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Innovation activities in the food and beverage sector in Ecuador; A probabilistic model

Actividades de innovación en el sector alimentos y bebidas de Ecuador; un modelo probabilístico

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Abstract

The purpose of this study is to determine the probability the enterprises of food and beverage sector in Ecuador produce a new good based on investment in research, development and innovation. Two databases were used. The first one proceeds from the last survey on innovation applied by the National Institute of Statistics and Census in Ecuador which contains information of the period 2012-2014; the second one was created from the application of a survey to the enterprises of the sector, which is the purpose of this study in Tungurahua Province in 2022; it has information of the period 2018-2021. A descriptive analysis of the research variables was done, prior to the development of a Logit model that established that, in both scenarios of study, the investment in research and development is the main factor that increases the probability that these enterprises will innovate.

JEL Code: O30, O31, O32
Keywords: food sector; logit; innovation; production of a new product; research and development (R&D)

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Resumen

Este estudio tiene como objetivo determinar la probabilidad de que las empresas del sector de alimentos y bebidas del Ecuador produzcan un bien nuevo con base a la inversión en investigación, desarrollo e innovación. Se utilizaron dos bases de datos, la primera proviene de la última encuesta sobre innovación aplicada por el Instituto Nacional de Estadística y Censos en Ecuador, y contiene información del periodo 2012-2014; la segunda fue construida a partir de la aplicación de una encuesta a las empresas del sector objeto de estudio en la provincia de Tungurahua en el año 2022, y contiene información del periodo 2018-2021. Se efectuó un análisis descriptivo de las variables de investigación, previo al desarrollo de un modelo Logit con el que se estableció que, en ambos escenarios de estudio la inversión en investigación y desarrollo es el factor principal que incrementa la probabilidad de que estas empresas innoven.

Código JEL: EL: O30, O31, O32
Palabras clave: sector alimentario; logit; innovación; producción de un bien nuevo; investigación y desarrollo (I+D)

Introduction

The food industry is considered one of the most important in Ecuador and Latin America due to its impact on employment and production (Erazo Merino, 2018). In Ecuador, the food industry has generated 5 out of 10 direct jobs, from food production and processing to distribution and sale, in addition to the fact that in 2020, the food industry accounted for 42.8% of the revenue generated in the country (Mucho mejor Ecuador, 2022; Sánchez Giler et al., 2019). This industry is critical in processing agricultural products and the population's food supply (Torres Salazar et al., 2018). Nevertheless, in recent years, it has faced significant technical and economic changes that have affected food demand and distribution; a clear example of this is the economic crisis caused by the COVID-19 pandemic, which brought with it the need to adapt its supply chains toward e-commerce in order to be efficient for the fast and safe delivery of food, while also observing the rigorous sanitary measures of that time (Fuentes-Pérez, 2020; Torres Salazar et al., 2018; Zeballos, 2013). These changes have generated opportunities for the creation of new products through innovative processes but have also had impacts on food retailing, food scandals, sociodemographic evolution, and modifications in consumer behavior (Barona Zuluaga et al., 2017; Calderón et al., 2015; Ospina Vélez, 2009).

In the field of research and development, the food industry is traditionally considered a sector with low investment in innovation (Díaz Hincapié et al., 2021; Garcia Martinez & Briz, 2000; Valenzuela B. & Valenzuela B, 2015); nonetheless, in some cases it has been found that this industry develops new products through certain innovations, as is the case of Coca-Cola company with the launch of "Coca-Cola Energy" which is an energy drink that combines the iconic Coca-Cola flavor with additional ingredients to provide an additional source of energy (Bellota Vasquez et al., 2021). Likewise, there is the case of the Ecuadorian company PRONACA (Spanish: Procesadora Nacional de Alimentos C.A.) that introduced to

the market its first plant-based protein brand called "Veggie Deli," ideal for customers who consume vegan foods (Pronaca, 2022). Innovations, understood as new products, processes, or services, are important alternatives for companies in the food industry to differentiate themselves from the competition and meet consumer expectations (Quiroga Parra et al., 2014).

Modern research into innovation suggests that companies rarely innovate independently, but their innovations are connected to a network of actors and institutional conditions (Saldarriaga Salazar et al., 2019). Therefore, it is important to analyze, not only individually, the innovations of companies but also within the innovation system as a whole, from knowledge generation to the introduction and market adoption of new products, processes, or services. Therefore, it is important to point out the need to analyze innovations individually and as a whole since they are part of an innovation system. This implies starting from generating knowledge that induces innovation, immersing oneself in the innovation process and its agents to continue introducing and positioning new products and services in the market. Quintero-Campos (2010) mentions that according to the ideas of Freeman in 1987 and Lundvall in 1992, an innovation system is understood as a set of actors, institutions, and processes that collaborate to generate, disseminate, and use knowledge and new technologies.

Traditionally, companies innovate by searching internally for new ideas, technologies, products, and processes that provide sustainable competitive advantages. Nevertheless, due to internal limitations in the food and beverage industry, little knowledge and few ideas are generated (Díaz Hincapié et al., 2021; Saldarriaga Salazar et al., 2019). Despite this, some companies, aware of these limitations, seek opportunities for innovation and improve their products and processes by combining internal and external ideas. Open innovation encourages companies or organizations to share their ideas and solutions with others by focusing on the combination of ideas. Collaboration between organizations and individuals takes many forms, including collaborations with universities, research chairs, and other organizations or companies through associativity (Chesbrough, 2003; Bayona et al., 2017). Previous research suggests that innovation contributes to increasing knowledge, reducing costs, shortening time to market, improving production and efficiency, and increasing sales and overall company performance (Gutiérrez Ponce & Palacios Duarte, 2015; Nieto & Santamaría, 2007; Wang et al., 2015). Therefore, it is important to develop innovation, both with endogenous and exogenous contributions, from the company and academia to boost innovation and continuous improvement.

Innovation occurs as a result of the implementation of various innovation-oriented activities, such as investment in research and development (R&D), as well as investment in other science, technology, and innovation activities (OACTI; Spanish: Otras Actividades de Ciencia, Tecnología e Innovación), which involves investment in machinery and equipment, hardware, software, disembodied technology, consulting, engineering and industrial design, training, and market research. The Oslo manual

considers it vitally important to include investment in OACTI (Table 1) as a study variable since it gathers information on the companies' innovations (OECD, 2005). Based on the above, the problem to be solved is: What is the probability that the companies in Ecuador's food and beverage sector will produce a new good, according to their investment in innovation?

This research aims to determine the probability of producing a new good as a function of investment in research and development (R&D) and other science and technology activities (OACTI) in the food and beverage sector in Ecuador in the period 2012-2014 and in the province of Tungurahua in the period 2018-2021.

The document is structured as follows: in the introduction, relevant aspects of the food and beverage sector, aspects related to innovation, the objectives of the research, and the structure of the article are addressed. In the background, the fundamentals of innovation, innovation in the food and beverage sector, and the context of this sector in Ecuador and the province of Tungurahua are presented. This is followed by the methodology in which the sources of information and the analyses carried out to fulfill the objectives are indicated. The results and discussion section presents the probability of generating new goods based on innovation. Finally, the conclusions of the study and the bibliographical references that have contributed to the research are presented.

Background

Innovation is defined as creating a new or significantly improved good or service by applying a new process, a new marketing or organizational method, new internal measures, or new external relations. To this end, the present research is based on the definitions, criteria, and variables considered in the Oslo Manual (OECD, 2018). On the other hand, Suárez Mella (2018), considering Nelson's idea in 1997, states that innovation is not a fact that is far from the reality of the contexts; rather, it is considered a response to a continuous change within them. If the term innovation is taken to the field of Economics, Schumpeter (1943; 1944) states that innovation is the path to social, economic, and cultural development through the introduction of new methods of transportation and production, new sources of work and changes for the improvement of management processes, so that they can be useful to consumers. In addition, it should be reiterated that the research takes as its main source the Oslo Manual, which provides guidelines for collecting and interpreting information-related information (OECD, 2005; 2018).

The concepts of innovation process and innovation are very close. Nevertheless, they have different contents (Sánchez Jordán, 2011). The innovation process is the preparation and application of changes (Robayo Acuña, 2016), whereas innovation is closely associated with concepts such as novelty, invention, and discovery. Innovation combines several interrelated phases: first, the need for changes is

ascertained, the objective is determined, and then the innovation is developed, mastered, disseminated, used, and dies (Hernández et al., 2016).

Innovation is the transformation of knowledge into products and services with new attributes. Hence, innovating is not an isolated event but a continuous response to changing circumstances and needs (Torres Salazar et al., 2018). According to the Oslo manual, there are two types of innovation: innovation of a product and innovation in business processes (OECD & Eurostat, 2018). Product, process, organizational, and marketing innovations are distinguished (OECD, 2005). On the other hand, according to their degree of impact, there are two types of innovation: incremental innovation, which refers to a gradual change in a product or process focused on its progressive improvement (Dewar & Dutton, 1986; López Sánchez et al., 2006); and radical innovation, which refers to the production of a new good or service that is created from a novel idea (Acosta Castillo et al., 2020; Forés & Camisón, 2016). This makes clear the different types of innovation according to several authors.

Innovation in the food and beverage industry

The food and beverage manufacturing industry is the largest sector in Ecuador. According to the Central Bank of Ecuador, this industry had a gross fixed capital formation (FBKF), in thousands of dollars, of $ 1 608 242 in 2019 and a Gross Value Added (GVA) of 5.21% in 2020 relative to the Gross Domestic Product (GDP), with which figures it is positioned at the head of the other manufacturing industries (BCE, 2020; Spanish: Banco Central del Ecuador). These two indicators are important since the FBKF reflects investment in modernization and expansion, while the GVA indicates the economic contribution and efficiency in the food industry, thus showing connections with innovation. In addition, it has consolidated itself within the manufacturing industry as one of the most important sectors since it produces 38% of food and beverage products in Ecuador (INEC, 2020; Spanish: Instituto Nacional de Estadística y Censos). In terms of structure, it is strongly weighted toward microenterprises with 47.85% of the total number of companies in the sector. Medium-sized companies represent 13.02%, large companies have 9.34% of the total number of companies, and the remaining 0.63% are companies that do not fall under any classification (SUPERCIAS, 2020; Spanish: Superintendencia de Compañias, Valores y Seguros).

The province of Tungurahua was considered to be included in the study in this research since its contribution to the economy is considerable; additionally, it is one of the provinces that generates the greatest production at the national level and offers a large number of jobs (Espinel López & Aguilar Echeverría, 2019). It is a region with high economic dynamics and a strong concentration of manufacturing industry (Coello Gómez, 2016).

According to a report of the Supply Use accounts of the Central Bank of Ecuador, Tungurahua contributes 3.2% of the national GDP and is the province with the seventh-highest contribution to the country's manufacturing GDP (BCE, 2020). This is largely due to several production sectors, such as the food, textile, metallurgical, and construction industries (Tamayo Viera et al., 2021). In addition, the province has a strategic geographical location, as it is located in the center of Ecuador, facilitating trade and the exchange of goods with other regions of the country and abroad (Coello Gómez, 2016; Tamayo Viera et al., 2021). In short, Tungurahua has become an important pole of economic development, and its manufacturing production capacity contributes significantly to the country's growth.

The food sector encompasses a huge diversity of production activities. This sector has over 5 912 companies whose investment in R&D is 0.23% in terms of turnover (Orellana, 2017). In this regard, Gutiérrez Ponce and Palacios Duarte (2015) state that the food industry is a mature industry considering the time it has been in the market, as well as the positioning of its products. Nevertheless, this industry has a low level of technological specialization and is dominated by small companies instead of multinational companies. In this context, innovation is one of the most important factors that enable companies to challenge major competitors in national and international markets (Álvarez Castañón & Bolaños Evia, 2014; Saldarriaga Salazar et al., 2019). It is important to highlight that these companies face modifications concerning new regulations, changes in consumer preferences, and complex and structural transformations in the industry (Nieto & Santamaría, 2007; Sarkar & Costa, 2008). Therefore, increasing innovation is a primary requirement for the development of the food and beverage industry.

These transformations have been identified by Melgarejo and Simon Elorz (2019) as the sector is moving from a supply-driven approach to a demand-driven approach. Several authors are working on the importance of consumer drive for innovation in this sector (Melgarejo & Simon Elorz, 2019; Torres Salazar et al., 2018). More specifically, innovation trends in the food sector are oriented toward sustainability, economy, health, biotechnology, and the effects of climate change on consumer preferences and interests (Capitanio et al., 2010; Lybbert & Sumner, 2012).

In terms of the types of innovations developed, another aspect of the behavior of food companies is that innovations in this sector are predominantly incremental rather than radical (Cano Salazar, 2012; Grunert et al., 2008). Most innovations comprise improvements or variations of existing products, and patented food technology is highly concentrated in multinationals (Gu et al., 2016). The predominance of the incremental nature of innovation is related to demand constraints and conservative consumer behavior (Cano Salazar, 2012). Nevertheless, investment in R&D drives companies to engage in radical innovation by allocating resources to research new technologies and approaches, which fosters the creation of disruptive solutions and revolutionary products in the market (Sánchez Jordán, 2011). On the other hand, the traditional stability of the sector is likely to undergo a major trend change in terms of complexity and

forms of innovation. Open innovation is one of these forms, which increases the number of radical innovations in a collaborative environment that translates into good results (Gill, 2013; Pineda Ospina, 2015).

In short, several factors favor the development of various innovation options and may lead this sector to show more interest in these innovative development paths (OECD, 2005). One of the main factors that drive companies to generate innovation is to increase their competitive level in the market. Such is the case of the German dairy market studied by Mandolesi et al. (2015), who state that innovation boosts competitiveness by adding value to the company through new products or services. The research builds on the views of Kotler, who expands on the perception that innovation beyond technological changes considers both producer and consumer perspectives. This factor and others include intense collaboration along the industry's value chain (agriculture, food processing, and distribution), the pace of change, intense competitiveness, and the small business size of its productive fabric (Pineda Ospina, 2015).

This is also highlighted by several authors who have studied the effect of innovation strategies in companies through case studies, such as Lybbert and Sumner (2012) and Pineda Ospina (2015). Other studies use samples, such as Capitanio et al. (2010) and Nieto and Santamaría (2007). These studies show that innovation is the appropriate paradigm to address the food industry's new challenges.

Methodology

This study is quantitative research on innovation in Ecuador's food and beverage sector at an explanatory level.

The methodology was developed through the following stages:

Stage 1: Sources and data collection

a) Identification of information sources

The Science, Technology, and Innovation Activities (ACTI; Spanish: Actividades de Ciencia, Tecnología e Innovación) survey was used for 2012-2014 at the Ecuadorian level. This survey was applied by the National Institute of Statistics and Census throughout the Ecuadorian territory in 2015 and reports the main indicators related to scientific research, technological development, and innovation in the country. It also provides information on companies' investments in activities to support innovation (INEC, 2015).

For the study of this sector in the province of Tungurahua in 2018-2021, a questionnaire was prepared based mostly on the survey of activities, science, technology, and innovation (ACTI). It is worth mentioning that the ACTI survey, taken from the official INEC website, is the most recent survey on innovation and has been little exploited in scientific research. The data extracted from the survey correspond to the activities detailed in Table 1, i.e., investment in R&D and OACTI.

b) Identification of the Study Universe

In Ecuador, the survey was applied to all the companies that report information in the ACTI survey, i.e. 468 food and beverage companies. In Tungurahua, the survey was conducted with 152 active companies registered with the SRI (Spanish: Servicio de Rentas Internas), with a response rate of 87.5%, i.e., 133 companies participated in the research.

c) Field research application

The application of the survey in the province of Tungurahua was carried out with the support of the Chamber of Industries and Production of Tungurahua (CIPT; Spanish: Cámara de Industrias y Producción de Tungurahua) and the Chamber of Commerce of Ambato (CCA; Spanish: Cámara de Comercio de Ambato), which provided updated information to build a new database of companies, based on the register of companies belonging to this industrial sector. In addition, the Internal Revenue Service (SRI) register was used to verify that the companies were active. Thus, information was collected through the questionnaire regarding investment in Research, Development, and Innovation (R&D&I) activities with the selected companies in 2018-2021.

The new survey is a structured and parameterized questionnaire according to the ACTI survey, which contains some dichotomous questions of an informative nature, and the amounts of investment in innovation. This survey was conducted in September, October, and November 2022. Thus, the necessary information was obtained to determine the probability that companies in the food and beverage sector, both in Ecuador and Tungurahua, will produce a new good based on specific variables.

Stage 2: Statistical analysis and variables

Prior to the probabilistic study, descriptive statistical tools were used to summarize the data. To this end, this research used descriptive analysis to examine the investment, research, and development activities in monetary values. The amount invested by each company in innovation was then recorded. The analysis results reported the mean, standard deviation, coefficient of variation, and minimum and maximum values (Hernández Martín, 2012).

On the other hand, using Inferential Statistics, the Logit model was applied, which predicts the probability of occurrence of an event under certain established conditions. In this case, the Logit model

was developed to predict the probability of producing a new good based on specific variables related to investment in innovation (García Pérez & Carrasco Bañuelos, 2005).

For the development of the Logit model, the following dependent variables were considered in their dichotomous form:

$$\text{Dependent variable } Y_{\text{Ecuador}} = \begin{cases} 0\ (\text{No}).\ \text{Does not produce a new good} \\ 1\ (\text{Yes}).\ \text{Produces a new good} \end{cases} \tag{1}$$

$$\text{Dependent variable } Y_{\text{Tungurahua}} = \begin{cases} 0\ (\text{No}).\ \text{Does not produce a new good} \\ 1\ (\text{Yes}).\ \text{Produces a new good} \end{cases} \tag{2}$$

The independent variables used, which are associated with the probability of producing a new good, are detailed in Table 1:

Table 1
Independent variables

	Variable - Investment	Abbreviation
Other Science, Technology and Innovation Activities (OACTI)	Research & Development (R&D)	ID
	Machinery and equipment	v_4_a
	Hardware	v_4_b
	Software	v_4_c
	Disembodied technology	v_4_d
	Consultancies	v_4_e
	Engineering and industrial design	v_4_f
	Training	v_4_g
	Market research	v_4_h

The variable OACTI represents the set of variables v_4_a +...+ v_4_h according to INEC & SENESCYT (2016) (Spanish: Secretaría de Educación Superior, Ciencia, Tecnologia e Innovación)
Source: created by the authors

Stage 3: Probabilistic model

Linear probabilistic models present limitations that have motivated the search for alternative models that permit the estimation of more reliable results when dealing with dichotomous variables. In order to avoid the estimated endogenous variable being outside the range (0, 1), nonlinear probability models have been

developed, such as the case of the Logit model, where the specification function guarantees that the estimation result is between 0 and 1.

Among the available alternatives of these models, the most widely used is the logistic distribution function, which relates the endogenous variable Yi to the explanatory variable Xi. The present research uses the Logit model, where Yi corresponds to producing a new good and Xi to investing in R&D and OACTI innovations. Regarding the interpretation of the parameters estimated through this model, it is important to note that the sign of the parameters indicates the direction in which the probability moves when the associated explanatory variable increases (Trejo García et al., 2017).

The following is the general equation of the Logit model that evaluates p_i corresponding to the probability that a new good will be produced.

$$E(Y_1) = \text{Prob}(Y_i = 1) = p_i = \frac{e^{\beta_0 + \beta_k X_k}}{1 + e^{\beta_0 + \beta_k X_k}} \quad (3)$$

Given the above, the proposed equations derived from the Logit model, both at the level of Ecuador and the province of Tungurahua, are shown in Table 2:

Table 2
Logit model equations

Ecuador 2012-2014	Tungurahua 2018-2021
$\text{New good}_{Ecu} = \beta_1 ID + \beta_2 OACTI$ (2)	$\text{New good}_{Tun} = \beta_1 ID + \beta_2 OACTI$ (3)

ID corresponds to R&D. The variable OACTI represents the set of variables v_4_a +...+ v_4_h in Table 1 according to INEC & SENESCYT (2016)
Source: created by the authors

Likewise, the formula corresponding to the occurrence quotient, or odds ratio, which represents the ratio between the probabilities of an event occurring in a group versus the probability of it not occurring, is proposed (Cerda et al., 2013).

$$\text{Odds ratio} = \frac{pi}{(1 - pi)} = e^{\beta_0 + \beta_k X_k} \quad (4)$$

Odds ratios can range from zero to any positive number, depending on the strength of the association between the two variables. An odds ratio greater than 1 means a greater probability of the event occurring in the exposed population; likewise, an odds ratio with a value equal to 1 means no difference in the probability of the event occurring or not occurring. On the other hand, an odds ratio lower than 1 means a lower probability that the event occurs in the study population (Dominguez-Lara, 2018).

$$\text{Odds ratio} = \frac{\frac{pi}{(1-p)}}{\frac{pj}{(1-pj)}} = \frac{e^{\beta_0+\beta_k X_{ki}}}{1+e^{\beta_0+\beta_k X_{kj}}} = e^{\beta_k(X_{ii}-X_{jj})} \quad (5)$$

Given the multiple linear regression model, the following equation represents the pi value for the calculation of the probabilities:

$$pi = \left(\frac{e^{\beta_0+\beta_k X_{ki}}}{1+e^{\beta_0+\beta_k X_{kj}}}\right) = \left(\frac{1}{1+e^{-(\beta_0+\beta_k X_{kj})}}\right) \quad (6)$$

Results and discussion

Descriptive analysis

Table 3
Descriptive statistics of research and development (R&D) and other science, technology, and innovation (OACTI) variables in Ecuador and Tungurahua

Statistic	Investment in R&D Ecuador 2012-2014	Investment in R&D Tungurahua 2018-2021	Investment in other science and technology activities Ecuador 2012-2014	Investment in other science and technology activities Tungurahua 2018-2021
Mean	$ 26 065.74	$ 44 591.25	$ 23 9630.20	$ 9 4991.67
Standard deviation	12 5425.35	257 108.00	99 0705.28	503 771.58
Variation coefficient	4.81	5.77	4.13	5.30
Minimum	$0.00	$0.00	$0.00	$0.00
Maximum	$1 605 000.00	$2 800 000.00	$ 13 939 920.00	$ 5 021 700.00

Source: created by the authors

Logit model for the study at the level of Ecuador 2012-2014

According to López-Roldán and Fachelli (2016), to be considered efficient, a Logit model must meet two fundamental requirements: good predictive capacity and high precision in estimating the parameters. In addition, the model must be as simple as possible, i.e., it must have the smallest number of explanatory variables and simultaneously meet the two previous requirements. The Logit model was created according

to the indicated methodology in order to fulfill the objective of the research by calculating the probability that companies in the C10 (food processing) and C11 (beverage processing) sectors in Ecuador generate a new good based on the study variables, referring to investment in research, development, and innovation. Accordingly, Table 4 reports the results obtained under the following criteria: logit coefficient (B), standard error, Wald statistic, which measures the normality of the B coefficient of the Logit model to affirm that it is different from 0, and the p-value.

The Cox and Snell R-squared (0.195) and Nagelkerke R-squared (0.312) values indicate the ratio of variance of the dependent variable (probability of generating a new good) that is explained by the fitted logistic regression model (ID and OACTI predictor variables) compared to the null model that only includes the constant. The Hosmer and Lemeshow test value (0.079) is the goodness of fit measure of the model; values close to 0 indicate a good fit. The Pseudo R^2 statistic of the model is 80.6%, a result that indicates good model performance. Overall, the results suggest that the ID (R&D) and OACTI variables directly impact the probability of generating new goods in Ecuador's food and beverage industry.

Table 4
Logit regression of the model for Ecuador 2012-2014

Variable	Abbreviation	Logit Coef. (B)	Standard error	Wald	p-value
R&D	ID	1.3853	0.3076	20.2810	0.0000***
Other science, technology, and innovation activities	OACTI	1.8269	0.4282	18.1989	0.0000***
Constant	C	-3.4334	0.3652	88.3986	0.0000***
Cox and Snell R-square				0.195	
Nagelkerke R square				0.312	
Hosmer and Lemeshow's test				0.024	
% of cases correctly estimated (Pseudo R^2)				0.806	
Number of cases				468	

Results according to the sample of 468 food and beverage companies in Ecuador 2012-2014. (***) Significance at 1%
The variable OACTI represents the set of variables v_4_a +...+ v_4_h from Table 1 according to INEC & SENESCYT (2016)
Source: created by the authors

Logistic regression in the Ecuador 2012-2014 scenario

For the development of the Logit model with the data on innovation in Ecuador 2012-2014, a binary logistic regression was performed for the second time due to the weak significance of variables such as investment in machinery and equipment, hardware, software, disembodied technology, consulting, engineering and industrial design, training, and market research. In order to determine which variables

should be unified, the Wald statistic test was used. This test compares the null hypothesis H0: $\beta i = 0$ against the alternative hypothesis H1: $\beta i \neq 0$ (Dominguez-Lara, 2018). In this context, it was decided to unify the abovementioned variables into a new one, called OACTI, which encompasses the other science, technology, and innovation activities not belonging to research and development R&D.

It is observed in the results reported in Table 4 that the p-values are highly significant when evaluated at a significance level of 1%. On the other hand, the coefficients of the Logit model indicate a change in the estimated model when experiencing the unit change in a specific predictor variable. Based on this background, Table 5 shows that investment in innovation increases the ratio of producing a new good by 3.996 times. Similarly, it is observed that this ratio rises even more in the case of OACTIs, as the ratio increases by 6.214 times. These results show a common pattern in the food and beverage industry, which is a mature sector, given its positioning, as stated by Capitanio et al. (2010) and Pineda Ospina (2015), who also states that other activities related to innovation, such as the acquisition of machinery and equipment (OACTI), are the most used in the food and beverage industry, and contribute to the increase in the probability of inducing innovations.

Table 5
Odds ratio estimation of the model for Ecuador 2012-2014

Variable	Abbreviation	Odds ratio	p-value
R&D	ID	3.996	0.0000***
Other science, technology, and innovation activities	OACTI	6.214	0.0000***
Constant	C	0.032	0.0000***

Results according to the sample of 468 food and beverage companies in Ecuador 2012-2014. (***) Significance at 1%
The variable OACTI represents the set of variables v_4_a +...+ v_4_h from Table 1 according to INEC & SENESCYT (2016)
Source: created by the authors

Logit model for the study at the level of the province of Tungurahua 2018-2021

Tungurahua is a province in central Ecuador with high rates of manufacturing activity (Cacho & Espinoza Layana, 2019). The results of the innovation study in this province are presented in Table 6; they include the logit coefficient (B), the standard error, the Wald statistic, and the p-value. Confidence statistics such as Cox and Snell (0.090) and Nagelkerke (0.191) are reported, which were lower than those obtained at the level of Ecuador from 2012 to 2014. The Hosmer and Lemeshow goodness of fit statistic (0.079) has a significance of 10%, so the proposed model is a good fit. Finally, the Pseudo R^2 is 90.20%, ten percentage points higher than the previous model, and indicates a high estimation percentage.

Similarly to what happened with the first logarithmic regression, the variables presented in R&D and OACTI are significant at a 95% confidence level. Therefore, the impact of these innovations on the probability of generating new goods in Tungurahua's food and beverage industry for 2018-2021 is significant.

Table 6
Logit regression estimation of the model for Tungurahua 2018-2021

Variable	Abbreviation	Logit Coef. (B)	Standard error	Wald	p-value
R&D	ID	1.9033	0.7036	7.3172	0.0068 **
Other science, technology, and innovation activities	OACTI	-2.3537	1.0813	4.7379	0.0295 **
Constant	C	3.4087	1.0162	11.2508	0.0008***
Cox and Snell R-square				0.090	
Nagelkerke R square				0.191	
Hosmer and Lemeshow's test				0.079	
% of correctly estimated cases (Pseudo R-squared)				0.902	
Number of cases				133	

Results according to the sample of 133 food and beverage companies in Tungurahua 2018-2021. (***) Significance at 1%; (**) Significance at 5%
Source: created by the authors

Logistic regression in the Tungurahua scenario 2018-2021

Similarly to the Logit model developed for Ecuador 2012-2014, in the case of the province of Tungurahua the explanatory variables of innovation, which individually did not prove to be significant, were unified into a new variable called OACTI. This includes the Wald and p-value statistics for the abovementioned unification, referring to the variables included within the OACTI.

Table 7 shows the results of the odds ratios for each significant variable. Thus, the investment in R&D made by the food and beverage processing companies in Tungurahua led to 6 708 times the production of a new good in the companies that carry out R&D activities, compared to a group that does not. In this scenario, twice the odds ratio was obtained for Ecuador, assuming a significant change was obtained. On the other hand, the odds ratio of OACTIs decreased significantly to only 0.095 times of generating new goods. This is reflected in the constant of the model, which has an odds ratio of 30 times, implying that other factors, such as the number of employees allocated for R&D&I or the business intention to introduce products to new customer groups or new markets, among others, may determine the

generation of new products in this industry in Tungurahua (OECD & Eurostat, 2018; Torres Salazar et al., 2018).

The increase in the odds ratio generated by investment in R&D and the decline in other Science, Technology, and Innovation activities (OACTI) in this productive sector of Tungurahua may be due to changes in the economic context of the sector, for example, external factors such as recessions, pandemics, or crises, among others (ECLAC, 2020). This means that food and beverage companies in this region opted to make greater efforts in research and development to generate new goods, leaving aside the traditional activities proposed by Pineda Ospina (2015); that is, traditional activities such as the purchase of machinery, equipment, and industrial development technology (OACTI) were less relevant to introducing innovations in the Tungurahua market between 2018 and 2021.

Table *7*
Estimation of model odds ratios for Tungurahua 2018-2021

Variable	Abbreviation	Odds ratio	P-value
R&D	ID	6.708	0.0068 **
Other science, technology, and innovation activities	OACTI	0.095	0.0295 **
Constant	C	30.226	0.0008***

Results according to the sample of 133 food and beverage companies in Tungurahua 2018-2021. (***) Significance at 1%; (**) Significance at 5%
The variable OACTI represents the set of variables v_4_a +...+ v_4_h from Table 1 according to INEC & SENESCYT (2016)
Source: created by the authors

Probability of generating new goods in Ecuador 2012-2014 and Tungurahua 2018-2021

Given the R&D and OACTI activities, the Logit conversion of the formula (6) was used to calculate the probability of generating a new good (PGBN). The main findings of the evolution of the probability of generating new goods within Ecuador and its Tungurahua province are detailed below.

Table 8 shows the probabilities of generating a new good in the food and beverage processing sector at the national and provincial levels in different periods: Ecuador 2012-2014 and Tungurahua 2018-2021. Some outstanding aspects were found when comparing the probabilities in both scenarios and periods. Thus, there is an increase in the probability of generating a new good in most sectors in Tungurahua compared to Ecuador in 2012-2014. The sectors with the largest increases are C103, with an

increase of 32.53%; C106, with an increase of 56.13%; and C107, with an increase of 60.91%. The sectors with the lowest increases are C102 and C108, with an increase of only 6.29% and 28.25% respectively.

It is important to clarify that the causes or reasons for these increases in the probabilities of generating a new good in Tungurahua compared to Ecuador in 2012-2014 may be due to several factors that contributed to these changes, such as economic development, investment in research and development, government policies, and availability of natural resources, among others. This analysis overviews a specific moment and is susceptible to variations and fluctuations in probabilities at different times.

Table 8
Probabilities of generating a new good in the food and beverage industry

ISIC: International Standard Classification	*2012-2014 PGBN in Ecuador	*PGBN 2018-2021 in Tungurahua
C101: Meat processing and preservation	19.56%	48.21%
C102: Processing and preservation of fish, crustaceans, and mollusks	19.20%	25.49%
C103: Processing and preservation of fruits and vegetables	25.08%	57.61%
C104: Processing of vegetable and animal oils and fats	19.20%	44.62%
C105: Dairy product processing	24.42%	41.33%
C106: Processing of milling products, starches, and starch products	17.84%	74.97%
C107: Processing of other food products	16.69%	77.60%
C108: Processing of prepared animal feeds	17.40%	45.65%
C110: Beverage manufacturing	19.07%	64.13%

*Probability of generating new goods
Source: created by the authors

Conclusions

In this section, conclusions are drawn from the results obtained regarding the factors that influence the probability that companies in the food and beverage sector, both in Ecuador in 2012-2014 and the province

of Tungurahua in 2018-2021, produce new products, given that the creation of a new good is a source of innovation that contributes significantly to the level of competitiveness of companies in this sector.

Based on the results obtained, it is concluded that investment in research and development is the main factor that increases the likelihood that companies will innovate by creating new products. This investment allows companies to be at the forefront of technology and market trends, which enables them to remain competitive and attract an increasingly demanding customer base. In addition, by increasing their capacity to innovate, companies can improve their productivity and profitability in the long run. Importantly, investment in research and development affects the creation of new products, process improvement, and cost reduction.

In this study, it was possible to identify two variables that increase the probability of generating new goods within the companies dedicated to food and beverage processing for both Ecuador and Tungurahua. In the case of the model for Ecuador from 2012 to 2014, it was estimated that the variable that has the greatest contribution to increasing the possibilities of generating radical innovations is investment in the OACTIs. Shifting the perspective toward the province of Tungurahua, it is concluded that investing in R&D activities positively correlates with the probability of generating new goods, while investing in the OACTIs has a lower contribution to generating new goods. The probability that companies in the food and beverage sector produce a new good based on investment in research, development, and innovation has increased significantly. This represents a notable change in how new products were generated in Ecuador's food and beverage sector eight years ago, compared to what has occurred in the province of Tungurahua in recent years.

The subsectors of the food and beverage production industry branch that exhibit the highest levels of increase in the probability of generating a new good are processing and preserving of fruits and vegetables (C103) with an increase of 32.53%, followed by processing of mill products, starches, and starch products (C106) with an increase of 57.13%, and processing of other food products (C107) with an increase of 60.91%. Nevertheless, it is important to remember that the study is based on analyses of specific periods and geographic areas and could vary in other contexts, which opens opportunities for further research. Finally, the results of this research provide evidence of the fulfillment of the research objective, thus obtaining a clear vision of the difference of innovation in the food industry in Ecuador 2012-2014 and in the province of Tungurahua 2018-2021, through the measurement of the probability of producing new goods.

References

Acosta Castillo, V. M., Vega Morejón, B. A., González Illescas, M. L., & Carmenate Fuentes, L. P. (2020). Tipos de Innovación como Estrategias de Adaptación al Dinamismo de los Mercados. INNOVA Research Journal, 5(3), 1–21. https://doi.org/10.33890/innova.v5.n3.2020.1288

Álvarez Castañón, L. del C., & Bolaños Evia, G. R. (2014). Innovación y Estrategia: dos conceptos aparentemente contradictorios. Nova Scientia, 3(5), 118. https://doi.org/10.21640/ns.v3i5.203

Barona Zuluaga, B., Rivera Godoy, J. A., & Garizado Román, P. A. (2017). Inversión y financiación en empresas innovadoras del sector servicios en Colombia. Revista Finanzas y Politica Economica, 9(2), 345–372. https://doi.org/10.14718/revfinanzpolitecon.2017.9.2.7

Bayona Saez, C., Cruz Cázares, C., García Marco, T., & Sánchez García, M. (2017). Open innovation in the food and beverage industry. Management Decision, 55(3), 526–546. https://doi.org/https://doi.org/10.1108/MD-04-2016-0213

BCE. (2020). Cuentas Nacionalaes. Formación Bruta de Capital Fijo. Available in: https://contenido.bce.fin.ec/documentos/PublicacionesNotas/Catalogo/CuentasNacionales/Anuales/Dolares/IndiceCtasNac.htm. Consultado: 17/12/2022

Bellota Vasquez, L. E., Huanchi Palacios, D. O., Palacios Muñoz, J. A., Torres Meier, J. I., & Verastegui Ñaupari, E. H. (2021). Estrategias de Publicidad que utiliza Coca-Cola en la población centennial latinoamericana en los últimos tres años. Repositorio Universidad de Lima. Available in: https://repositorio.ulima.edu.pe/bitstream/handle/20.500.12724/13973/Bellota-Huanchi-Palacios-Torres-Verastegui_Publicidad-CocaCola.pdf?sequence=1&isAllowed=y. Consultado: 25/09/2023

Cacho, M. J., & Espinoza Layana, D. (2019). Análisis Econométrico de la Producción en la Industria de Alimentos y Bebidas del Ecuador Durante el Periodo 2007 – 2017. Pedientes Económicos, 3(6), 6–22. Available in: http://portal.amelica.org/ameli/jatsRepo/392/3921933007/index.html. Consultado: 22/11/2022

Calderón, G. G. A., García, V. G. A., & Lafuente, A. M. G. (2015). Análisis de innovación en la pequeña y mediana empresa del sector productivo aplicando Data Envelopment Analysis (DEA). Repositorio de La Red Internacional de Investigadores En Competitividad, 9(1), 1158–1176. Available in: https://www.riico.net/index.php/riico/article/view/64. Consultado: 09/01/2023

Cano Salazar, J. A. (2012). La innovación en alimentos. Revista Lasallista de Investigación, 9(2), 9–10. Available in: http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=87002942&lang=es&site=ehost-live. Consultado: 31/12/2022

Capitanio, F., Coppola, A., & Pascucci, S. (2010). Product and process innovation in the Italian food industry. Agribusiness, 26(4), 503–518. https://doi.org/10.1002/agr.20239

CEPAL. (2020). Sectores y empresas frente al COVID-19: emergencia y reactivación. Available in: https://hdl.handle.net/11362/45734. Consultado: 14/02/2023

Cerda, J., Vera, C., & Rada, G. (2013). Odds ratio: Aspectos teóricos y prácticos. Revista Medica de Chile, 141(10), 1329–1335. https://doi.org/10.4067/S0034-98872013001000014

Chesbrough, H. (2017). The Future of Open Innovation. Research-Technology Management, 60(1), 35–38. https://doi.org/10.1080/08956308.2017.1255054

Chesbrough, H. W. (2003). Open Innovation: The New Imperative for Creating and Profiting from Technology (Harvard Business Press (ed.); ilustrada). Harvard Businesss school publishing corporation. Available in: https://books.google.com.ec/books?id=4hTRWStFhVgC&printsec=frontcover&hl=es#v=onepage&q&f=false Consultado: 07/12/2022

Coello Gómez, G. (2016). Industria manufacturera y crecimiento económico en la provincia de Tungurahua. Bolentín de Coyuntura, 1(11), 16. https://doi.org/10.31164/bcoyu.11.2016.620

Dewar, R. D., & Dutton, J. E. (1986). The Adoption of Radical and Incremental Innovations: An Empirical Analysis. Management Science, 32(11), 1422–1433. https://doi.org/https://doi.org/10.1287/mnsc.32.11.1422

Díaz Hincapié, F. I., Melgarejo Molina, Z. A., & Vera Colina, M. A. (2021). Relación entre innovación y crecimiento empresarial en la pyme de la industria de alimentos y bebidas de Bogotá, Colombia. Revista de Investigación, Desarrollo e Innovación, 11(3), 493–506. https://doi.org/10.19053/20278306.v11.n3.2021.13346

Dominguez-Lara, S. A. (2018). El odds ratio y su interpretación como magnitud del efecto en investigación. Educación Médica, 19(1), 65–66. https://doi.org/10.1016/j.edumed.2017.01.008

Erazo Merino, M. A. (2018). Análisis situacional de la innovación empresarial en el Ecuador. Universidad Andina Simón Bolívar. Available in: https://repositorio.uasb.edu.ec/bitstream/10644/6239/1/T2670-MAE-Erazo-Analisis.pdf. Consultado: 26/01/2023

Espinel López, C., & Aguilar Echeverría, M. (2019). Desarrollo territorial de la provincia de Tungurahua y su efecto en la economía del Ecuador entre el período 2010- 2015. Observatorio de La Economía Latinoamericana. Available in: https://www.eumed.net/rev/oel/2019/07/desarrollo-territorial-tungurahua.html. Consultado: 14/09/2023

Forés, B., & Camisón, C. (2016). Does incremental and radical innovation performance depend on different types of knowledge accumulation capabilities and organizational size? Journal of Business Research, 69(2), 831–848. https://doi.org/10.1016/j.jbusres.2015.07.006

Fuentes-Pérez, E. M. (2020). industria alimentaria frente a la nueva normalidad post COVID-19. CienciAmérica, 9(2), 45–50. https://doi.org/10.33210/ca.v9i2.290

Garcia Martinez, M., & Briz, J. (2000). Innovation in the Spanish food & Drink industry. International Food and Agribusiness Management Review, 3(2), 155–176. https://doi.org/10.1016/s1096-7508(00)00033-1

García Pérez, E., & Carrasco Bañuelos, E. (2005). Aplicación logit a la predicción de rendimientos bursátiles. Investigaciones Europeas de Dirección y Economía de La Empresa (IEDEE), 11(3), 99–113. Available in: http://www.redalyc.org/articulo.oa?id=274120410006. Consultado: 30/09/2023

Gill, G. (2013). Innovación Alimentaria. Editorial Sintesis. Available in: https://www.sintesis.com/data/indices/9788490774939.pdf. Consultado: 19/11/2022

Grunert, K. G., Jensen, B. B., Sonne, A. M., Brunsø, K., Byrne, D. V., Clausen, C., Friis, A., Holm, L., Hyldig, G., Kristensen, N. H., Lettl, C., & Scholderer, J. (2008). User-oriented innovation in the food sector: relevant streams of research and an agenda for future work. Trends in Food Science and Technology, 19(11), 590–602. https://doi.org/10.1016/j.tifs.2008.03.008

Gu, Q., Jiang, W., & Wang, G. G. (2016). Effects of external and internal sources on innovation performance in Chinese high-tech SMEs: A resource-based perspective. Journal of Engineering and Technology Management - JET-M, 40(2015), 76–86. https://doi.org/10.1016/j.jengtecman.2016.04.003

Gutiérrez Ponce, H., & Palacios Duarte, P. D. (2015). Factores De La Innovación Y Su Influencia en las ventas y el empleo. 34(65), 401–422. https://doi.org/10.15446/cuad.econ.v34n65.41871.Este

Hernández, J., Tirado, P., & Ariza, A. (2016). El concepto de innovación social: ámbitos, definiciones y alcances teóricos. CIRIEC-España, Revista de Economía Pública, Social y Cooperativa, 88, 165–199. Available in: http://www.redalyc.org/articulo.oa?id=17449696006. Consultado: 09/01/2023

Hernández Martín, Z. (2012). Métodos de análisis de datos: Apuntes (6th ed.). Universidad de La Rioja. Available in: http://www.redalyc.org/articulo.oa?id=17449696006 Consultado: 05/02/2023

INEC. (2015). Encuesta Nacional de Actividades de Ciencia, Tecnología e Innovación-ACTI. Available in: https://www.ecuadorencifras.gob.ec/encuesta-nacional-de-actividades-de-ciencia-tecnologia-e-innovacion-acti/. Consultado: 15/11/2022

INEC. (2020). Encuesta a Empresas. Encuesta Estructural a Empresas ENESEM. Available in: https://www.ecuadorencifras.gob.ec/encuesta-a-empresas/. Consultado: 15/11/2022

INEC, & SENESCYT. (2016). Encuesta Nacional de Actividades de Innovación (AI): Metodología 2016, Noviembre (INEC & SENESCYT (eds.); Segunda). INEC. Available in: http://www.ecuadorencifras.gob.ec/documentos/web-inec/Estadisticas_Economicas/Ciencia_Tecnologia-ACTI/2012-2014/Innovacion/MetodologIaINN 2015.pdf. Consultado: 15/11/2022

López-Roldán, P., & Fachelli, S. (2016). Análisis de Regresión Logística. In Metodología de la Investigación Social Cuantitativa (Primera). Universitat Autònoma de Barcelona. Available in: https://ddd.uab.cat/pub/caplli/2016/163570/metinvsoccua_a2016_cap3-10.pdf. Consultado: 18/09/2023

López Sánchez, J. I., Minguela Rata, B., Rodríguez Duarte, A., & Sandulli, F. D. (2006). Innovaciones incrementales e innovaciones radicales. Cuadernos de Estudios Empresariales, 16, 33–53. Available in: https://revistas.ucm.es/index.php/CESE/article/download/CESE0606110033A/9463. Consultado: 03/02/2023

Lybbert, T. J., & Sumner, D. A. (2012). Agricultural technologies for climate change in developing countries: Policy options for innovation and technology diffusion. Food Policy, 37(1), 114–123. https://doi.org/10.1016/j.foodpol.2011.11.001

Mandolesi, S., Nicholas, P., Naspetti, S., & Zanoli, R. (2015). Identifying viewpoints on innovation in low-input and organic dairy supply chains : A Q-methodological study. Food Policy, 54, 25–34. https://doi.org/10.1016/j.foodpol.2015.04.008

Melgarejo, Z., & Simon Elorz, K. (2019). Desempeño empresarial y ciclo económico en la industria de alimentos y bebidas colombiana: una aproximación no paramétrica. Estudios Gerenciales, 35(151), 190-202. https://doi.org/10.18046/j.estger.2019.151.3162

Mucho mejor Ecuador. (2022, June 28). El sector de alimentos y bebidas, un mercado que sigue creciendo en el Ecuador. Available in: https://muchomejorecuador.org.ec/elementor-26163/. Consultado: 10/12/2022

Nieto, M. J., & Santamaría, L. (2007). The importance of diverse collaborative networks for the novelty of product innovation. Technovation, 27(6–7), 367–377. https://doi.org/10.1016/j.technovation.2006.10.001

OECD. (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. In EUROSTAT (Tercera). Tragsa. Available in: http://www.itq.edu.mx/convocatorias/manualdeoslo.pdf. Consultado: 28/01/2023

OECD & Eurostat. (2018). Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation. Available in: https://www.oecd.org/science/oslo-manual-2018-9789264304604-en.htm. Consultado: 25/01/2023

Orellana, D. (2017). La innovación tecnológica y su incidencia en la competitividad empresarial de las pymes de la industria manufacturera de la provincia del Azuay - Ecuador. In Repositorio de Tesis - UNMSM. Universidad Nacional Mayor de San Marcos. Available in: https://cybertesis.unmsm.edu.pe/handle/20.500.12672/6863. Consultado: 15/12/2022

Ospina Vélez, J. A. (2009). Determinantes de la inversión en innovación en el sector de Bogotá: Estimaciones econométri cas a nivel de la firma. Ensayos Sobre Politica Economica, 60(1), 110–167. https://doi.org/10.32468/espe.6004

Pineda Ospina, D. L. (2015). Bibliometric analysis for the identification of factors of innovation in the food industry. AD-Minister, 27, 95–126. https://doi.org/10.17230/ad-minister.27.5

Pronaca. (2022). Alimentamos nuestra innovación: ¡Llega a Pronaca "Veggie Deli! Pronaca. Available in: https://www.pronaca.com/alimentamos-nuestra-innovacion-llega-a-pronaca-veggie-deli/. Consultado: 22/09/2023

Quintero-Campos, L. J. (2010). Aportes teóricos para el estudio de un sistema de innovación. Innovar, 20(38), 57–76. Available in: http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0121-50512010000300006. Consultado: 11/02/2023

Quiroga Parra, D., Hernández, B., Torrent Sellens, J., & Ramírez, J. F. (2014). La innovación de productos en las empresas: Caso empresa América Latina. Cuadernos Del Cendes, 31(87), 63–85. Available in: http://www.redalyc.org/articulo.oa?id=40338661004. Consultado: 01/12/2022

Robayo Acuña, P. V. (2016). La innovación como proceso y su gestión en la organización: una aplicación para el sector gráfico colombiano. Suma de Negocios, 7(16), 125–140. https://doi.org/10.1016/j.sumneg.2016.02.007

Saldarriaga Salazar, M. E., Guzmán González, M. F., & Concha Cerón, E. A. (2019). Innovación Empresarial: Factor de competitividad y calidad de vida en Popayán, Colombia. Revista Venezolana de Gerencia, 2(1315–9984). https://doi.org/10.37960/revista.v24i2.31486

Sánchez Giler, S., García Regalado, J. O., & Holguín Alvarado, W. F. (2019). Industria ecuatoriana de elaboración de productos alimenticios: Análisis econométrico de indicadores de rentabilidad, período 2010-2017. Revista Espacios, 40(1), 27. Available in: https://www.revistaespacios.com/a19v40n01/a19v40n01p27.pdf. Consultado: 20/01/2023

Sánchez Jordán, J. C. (2011). La innovación: una revisión teórica desde la perspectiva de marketing. Perspectivas, 27, 47–71. Available in: https://www.redalyc.org/pdf/4259/425941231004.pdf. Consultado: 08/02/2023

Sarkar, S., & Costa, A. I. A. (2008). Dynamics of open innovation in the food industry. Trends in Food Science and Technology, 19(11), 574–580. https://doi.org/10.1016/j.tifs.2008.09.006

Schumpeter, J. A. (1944). Teoría del desenvolvimiento económico : una investigación sobre ganancias, capital, cré dito, interé s y ciclo económico (1a. ed.) [Book]. Fondo de Cultura Económica.

Suárez Mella, R. P. (2018). Reflexiones sobre el concepto de innovación. Revista San Gregorio, 1(24), 120–131. https://doi.org/https://doi.org/10.36097/rsan.v1i24.575

SUPERCIAS. (2020). RANKING EMPRESARIAL. Superintendencia de Compañias, Valores y Seguros. Available in: https://appscvsconsultas.supercias.gob.ec/rankingCias/#ps. Consultado: 04/01/2023.

Tamayo Viera, J. O., Pérez Yauli, V. L., & Arroba Freire, E. M. (2021). Impacto económico en la provincia de Tungurahua en relación con los eventos adversos. Revista Eruditos, 2(3), 55–76. Available in: https://doi.org/10.35290/re.v2n3.2021.473. Consultado: 11/01/2023

Torres Salazar, M., Ayvar Campos, F. J., & Navarro Chávez, J. C. L. (2018). La eficiencia de la industria de alimentos, bebidas y tabaco: un análisis a través de la envolvente de datos. Revista Nicolaita de Estudios Económicos, 13(1), 29–52. https://doi.org/10.33110/rnee.v13i1.256

Trejo García, J. C., Martínez García, M. Á., & Venegas Martínez, F. (2017). Administración del riesgo crediticio al menudeo en México: una mejora econométrica en la selección de variables y cambios en sus características. Contaduria y Administracion, 62(2), 377–398. https://doi.org/10.1016/j.cya.2017.01.003

Valenzuela B., A., & Valenzuela B, R. (2015). La innovación en la industria de alimentos: Historia de algunas innovaciones y de sus innovadores. Revista Chilena de Nutricion, 42(4), 404–408. https://doi.org/10.4067/S0717-75182015000400013

Wang, G., Dou, W., Zhu, W., & Zhou, N. (2015). The effects of firm capabilities on external collaboration and performance: The moderating role of market turbulence. Journal of Business Research, 68(9), 1928–1936. https://doi.org/10.1016/j.jbusres.2015.01.002

Zeballos, E. (2013). La industria de alimentos , bebidas y tabaco como motor de empleo y desarrollo. Available in: rural. https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_235484.pdf. Consultado: 29/01/2023