and its strategy. The levels of incorporation of information technology go from an organization that manually manages its information in an initial level to an organization that has adopted an integrated system that supports decision-making.

Objectives

The main objective of this research project is to evaluate the impact of the risk aversion of the organization's senior managers who make decisions about the incorporation of information technologies in their companies.

Specifically we study the existence of this impact in the agribusiness sector because we have observed a low level of incorporation of information technologies in this type of companies

Methodology

Instruments

In order to measure risk aversion of each senior manager, we created investment and results panels based on the method of measuring risk aversion in lottery panels through four panels that are applied to each respondent (Georgantzís & Sabater-Grande, 2002).

The investment panels and the investment results panels prepared for this study consist of two panels: the Investment and Results Panel of Low Investment and Small Profit (LISP) and the Investment and Results Panel of High Investment and Large Profits (HILP). Both panels should be applied to the respondent to determine individual risk aversion of a person.

In the original panels (Georgantzís & Sabater-Grande, 2002) they use probabilities of 0.1 to 1.0 in o.1 intervals as they correspond to the probability of occurrence of lottery prizes. In the panels prepared for this study we have used percentages of occurrence for each expected result. This is what business people are most commonly used to use when referring to probabilities of occurrence of an expected investment outcome. Because of this, we used percentages ranging from 10% to 100% with 10% intervals. Figure 2 shows the panels we used in this study.

Figure 2: Investment and Results Panels to measure Risk Aversion (originally presented in Spanish)

Para cada caso tomar la decisión teniendo en cuenta LA INVERSIÓN, EL RETORNO ESPERADO Y LA PROBABILIDAD:

4. Si Ud. tiene que invertir **Un mil nuevos soles (S/. 1,000).** ¿Cuál es el resultado que espera obtener teniendo en cuenta la probabilidad de ocurrencia?

Elija el resultado y marque con "X" en un solo casillero de la fila SELECCIÓN

PROBABILIDAD	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
RESULTADO S/.	1,000	1,100	1,250	1,450	1,700	2,000	2,500	3,500	6,000	11,000
SELECCIÓN										

5. Si Ud. tiene que invertir **Cinco mil nuevos soles (S/. 5,000).** ¿Cuál es el resultado que espera obtener teniendo en cuenta la probabilidad de ocurrencia?

Elija el resultado y marque con "X" en un solo casillero de la fila SELECCIÓN

PROBABILIDAD	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
RESULTADO S/.	5,000	8,500	12,500	18,000	25,000	35,000	50,000	75,000	125,000	275,000
SELECCIÓN										

Source: Prepared by the authors based on Georgantzís & Sabater-Grande (2002)

In order to find the value of the independent variable "risk aversion", which refers to the risk aversion of the senior managers who make decisions about incorporating IT, we average the responses for risk aversion of each respondent, recalling that for each respondent we have two values, one corresponding to LISP and the other to HILP. Therefore we must average the two values to find the level of risk aversion for each respondent.

In order to measure the level of incorporation of IT in the organization, an instrument was developed based on the model of Strategic Alignment Maturity (Luftman, 2000). This instrument is applied to two key persons who are considered involved in the decision-making regarding the acquisition of information technologies: the Manager or Head of Information Systems or Operations and the General Manager or Administration Manager. In most companies that participated in the study, the information systems/technology area is small and typically depends on the Operations Manager or Head. For this reason we combined the participation of both areas of operations and systems through one representative from each organization.

The instrument was validated through pilot tests and the final version is presented in Figure 3.

Figure 3: Level of Incorporation of Information Technologies in the Organization (originally in Spanish)

1. Marque la alternativa adecuada:

INSTRUCCIONES: Elegir la alternativa que más se ajusta a la realidad de su empresa	MARCAR solo una
A.- Cuenta la empresa con software de gestión de los recursos de la empresa (ERP de clase mundial) y con software de inteligencia de negocios (BI) con Indicadores para el control de la gestión y la toma de decisiones.	
B.- Cuenta la empresa con un software para el manejo integral de la información de toda la empresa – ERP de Clase mundial, como SAP, Oracle, JD Edwards	
C.- Cuenta la empresa con un software de desarrollo nacional para el manejo integral de la información de la empresa.	
D.- Solo algunas áreas de la empresa cuentan con un software para el manejo de su información.	
E.- El manejo de la información de la empresa solo se realiza con el Office, mediante Excel o Access.	

Source: Prepared by the authors based on Luftman (2000)

Population and Sample

The initial objective of this study is to investigate one of the potential antecedents that could explain the low incorporation of information technologies in agro-industrial (agribusiness) companies in the north of Peru. Therefore, the population

considered are all agribusiness companies in northern Peru that are mainly engaged in the cultivation, collection, processing and marketing of sugar, rice, beans, peppers, coffee and fruits. The region considered includes the political regions of La Libertad, Lambayeque and Piura in the northern coast of the country and Cajamarca, Amazonas and San Martin in the northeastern side of Peru.

Companies that participated in the study eventually form a convenience sample. Initially most companies identified in the target regions were invited to participate but we had an unusually low response rate. Therefore, one of the researchers started to gather personal contacts and we were able to find 35 companies interested in participating and answering the questionnaires. Finally, 31 companies that participated fully answered the questionnaires. To collect the data it was necessary to personally visit each of the companies and two senior managers were surveyed in each of them, preferably the chief operating officer and the chief executive officer or the chief financial officer. In some cases we surveyed the information systems manager. Since each company has two representatives who participated responding individually and independently the questionnaires, we collected 62 complete responses. The 31 companies have the characteristics as shown in Tables 1, 2 and 3. Although it is a convenience sample because of lack of participation, we tried to have a sample that represents the population in some characteristics.

Table 1: Number of companies by type of product

Product	Managers	Percentage	Companies
Sugar	10	16,1	5
Rice	24	38,7	12
Beans, Chili	8	12,9	4
Coffee	4	6,5	2
Fruits	8	12,9	4
Other	8	12,9	4
Total	**62**	**100,0**	**31**

Source: Prepared by the authors

Table 2: Number of companies by region

Region	Managers	Percentage	Companies
Amazonas	2	3,2	1
Cajamarca	2	3,2	1
Lambayeque	48	77,4	24
La Libertad	4	6,5	2
Piura	4	6,5	2
San Martin	2	3,2	1
Total	**62**	**100,0**	**31**

Source: Prepared by the authors

Table 3: Number of companies by annual sales (in millions of dollars)

Annual Sales (millions of dollars)	Managers	Percentage
Up to 1	7	11,3
From 1 to 20	34	54,8
From 20 to 60	6	9,7
From 60 to 100	11	17,7
More than 100	4	6,5
Total	**62**	**100,0**

Source: Prepared by the authors

Results

The two variables in this study were measured through the instruments described in the previous sections. The data collected from 62 managers of agribusiness companies that participated were tabulated and analyzed using the IBM SPSS statistical package. Since the specific goal is to evaluate the relationship between risk aversion and the level of incorporation of IT, we used correlation analysis to determine the degree of relationship.

Table 4 shows the results of the tabulation of the responses for the level of incorporation of IT in the companies in the sample.

Table 4: Level of Incorporation of IT in the companies (62 responses from 31 companies)

Level of IT	Managers	Percentage
Basic	5	8,1
Initiated	15	24,2
Intermediate	35	56,5
Advanced	6	9,7
Emergent	1	1,6
Total	62	100,0

Prepared by the authors

Data collected for risk aversion in the two panels of investment and results: Low Investment and Small Profits - LISP and High Investment and Large Profits - HILP were processed to obtain one measure for each manager (respondent) using a simple average that indicates the level of risk aversion of each manager. Table 5 shows the level of risk aversion of the managers in the sample classified in five levels.

Table 5: Level of Risk Aversion of the 62 managers participating in the study

Level of Risk Aversion	Managers	Percentage
Very risky	6	9,7
Risky	15	24,2
Indifferent	19	30,6
Risk Averse	21	33,9
Very Risk Averse	1	1,6
Total	**62**	**100,0**

Prepared by the authors

Finally, the statistical analysis indicates a Pearson correlation of r = -=.416 (significance level of 0.001). This indicates that the relationship is negative, as expected, and although this relationship is not very strong it is significant. In other words, there is a moderate and inverse relationship between the level of risk aversion of the senior managers and the level of incorporation of information technology in the companies that participated in this study. The inverse relationship between

the variables implies that at a higher level of risk aversion of the senior manager, the lower the level of incorporation of information technologies in the company.

Discussion and conclusions

The academic and practitioner literature that we reviewed for this study, broadly supports the idea that the incorporation of information technology in the organization facilitates operational and managerial work. Many organizations have been able to generate competitive advantages by relying on the strategic use of information technologies.

Despite the undeniable help provided by information technologies to the organizations, we find evidence that there are still many companies that make little use of them. This is the case for agribusiness companies. Particularly, in Peru there are a significant number of agribusiness companies that, being in a sector that has grown considerably and providing a larger and larger portion of GDP, have not incorporated information technologies at the same level as other companies in other sectors.

For that reason we decided to study the antecedents of in the decision-making process of incorporating information technologies in the organization. The literature has studied different antecedents but we could not find conclusive studies about the relationship that may have risk aversion of the managers who make the decisions of acquisitions in the organizations and the level of incorporation of IT.

In this study we explore risk aversion as a potential antecedent of the level of incorporation of information technologies in the agribusiness companies. Based on a study of 62 senior managers of agribusiness companies from the northern regions of Peru, we show that there is a significant relationship between the level of risk aversion of senior managers and the level of incorporation of information technology in the organizations.

Due to difficulties in engaging senior managers of companies in the agribusiness sector for this study, it was necessary to use a convenience sample. This is a limitation in the generalization of our findings, however, we did our best to try to have a sample that represents the population and therefore we believe that the findings may provide the basis for further studies.

Likewise, this study was focused on agribusiness companies and therefore conclusions should be limited to that industry as well as the geographic area where the study was conducted. However, we cannot find specific reasons how agribusiness

companies are different from companies in other economic sectors in characteristics that could affect the relationship we studied. That is why we also believe that this initial study may provide the basis for a more broad study.

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