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Association of researcher characteristics and entrepreneurial intention

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Abstract: Investigating the antecedents and determinants of entrepreneurial intention is key to understanding the beginning of the entrepreneurial process. There is scarce literature on academic entrepreneurship that identifies the characteristics of an individual in an academic context with the intention of starting a spin-off company. This study explores the association of gender, age, research certification and knowledge area to Academic Entrepreneurial Intention. To this end, data was obtained from the participation of 172 academics at a Mexican university. Through logistic regression, it was possible to find a significant association between age, research certification and certain knowledge areas to academic entrepreneurial intention. This represents a first approximation to identifying the key factors that affect the academic entrepreneurship process, focused particularly on entrepreneurial intention.

Keywords: entrepreneurship, academic entrepreneurship, academic spin-off, academic entrepreneur, entrepreneurial intention.

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Asociación entre Características del Investigador e Intención Emprendedora

Resumen: Investigar los antecedentes y determinantes de la intención emprendedora es clave para comprender el inicio del proceso emprendedor. Existe poca literatura sobre emprendimiento académico que identifique las características de un individuo en un contexto académico con la intención de iniciar una empresa spin-off. El presente estudio explora el efecto de los factores género, edad, acreditación en investigación y área de conocimiento sobre la Intención Emprendedora Académica. Con este fin, se realizó un levantamiento de datos en una universidad mexicana, con la participación de 172 académicos. Mediante regresión logística se encontró que la edad, acreditación en investigación y algunas áreas del conocimiento muestran una asociación significativa con la intención emprendedora académica. Esto representa una primera aproximación hacia la identificación de factores clave que inciden en los procesos de emprendimiento académico, enfocados particularmente en la intención emprendedora.

Palabras clave: emprendimiento, emprendimiento académico, spin-off académico, emprendedor académico, intención emprendedora.

1. Introduction

According to Bird (1988), Entrepreneurial Intention (EI) is the closest predictor of the decision to become an entrepreneur. Following this idea, many motivational theories rely on the concept of intention and its antecedents to predict subsequent actions (Ji et al., 2020; Liao et al., 2022; Sohu et al., 2022). In particular, the Theory of Planned Behavior (Ajzen, 1991) postulates the process of formation of an Intention from three independent constructs: attitude, social norm and perceived behavior; supporting most of the research on Intention within the field of entrepreneurship.

EI indicates how intensely the person is preparing and how much effort they are planning to commit to carry out an entrepreneurial behavior (Blaese & Liebig, 2021). Thus, the study of the antecedents and determinants of EI is the key to understanding the beginning of the entrepreneurship process, since potential entrepreneurs are involved in the formation of an intention to start a company (Van Gelderen et al., 2006; Kautonen et al., 2015; Kolvereid, 2016).

In recent years, the impact of academic entrepreneurship has been recognized as a catalyst to innovate, generate competitive advantages and for the economic development of regions (Guerrero et al., 2016; Davari et al., 2018; Liao et al., 2022). For this reason, in the literature on entrepreneurship and academic spin-offs, those personal attributes that act as determining factors of entrepreneurial activity and business creation have been explored, trying to identify the causes that influence an academic to decide to create his own business; That is, why some academics decide to start a business and others do not. Specifically, previous research has focused on the individual characteristics, attitude and motivation of academics towards entrepreneurship (Guerrero & Urbano, 2014; Miranda et al., 2017a; Calderón & Pérez, 2021; Garcez et al., 2023).

There are various investigations focused on identifying an entrepreneurial profile based on personal attributes, to characterize the individual who undertakes versus the non-entrepreneur, and trying to determine traits that are defining. Specifically, in studies related to the intention to create a spin-off in the university environment, some of the most analyzed individual

variables have been age, gender, educational level, and role models, among others. The literature is still scarce and incomplete (Abreu et al., 2016; Sinell et al., 2018; Ji et al., 2020), the main results of existing works confirm that entrepreneurial intention in the academic sector is lower in women (Liñan & Fayolle, 2015; Abreu & Grinevich, 2017; Miranda et al., 2017b), and that the entrepreneurial intention of young researchers has hardly been studied (Varamäki et al., 2016; Samo & Huda, 2019; Monge-Agüero et al., 2022; Lopes et al., 2023). In summary, the literature related to academic entrepreneurship suggests an opportunity for deeper investigation into the determinants of academic entrepreneurial intention.

This study explores the relationship between some individual factors (gender, age, research experience and area of knowledge) and the academic entrepreneurial intention of university researchers. The proposed structural research model analyzes a public university located in the northwest of Mexico; through a sample of its academics whose activities include scientific research.

The document is structured as follows: (1) the literature related to academic entrepreneurship, entrepreneurial intention and the importance of individual factors is reviewed, to offer a theoretical and conceptual context to the work; (2) the environment and the methodological process applied in the research are described; (3) the results obtained and their discussion are presented; (4) the conclusion, implications, limitations and future research gaps are proposed.

2. Theorical framework

2.1 Academic entrepreneurship and spin-off

Entrepreneurship is an extremely relevant activity for most countries that adhere to a capitalist economic model. This activity manifests itself in various ways, from the initiative of independent individuals to companies whose main objective is to generate ideas that lead to business opportunities. Within these variants in entrepreneurial activity is that which arises from academic and research activity within universities.

Entrepreneurial activities carried out in the university environment have gained increasing attention (Prodan & Drnovsek, 2010; Alonso-Galicia et al., 2015; De Silva et al., 2016; Wang et al., 2021b) since the Interaction with

the industry through technology transfer and academic entrepreneurship has become an important component for the development of said process (Yusof & Jain, 2010; Samo & Huda, 2019; Wang et al., 2021c). The above is because, in addition to facilitating the dissemination of university research, it allows new scientific knowledge to be converted into applications for the benefit of society (Perkmann et al., 2013; Rasmussen & Wright, 2015; Boh et al., 2016).

Academic entrepreneurship is a heterogeneous phenomenon that integrates activities of various kinds (Yusof & Jain, 2010; Liao et al., 2022), but mainly refers to the generation of patents, licensing, and academic spin-offs, that is, the creation of companies generated from university research results (Siegel & Wright, 2015a, Castillo & Watson, 2017).

Various studies related to the topic of academic entrepreneurship support that business creation in the university context comes with a high degree of technology transfer as academics decide to partake in this activity (Siegel & Wright, 2015b; Jung & Byung-Keun, 2017; Zhang et al., 2021). Academic spin-offs are defined as companies founded by individuals from the scientific community, including people with substantial research experience, such as professors, assistants, researchers, and doctoral students (Feola et al., 2017). Such companies play a fundamental role in bringing early-stage technologies developed at universities to the market (Berbegal-Mirabent et al., 2015; Boh et al., 2016; Odei & Novak, 2023).

Great efforts have been directed toward investigating the contribution of academic spin-offs to economic development, which has already been established (Grimaldi et al., 2011; Audretsch, 2014); The characteristics of academic spin-offs and the process behind their creation have also been analyzed (Vohora et al., 2004; Muscio et al., 2016; Athreye et al., 2023). On the contrary, a review of the literature shows little empirical evidence that pays attention to the phenomenon at the individual level, that is, to the analysis of how the entrepreneurial potential of the academic community can be stimulated (Fini & Toschi, 2016; Hayter et al., 2017). Consequently, the contribution to knowledge on how to promote entrepreneurial intention in academics is omitted, considering that most of them still do not perceive themselves as entrepreneurs (Etzkowitz, 2016; Monge-Agüero et al., 2022).

2.2 Academic Entrepreneurial Intention

Entrepreneurial intention is key to understanding the business process since it is the first step in this complex process (Bird, 1988; Krueger et al., 2000; Miranda et al., 2017a; Blaese & Liebig, 2021). In this sense, Kautonen et al. (2015) and Farrell et al. (2022) indicate that EI is the closest predictor of the decision to become an entrepreneur, since in general, entrepreneurial behavior is intentional and is driven by an arduous decision-making process in an environment that can behave as a driver or inhibitor of the decision to create a company.

Various intention models, appropriate to explain and predict entrepreneurial behavior, have been developed to analyze the antecedents that affect the decision to start an entrepreneurial career. The first models of entrepreneurial intention are based on the Theory of Reasoned Action (Fishbein & Ajzen, 1975) and the Theory of Planned Behavior (Ajzen, 1991), among others. In particular, the Entrepreneurial Event Model (Shapero, 1982), and the Entrepreneurial Potential Model (Krueger & Brazeal, 1994) were developed for this purpose, based on the aforementioned theories. The common idea shared by the models is that intention is the best predictor of entrepreneurial behavior. In this regard, the specific term academic entrepreneurial intention (AEI) refers to the intention of academics to start their own business to commercialize their research knowledge (Goethner et al., 2012; Yu & Lu, 2023), or how that matures the intention to start a business process in individuals who engage in research (Prodan & Drnovsek, 2010; Feola et al., 2017; Ji et al., 2020). Thus, some IEA studies focus on studying how an individual involved in the academic environment develops the intention to start a company based on the results of their research (Guerrero & Urbano, 2014; Grünhagen & Volkmann, 2014; Shi et al., 2020).

Based on some intention models, various investigations have tried to identify different antecedents that determine AEI, highlighting contextual, organizational, and motivational factors and perceived obstacles at the individual level (Obschonka et al., 2015; Huyghe & Knockaert 2015; Ozgul & Kunday 2015; Monge-Agüero et al., 2022). Regarding individual factors, studies have focused on determining which academic and sociodemographic characteristics explain the profile of an academic entrepreneur, who is the main actor in the business process.

The review of AEI literature allows us to visualize the growing trend of empirical analyzes using quantitative data with different statistical techniques, highlight the structural equation modeling (SEM) through the partial least squares (PLS) (Wibowo et al., 2020; Chafloque-Cespedes et al., 2021; Garcez et al., 2023), fuzzy method (Zhang et al., 2022; Wang et al., 2022) and mixed methodologies such as Luo et al. (2024) who use one-way analysis of variance (ANOVA) and qualitative comparative analysis (QCA).

2.3 Individual factors and entrepreneurial intention

In the analysis of the individual as a key element in the entrepreneurial process, various investigations have studied the impact of individual characteristics on the intention to undertake, to determine the variables that define the profile of the entrepreneur and characterizing the individual who undertakes versus that who does not undertake, that is, finding traits that define it (Hayter et al., 2017; Wang et al., 2021a; Wang et al., 2022).

Previous studies related to entrepreneurial intention have suggested the importance of exploring its relationship with individual factors or sociodemographic variables (Knockaert et al. 2015; Moog et al. 2015; Ruiz-Ruano & Puga, 2019). In this regard, the most analyzed sociodemographic factors have been age, gender, race, educational level, socio-economic status, previous work experience, family background and role models, among others (Abreu & Grinevich, 2013; Liñan & Fayolle, 2015; Varamäki et al., 2016).

Next, we present how some individual factors have been linked to AEI in previous research, which allowed us to establish the hypotheses of this research.

2.3.1 Age

Age as a factor for academic entrepreneurship presents certain contradictions in the literature. According to Hatak et al. (2015) people over 50 years of age are more capable of exhibiting entrepreneurial behaviors, since they have greater means and opportunities to do so, while young people are much less likely to present the intention of establishing a business. For his part, Roberts (1991) maintains that the average age of the founders of academic spin-offs at the Massachusetts Institute of Technology, MIT, was 37 years and Ortín et al. (2008) found that the spin-offs generated in Spanish universities were

created by young entrepreneurs whose age was between 30 and 40 years old. These works do not support a definite direction in the relationship between age and AEI, therefore, the following research hypothesis was proposed:

H1. Age is associated with AEI.

2.3.2 Gender

Because men and women present distinctive social stereotypes, they are likely to show different personalities and attitudes towards certain behaviors (Indarti et al., 2016; Barron et al., 2022). Regarding gender, some studies have found that men exhibit a more positive attitude towards entrepreneurship and a higher EI than women (Strobl et al., 2012; Alonso-Galicia et al., 2015; Goel et al., 2015; Micozzi & Lucarelli, 2016). For their part, Haeussler and Colyvas (2011) and Miranda et al. (2017b) confirm that gender influences the probability of creating an academic spin-off, since male academics have a higher percentage of probability of founding a company compared to women. Given this context, the following research hypothesis was proposed:

H2. Females show lower association with AEI than Males.

2.3.3 Research Experience

In the context of academic entrepreneurship, some studies have highlighted the importance of the individual's research experience as a determining factor in the creation of academic spin-offs. Landry et al. (2006) reported that AEI is greater for researchers with more academic experience. However, Prodan and Drnovsek (2010) found that the number of years the researcher spends at the academic institution is negatively related to their AEI. In this way, the following hypothesis can be proposed:

H3. Research Experience is associated with AEI.

2.3.4 Area of Knowledge

According to Tang (2022), certain areas of knowledge are more likely than others to stimulate academic entrepreneurship activities, particularly the creation of academic spin-offs. For example, O'Shea et al. (2014) points out that the fields of science and engineering are the most prolific spin-off

creators, especially highlighting the branches of health sciences, computer science and chemistry. On the other hand, Buenstorf (2009) indicates that technology transfer activities in the humanities area are insignificant. The literature reviewed does not provide enough evidence to propose a directional hypothesis. Therefore, we can only propose the following hypothesis:

H4. Social sciences present a lower correlation with AEI than Medicine & Health and Chemical & Biological sciences.

In summary, Figure 1. shows the proposed model to explore the effect of individual factors on Academic Entrepreneurial Intention.

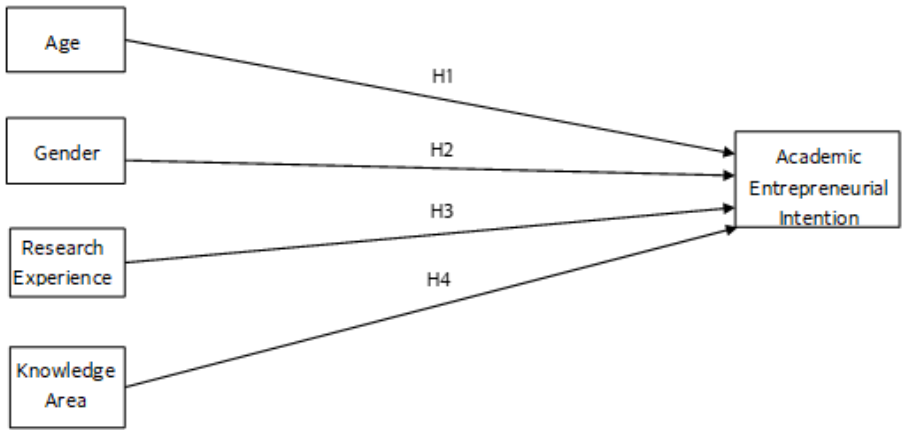

Figure 1. Proposed Model.

3. Methodology

3.1 Sample

The sample of the present study was collected at the Autonomous University of Sinaloa (UAS), located in the city of Culiacán, Sinaloa, Mexico. The sampling frame was built from the information available on the university website, including faculties related to the following areas of knowledge: Physics-Mathematics, Biotechnology and Agriculture, Chemical-Biological, Medicine and Health Sciences, Engineering and Industry and Social Sciences. The starting point was the population of academics with the appointment of Full-Time Professor and Researcher (a total of 821 teachers), because this

group of teachers carry out research activities within the institution. Contact with the researchers for their consent to participate in the survey was carried out through email and/or personal interviews. In total, the questionnaire was applied to 172 researchers (21% of the initial population).

Entrepreneurial Intention was assessed using the instrument of Miranda et al. (2017a) and validated for México by Terán et al. (2021).

3.2 Operationalization of variables

From the Miranda et al. instrument. (2017a), the four items that correspond to the AEI were selected:

EI1: "I am determined to create a business in the future."

EI2: "I intend to commercialize the results of my research through a spin-off."

EI3: "I would very much like to be an entrepreneur."

EI4: "I recently looked for information on how to create a spin-off to commercialize the results of my research."

These items are evaluated using a 7-point bipolar Likert scale (see Table 1).

Table 1. Bipolar 7-point Likert scale

1	2	3	4	5	6	7
Totally disagree	Mostly disagree	Disagree	Do not agree nor disagree	Agree	Mostly agree	Totally agree

The dependent variable was the degree of AEI, calculated as the average of the results obtained by each survey participant for the four items described above.

Regarding the independent variables, individual factors such as: age, gender, research accreditation and area of knowledge were included (see Table 2).

Table 2. Definition of independent variables

Variable	Description	Scale
Age	Age of the academic.	Years.
Gender	Gender of the academic.	Masculine, Feminine.
Research Experience	National System of Researchers (NSR) membership.	Yes/No.
Area of Knowledge	Physics & Mathematics (Phy_Math) Biotechnology & Agriculture (Bio_Agr) Chemical & Biological (Chem_Biol) Medicine & Health Science (Med_Hth_Sci) Engineering & Industry (Eng_Ind) Social Science (Soc_Sci)	Yes/No.

It should be noted that, in the Research Experience factor, it has been considered whether the academic is part of the NSR, which promotes the quality of scientific and technological research, and the innovation that occurs in Mexico. The purpose is to demonstrate whether the distinctive is a factor that motivates or demotivates the academic to develop the intention to undertake based on the results obtained in research.

3.3 Data analysis

1. Gender, NSR and Area of Knowledge were summarized as frequencies and percentages, and Age using mean and standard deviation.
2. Association between the AEI and Gender, as well as between AEI and NSR were determined using chi-square analysis.
3. Association between AEI and Area of Knowledge was determined by single correspondence analysis.
4. Nominal logistic regression was implemented to determine the contribution of each independent variable to the AEI. Academic entrepreneurial intention was defined on a nominal scale as a response variable.

The statistical analysis was carried out using the statistical software Minitab V19.

4. Results

4.1 Sample characteristics

Table 3 presents a descriptive summary of the variable outcomes from the sample data of the academic researchers included in the study.

Table 3. Descriptive summary of sample characteristics

Variable	Description	Units
Age	Min	28.0
	Max	67.0
	Mean	41.6
	Std Dev	8.9
Gender	Male	108 (62.8%)
	Female	64 (37.2%)
Research Experience	Member of NSR	96 (55.8%)
	Not member of NSR	76 (44.2%)
Area of Knowledge	Physics & Mathematics	21 (12.2%)
	Biotechnology & Agriculture	52 (30.2%)
	Chemical & Biological	21 (12.2%)
	Medicine & Health Science	7 (4.1%)
	Engineering & Industry	34 (19.8%)
	Social Science	37 (21.5%)

With respect to a descriptive summary of the outcomes by item of Entrepreneurship Intention, the mean for AEI was 4.23 ± 1.4 which, given the description of the Likert scale of 1-7, can be considered a neutral level (neither agreement nor disagreement). This result shows that the researchers in the sample do not have a clear opinion about their entrepreneurial intention. The item that contributes the most to the AEI is EI1: "I am determined to create a business in the future", which averaged a value of 4.97 ± 1.7. The item with the least contribution was EI4: "I recently looked for information on how to create a spin-off to commercialize the results of my research", with an average of 2.81 ± 1.9 (see Table 4).

Table 4. Descriptive statistics by item of entrepreneurship intention

Variable	Mean	SE mean	SD	Minimun	Median	Maximum
EI1	4.97	0.13	1.68	1.00	5.00	7.00
EI2	4.58	0.13	1.64	1.00	5.00	7.00
EI3	4.55	0.14	1.79	1.00	5.00	7.00
EI4	2.81	0.14	1.85	1.00	3.00	7.00
EI Means	4.23	0.10	1.36	1.00	4.00	7.00

SE: standard error; SD: standard deviation.

4.2 The relation among AEI and the individual factors

The following results presents the different sort of association among the academic entrepreneurial intention and those factors that, according to the literature review, are considered relevant for its study. In particular, the association among AEI and the categorical variables Gender, Research Experience and Area of Knowledge was determined using Chi-Square analysis from contingency tables elaborated by cross-classification of the variables. The AEI variable was categorized as follows: AEI ≤ 3 (Low), $3 < \text{AEI} \leq 5$ (Medium), and $5 < \text{AEI} \leq 7$ (High). Categories for the independent variables were taken as in Table 3.

4.2.1 AEI and Gender Association

The association between these two variables was determined from the cross-classification given in the following contingency table (Table 5). The estimated value of the Pearson coefficient was 5.394, with a p-value of 0.067.

Table 5. Contingency table of Gender vs AEI

Gender	AEI			All
	Low	Medium	High	
M	17	59	32	108
F	13	42	9	64
All	30	101	41	172

4.2.2 AEI and NSR Association

The association between these two variables was determined from the cross-classification given in the following contingency table (Table 6). The estimated value of the Pearson coefficient was 6.098, with a p-value of 0.047.

Table 6. Contingency table of NSR vs AEI

	L	M	H	All
No	8	45	23	76
Yes	22	56	18	96
All	30	101	41	172

4.3 Correspondence análisis

Given that the variable Area of Knowledge consists of six categories, the contingency table obtained from its cross-classification against AEI produces cells with frequencies lower than five (see Table 6). In this case, simple correspondence analysis is the appropriate tool used to study association. Simple correspondence analysis assesses the heterogeneity (association) of the categories of the variables in the contingency table using Chi-square distance in the scatter plot described by the frequencies. Two categories are positively associated if the angle between the line segments from the points to the centroid is less than 90 degrees, no association if the angle is around 90 degrees and inverse (negative) association if the angle is around 180 degrees. Such an analysis is carried out by mean of symmetric plot of linear combinations of the categories named components. The association between AEI and Area of Knowledge was determined from the cross-classification given in the following contingency table (Table 7).

The corresponding explanation of the heterogeneity is given by Component 1 (88.65%). Low AEI resulted strongly positively associated with Physics-Mathematics and Medicine & Health Science. Medium AEI did not show association with any Area of Knowledge, while High AEI was strongly positively associated with Social Science and Engineering & Industry (Figure 1).

Table 7. Contingency table of Area of Knowledge vs AEI

AEI	Area of Knowledge						All
	Bio_Agr	Chem_ Biol	Eng_Ind	Med_ Hth_Sci	Phy_ Math	Soc_Sci	
Low	7	4	3	3	7	6	30
Medium	33	13	21	5	9	20	101
High	12	4	10	1	4	10	41
All	52	21	34	9	20	36	172

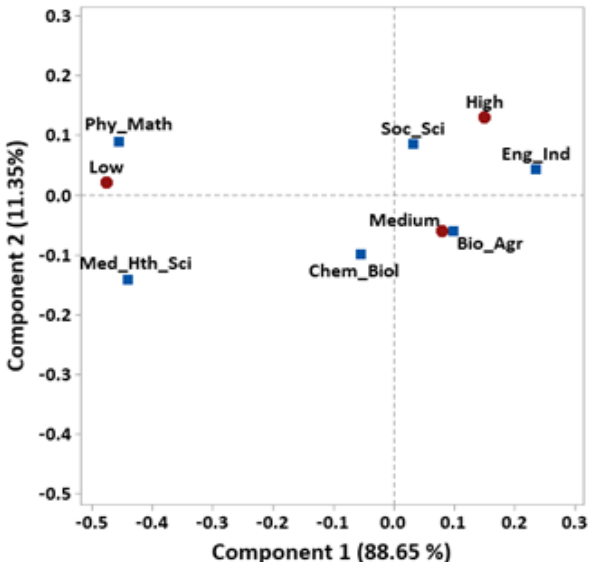

Figure 2. Symmetric Graph from AEI and Area of Knowledge corresponding to Table 7

4.4 Nominal Logistic Regression

A nominal logistic regression (NLR) was done to determine which independent categories contribute to the association with AEI. The academic entrepreneurial intention was defined using three categorical levels: low, medium, and high. This statistical tool allows us to determine which independent variable is statistically significant, providing the degree and directionality of each association. NLR gives estimates of the regression coefficients, standard error, the value of z statistic, the p value, the odds ratio, and

a 95% confidence interval for each odds ratio (Table 8). The association between AEI and each independent variable must be interpreted in terms of the corresponding odds ratio. The reference levels are Age = 0, Male = 0, NSR = 0, and Medicine & Health Science = 0.

Table 8. Nominal Logistic Regression Analysis.

DF		G		P-Value			
16		36.461		0.002			
Method		**Chi-Square**		**DF**	**P-Value**		
6Pearson		267.822		256	0.293		
Log-likelihood = -146.719							
Predictor	**Coef**	**SE Coef**	**Z**	**P**	**Odds Ratio**	**95% CI**	
						Lower	Upper
Logit 1: (Medium/ Low)							
Constant	5.53211	1.52967	3.62	0.000			
Age	-0.0986164	0.0284398	-3.47	**0.001**	**0.91**	0.86	0.96
Gender							
Female	-0.420871	0.494657	-0.85	0.395	0.66	0.25	1.73
National System of Researchers							
Yes	-1.43199	0.576680	-2.48	**0.013**	**0.24**	0.08	0.74
Area of Knowledge							
Bio_Agr	1.84894	0.731871	2.53	**0.012**	**6.35**	1.51	26.67
Chem_Bio	1.06814	0.831444	1.28	0.199	2.91	0.57	14.85
Eng_Ind	1.44614	0.853328	1.69	**0.090**	**4.25**	0.80	22.62
Med_Hth_Sci	0.112887	0.977946	0.12	0.908	1.12	0.16	7.61
Soc_Sci	0.513085	0.813140	0.63	0.528	1.67	0.34	8.22
Logit 2: (High/ Low)							
Constant	3.37120	1.65706	2.03	0.042			
Age	-0.0607098	0.0305314	-1.99	**0.047**	**0.94**	0.89	1.00
Gender							

Female	-1.33033	0.597479	-2.23	**0.026**	**0.26**	0.08	0.85
National System of Researchers							
Yes	-1.75877	0.636021	-2.77	**0.006**	**0.17**	0.05	0.60
Area of Knowledge							
Bio_Agr	1.90453	0.865948	2.20	**0.028**	**6.72**	1.23	36.66
Chem_Bio	0.979305	1.01326	0.97	0.334	2.66	0.37	19.40
Eng_Ind	1.75518	0.957898	1.83	**0.067**	**5.78**	0.88	37.81
Med_Hth_Sci	-0.419714	1.40929	-0.30	0.766	0.66	0.04	10.41
Soc_Sci	0.881203	0.929545	0.95	0.343	2.41	0.39	14.93

The goodness of fit of the two models were established using Pearson test (p = 0.293), and Deviance test (p = 0.485). The first estimated NLR model, with significant terms, is given below:

$$Ln\frac{\hat{e}^{\hat{u}}_{\hat{e}}P(AEI=Medium)^{\hat{u}}_{\hat{u}}}{\hat{e}^{\hat{e}}_{\hat{e}}P(AEI=Low)^{\hat{u}}_{\hat{u}}} = 5.532 - 0.099Age - 1.432NSR + 1.849Bio_{Agr} + 1.446Eng\_Ind \quad (1)$$

$$OWA = \sum_{i=1}^{n} w_i\, x_i, \quad (2)$$

Definitions of the odds ratios are given below to facilitate the interpretation of the results shown in Table 8. The corresponding odds ratios, for each independent variable, are computed as follows:

$$\frac{Odds^{\hat{e}}_{\hat{e}}Medium\|Age=1^{\hat{u}}_{\hat{u}}}{Odds^{\hat{e}}_{\hat{e}}Medium\|Age=0^{\hat{u}}_{\hat{u}}} = e^{-0.099} = 0.91 \quad (3) \qquad \frac{Odds^{\hat{e}}_{\hat{e}}Medium\|NSR=1^{\hat{u}}_{\hat{u}}}{Odds^{\hat{e}}_{\hat{e}}Medium\|NSR=0^{\hat{u}}_{\hat{u}}} = e^{-1.432} = 0.24 \quad (4)$$

$$\frac{Odds^{\hat{e}}_{\hat{e}}Medium\|Bio\_Agri=1^{\hat{u}}_{\hat{u}}}{Odds^{\hat{e}}_{\hat{e}}Medium\|Med\_Hthg\_Sci=0^{\hat{u}}_{\hat{u}}} = e^{1.849} = 6.35 \quad (5) \qquad \frac{Odds^{\hat{e}}_{\hat{e}}Medium\|Eng\_Ing=1^{\hat{u}}_{\hat{u}}}{Odds^{\hat{e}}_{\hat{e}}Low\|Med\_Hthg\_Sci=0^{\hat{u}}_{\hat{u}}} = e^{1.446} = 4.25 \quad (6)$$

The second estimated NLR model, with significative terms, is given below:

$$Ln\frac{\hat{e}^{\hat{u}}_{\hat{e}}P(AEI=High)^{\hat{u}}_{\hat{u}}}{\hat{e}^{\hat{e}}_{\hat{e}}P(AEI=Low)^{\hat{u}}_{\hat{u}}} = 3.3712 - 0.061Age - 1.330Female - 1.759NSR - 1.905Bio_{Agr} + 1.755Eng\_Ind \quad (7)$$

The corresponding odds ratios, for each independent variable, are computed as follows:

$$\frac{Odds\hat{e}High\|Age=1\dot{u}}{Odds\hat{e}High\|Age=0\dot{u}} = e^{-0.061} = 0.94 \quad (8)$$

$$\frac{Odds\hat{e}High\|NSR=1\dot{u}}{Odds\hat{e}High\|NSR=0\dot{u}} = e^{-1.759} = 0.17 \quad (10)$$

$$\frac{Odds\hat{e}Medium\|Eng\_Ing=1\dot{u}}{Odds\hat{e}Low\|Med\_Hthg\_Sci=0\dot{u}} = e^{1.755} = 5.78 \quad (13)$$

$$\frac{Odds\hat{e}High\|Female=1\dot{u}}{Odds\hat{e}High\|Male=0\dot{u}} = e^{-1.33} = 0.26 \quad (11)$$

$$\frac{Odds\hat{e}High\|Bio\_Agri=1\dot{u}}{Odds\hat{e}High\|Med\_Hth\_Sci=0\dot{u}} = e^{1.905} = 6.72 \quad (12)$$

4.4.1 AEI vs Independent Variables

The coefficient for Age, in both models, was statistically significant. However, the odds ratio in both cases is close to 1, showing that AEI is practically independent of Age. Gender resulted significant only in the second model, with an odds ratio (0.26) indicating an inverse association between this variable and AEI. Given the latter, women presented lower AEI than men. In the case of research experience (NSR), the odds ratio for model 1 and model 2 (0.24 and 0.17, respectively) indicated that having a greater research activity is negatively associated with AEI. Finally, model 1 indicated that Biotechnology & Agriculture, as well as Engineering & Industry, showed odds ratios 6.35 and 4.25 respectively. Under model 2, the same categories had odds ratios of 6.72 and 5.78 respectively. Both models imply that these Areas of Knowledge have a strong positive association with AEI.

5. Discussion

With respect to age, previous studies found that young academics and postgraduate students have a stronger intention of entrepreneurship as an option to create jobs related to their scientific areas compared to their older counterparts, especially due to the scarcity of academic positions for which they have prepared (Feola et al., 2017; Hayter et al., 2017; Wright et al., 2017; Samo & Huda, 2019). Our results show a similar behavior between these variables, but the degree of association is weak.

Gender showed association to AEI. Males presented a stronger academic entrepreneurial intention than Females. Our result coincides with other studies that have found that the male gender tends to have a greater intention

to start a business compared to its counterpart (see Barron et al., 2022). This is in line with the theory that supports that women in academia tend to be less active in the process of technology transfer and entrepreneurship, considering reasons such as that the female gender faces a greater challenge to make their daily professional practice, tasks of teaching, research, and entrepreneurship activities (Alonso-Galicia et al., 2015; Miranda et al., 2017b; Abreu & Grinevich, 2017).

For its part, the Research Experience factor, whose effect is captured from the status of membership to the NSR, showed statistical significance. In addition to this, the odds ratios of this factor (0.24 and 0.17 for models 1 and 2, respectively) point to an inverse relation to AEI. This result coincides with some findings from similar studies; particularly, Prodan and Drnovsek (2010), Ding and Choi (2011), Moog et al. (2015) and Acuña-Durán et al. (2021), who determine that the time that the academic dedicates to research has an inverse effect on the intention to undertake and maintain that the AEI and academic activities must be balanced. Additionally, there should be an environment at the university that motivates entrepreneurship. Although the indicator used to measure research experience differs between some studies, the characteristics of what belonging to the NSR entails support the logic of the results obtained. Membership and permanence within the NSR are closely linked to academic activities of scientific productivity (publication of articles, chapters, books, human capital formation, etc.). The permanence rules do not give significant value to activities linked to entrepreneurship, so those academics who decide to maintain their status within the system do not show a particular interest in this type of activity.

Regarding the Knowledge Area as a factor, statistical significance is found for some individual areas. It is also observed that the effect varies in magnitude according to the scientific discipline to which the researcher belongs. Researchers in Biotechnology and Agriculture and Engineering & Industry presented a significant association to AEI. This result appears to be consistent with the type of products that emerge from their research activities, as they lend themselves to the development of products with practical and commercialization potential. Furthermore, these products are directly connected to emerging areas of economic activity, where entry into competitive markets is low and a direct connection can be made between

scientific activity and technology-based entrepreneurship. Our results contrast with Tang (2022), who maintains that merit systems and university prestige are more important than the effect of the university discipline on the researcher who decides to undertake. However, the studies by Huyghe and Knockaert (2015); Knockaert et al. (2015), and Antonieli et al. (2016) find that the area of knowledge factor has an important role in determining the AEI, and there are significant differences in the areas whose research products can find direct channels for their application (engineering, biotechnology, agronomy, health, economic-administrative).

6. Conclusions

The main results yielded by our study in relation to the association between academic entrepreneurial intention and the selected individual factors were as follows:

First, Age showed an inverse relationship with AEI. Older age tends to be associated with a lower level of entrepreneurial intention. However, this association is weak within the sample studied.

Second, Gender presented an inverse association with AEI with respect to female researchers. This coincides with results in the reviewed literature.

Likewise, the Research Experience factor presented a detrimental effect on AEI; That is, belonging to the National System of Researchers has an inverse effect on the level of AEI. Finally, regarding Areas of Knowledge, Biotechnology and Agriculture and Engineering & Industry showed a strong positive association with AEI.

Although practical implications could be glimpsed because of this research, it is important to consider that the results correspond to the characteristics of the institution under study. The generalization of the findings expressed here is still far from being appropriate, however, it could be considered as an adequate analysis model to reproduce in other university environments and contrast the results to find points of convergence and divergence.

The findings obtained contribute to a better understanding of the AEI and the identification of its determinants, allows an approach to the profile of the

academic entrepreneur and manifest the need to promote a university culture favorable to academic entrepreneurship, providing support in the form of tangible resources and infrastructure at the university. Even though there are AEI models in the literature that have been empirically tested in the context of European universities, this study responds to the gaps opened by Ruiz-Ruano and Puga (2019), Vesci et al. (2020), Wibowo et al. (2020) and Wang et al. (2022) on the need to study the direct effect of individual and environmental factors on AEI.

In Latin America, there are few studies with great potential to contribute to the development of policies and strategies to promote the growth of entrepreneurial activities in universities (Acuña-Duran et al., 2021; Chafloque-Cespedes et al., 2021; Aristizábal et al., 2024). Particularly, this study, in the Mexican context, contributes to the analysis of academic entrepreneurial intention and its association with individual factors and professional discipline approach, applied in the academic environment of a public university, unlike previous research carried out in private universities (Franco-Rodríguez & Alonso-Galicia, 2019; Barron et al. 2022).

The present study suggests opportunities for future lines of research. For example, comparisons can be made between characteristics of academic entrepreneurs from public and private universities; Other variables of Theory of Planned Behavior can be included (attitude towards entrepreneurship, subjective norm, and perceived control over behavior), to address the complexity of the type of phenomenon under study, and whose analysis could benefit from the inclusion of other factors that could be associated directly or indirectly with the AEI; An analysis could be proposed with tools other than those used in the present study (for example, structural equation analysis) whose approach is more oriented towards the explanation of the relationships between variables.

Authors' contributions

Beatriz M. Terán-Pérez: conceptualization, writing (original draft), methodology, validation, data curation, and formal analysis. Cuitláhuac Valdez-Lafarga: Methodology, data curation, software. Denisse Ballardo-Cárdenas: conceptualization, writing (draft review). José B. Valdez-Torres: Methodology, software, writing (revision/correction). All authors have read and accepted the published version of the manuscript.

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Conflicts of Interest
The authors declare that they have no conflicts of interest.

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