

**SÉRIE DE TEXTOS PARA DISCUSSÃO
DO CURSO DE CIÊNCIAS
ECONÔMICAS
TEXTO PARA DISCUSSÃO N. 21**

**The University as a knowledge reservoir – the comparative study
of business and engineering undergraduate students' profile of the
Federal University of Goiás (UFG)**

**Paula Andréa Marques do Valle
Dnilson Carlos Dias**

**NEPEC/FACE/UFG
Goiânia – Dezembro de 2010**



**Dados Internacionais de Catalogação na Publicação (CIP)
GPT/BC/UFG**

	Valle, Paula Andréa Marques do.
V181u	The university as a knowledge reservoir – the comparative study of business and engineering undergraduate students' profile of the Federal University of Goiás (UFG)/ Paula Andrea Marques do Valle, Dnilson Carlos Dias. – Goiânia : UFG/NEPEC/FACE, 2010. 17 f. (Série de Textos para Discussão do Curso de Ciências Econômicas. Texto para Discussão; n. 21). Bibliografia. 1. Produção de Conhecimento. 2. Educação. 3. Empreendedorismo. I.Título
	CDU: 658:37.015

TEXTO PARA DISCUSSÃO N. 21

The University as a knowledge reservoir – the comparative study of business and engineering undergraduate students' profile of the Federal University of Goiás (UFG)¹

Paula Andréa Marques do Valle^{*}
Universidade Federal de Goiás

Dnilson Carlos Dias [♦]
Universidade Federal de Goiás

RESUMO

O presente estudo tem como objetivo a identificação das características dos grupos de estudantes em negócios e engenharia, de forma comparativa, que os qualifiquem como futuros profissionais "inovadores" ou difusores de conhecimento de fronteira. Cinco fatores foram destacados: assertividade, liderança, tolerância ao risco/acessibilidade, dedicação e competência em informação. O foco da análise foi na identificação da presença de características empreendedoras, contrastando as graduações de engenharia e de negócios, e a relação dessas características com o sexo e a idade dos entrevistados, permitindo uma análise comparativa das suas formações educacionais. Para esse fim, o presente estudo fez uso de um questionário aplicado aos alunos da Universidade Federal de Goiás. Este estudo é parte de uma pesquisa em andamento, que avaliará o perfil empreendedor dos alunos por um período de dez (10) anos, com o objetivo de compreender o papel das instituições de ensino superior, via este estudo de caso. O instrumento principal deste trabalho foi um questionário desenvolvido pela Iowa University (USA) aplicado para alunos de negócios (economia, administração e contábeis) e alunos de engenharia (engenharia civil) da Universidade Federal de Goiás. A metodologia utilizada foi análise multivariada, especificamente a análise fatorial via ACP (análise de componentes principais); seguida de regressão logística para análise da relação gênero e traços empreendedores; e, finalmente, regressão linear, via MQO (mínimos quadrados ordinários) para avaliar a relação idade comparativamente as características inovadoras. Os resultados apontaram que em os dois grupos apresentam os seguintes traços inovadores em comum: assertividade, empenho, liderança, competência informacional, e individualmente o grupo de engenheiros apresentou acessibilidade como uma característica importante, frente a tolerância ao risco apresentada pelos estudantes de negócios. Na análise de regressão logística, os traços empreendedores mais marcantes foram assertividade e liderança para os alunos de negócios, frente à dedicação e acessibilidade para os alunos de engenharia. Permitiu assim, identificar maior assertividade no grupo do sexo feminino frente

¹ The Federal University of Goiás is by far the most important higher education institute of Goiás, one of three state of the Middle-Western area of Brazil. And it is the only federal institute of higher education in the state, highly differentiated to the other private or state institutions of higher education present in the area. In this state of approximately 6.000 thousand inhabitants, the production of new researchers and engineers rest most solely to the Federal University of Goiás.

* Doutoranda em economia (UFU). Professora de economia da UFG. E-mail: paula.hamberger@yahoo.com.br

♦ Doutor em economia (UFV). Professor de economia da UFG. E-mail: dnilsoncar@gmail.com

a uma maior liderança masculina, para os alunos de negócios; enquanto, que para os engenheiros foi identificada uma maior dedicação feminina, frente a uma maior acessibilidade dos alunos do sexo masculino. E, em relação à idade somente os dados dos alunos de negócios demonstraram que o empenho é maior, quanto mais velho são os alunos; sendo que a análise para os estudantes de engenharia não apresentou resultados significativos.

Palavras-chave:

ABSTRACT

This study aims to identify the characteristics of groups of students in business and engineering, in a comparative way, which qualifies them as future innovative professionals, spreading the knowledge frontier. Five factors were highlighted: assertiveness, leadership, risk tolerance/accessibility, dedication and competence in information. The focus was on identifying the presence of entrepreneurial characteristics, contrasting the ranks of engineering and business, and the relationship of these characteristics with age and gender of respondents, allowing a comparative analysis of their educational backgrounds. To discuss that, this paper made use of a data set obtained from a research applied to students of the Federal University of Goiás. This study is part of an ongoing research that will investigate students' profiles for a period of ten years, understanding the role carried out by institutions of higher education, through this case study. The research main instrument is a questionnaire developed by the University of Northern Iowa (USA) and applied to students of business (economics, business administration and accounting) as well as engineering majors (civil engineers) of the Federal University of Goiás. To analyze the data the study will make use of multivariate analysis, such as factor analysis (FA) via PCA (principal component analysis), followed by a logistic regression of gender in relation to the entrepreneurial profile of students, as well as an OLS linear regression of age in relation to these same factors. The results pointed out that both groups presented innovative traces in common, such as: assertiveness, dedication, leadership and informational competence; and, individually, the engineer group showed accessibility to be a major factor, versus risk tolerance for the business group. In the logistic regression analysis the innovative characteristics were assertiveness and leadership for the business majors; versus dedication and accessibility for the engineering majors. This allowed the considerations that the assertiveness was associated with the female students, while leadership was consistent with the male respondents, for the business students; as for the engineers it was identified a higher dedication trait for women in face of a more pronounced accessibility for men. Regarding the age analysis it was only possible to identify significance for the business group, which presented a higher dedication for older students.

Key-words: Production of knowledge, education, entrepreneurship

JEL: O31, O38, L26.

1. Introduction

According to Feldman and Desrochers *apud* Huggins, Johnston & Steffenson (2008), universities and other higher education institutions are being regarded as key sources of knowledge therefore essential contributors in the pursuit of economic growth. Knowledge is viewed as a key ingredient in the competitiveness of regions, countries, firms and sectors. The educational system and specially the university programs are an integral part of the infrastructure for the industry based on science, carrying a relevant role in the diffusion and generation of technologic progress, according to Nelson (2006).

Neslon (2006) presents studies that show the importance of the stimuli given to the teaching of engineering, in the XX century, in the United States, when the number of undergraduates with engineering degrees leaps from “.. a hundred, in 1870, to 4.300, in the beginning of the First World War”, according to Noble *apud* Neslon (2006). These studies also indicate as significant the increase in the number of undergraduates majoring in business and science, in the same period.

The increase of professionals holding degrees in these strategic areas occurs in a period of American industrial leadership growth, when the number of undergraduate students distinguished the United States from the other developed countries, such as Japan, Germany, United Kingdom and France, according to Maddison *apud* Nelson (2006). And that is considered one of the key factors that contributed to the development of American technological leadership.

Therefore, discussions concerning the academic level or profile demonstrate the connection with the analysis of industrial and technological performance of any given country or region. Allowing asserting that the simple presence of undergraduates graduates, in special, in the areas of engineering, business and science constitute an institutional basis for the technological development.

This indicates a new role of the Universities as promoters of learning, integrated in the innovation process, being important “knowledge repositories”, according to Lundvall (2000). Understanding knowledge as “...fundamental to the training of individuals abilities, organizations, networks and regions” (LUNDVALL, 2000, p.202). The University is therefore a reservoir of knowledge responsible to the creation of competences for the market and companies, through the development of human resources, being this way integrated in the innovation process.

The present study understanding the importance and relevance of the human capital development by the Universities through the undergraduates and graduates in the areas of business and engineering, as part of the institutional basis for economic development, attempted to identify not the number of students, a mere quantitative descriptive analysis, but the profile of both group of students (engineering and business) in the Federal University of Goiás, as far as identifying the characteristics of both groups that allows these future professional to assume the role of “innovators” or play any part in the knowledge formation.

In the study, the focus was on five aspects of the respondents’ entrepreneur profile: assertiveness, leadership, tolerance to risk, dedication and information competence. These will be respectively referred throughout this paper as: assert, leader, risk, dedication and info. The starting hypothesis is that the engineer and business⁴ major profiles demonstrate important entrepreneur capacity that is one factor that boosts the development of certain country or region, where they are immersed, as they help build the institutional basis for technological development and overall development. Therefore the present study tried to identify the presence of certain traits of entrepreneurship in the group of students, contrasting

⁴ Includes the following areas: Economics, Accounting and Business Administration.

engineering with business undergraduates, analyzing the relation of these traits with the gender and age of the respondents, allowing a comparative analysis of their educational formations.

2. Literature Review

It is factual knowledge that the economy has been the stage of accelerated economic and technological changes, in the past decades, while the firms have been the agents of these changes, through the intensification of their competition. In this context of constant change, the firm is conceived, by the evolutionary theory, as reservoir of knowledge. And the firm responds to this changing environment implementing innovations and inventions (FREEMAN, 1998).

Every innovation, as a rule, must be based in the previously constructed knowledge, to a certain extent. This knowledge or technological basis incorporates both the universal knowledge (the scientific know-how) as well as the tacit knowledge; both the knowledge originated from exogenous sources, as well as the one generated inside the innovative unity (DOSI, 1998). This technological basis varies among firms, determining the sizable opportunities for innovation. The tacit knowledge, in particular, is generally associated to organizational and space specific contexts, being transmitted and developed by local interactions (POLANYI, 1966). In any way, the basis for learning is to create an explicit business explicit knowledge repository (codified or codifiable) and tacit knowledge.

But once the opportunity for innovation is detected the firm will expend more efforts if it is motivated by the market, responding to the need to satisfy new niches or unsatisfied demand; or yet, if the firm can perceive the possibility of appropriating, in monopoly or quasi-monopoly conditions, the advantages of the innovation. Therefore, based on different combinations of these factors, it is possible to visualize the different patterns of innovative activity, inter and intra sectors.

An additional relevant factor, in relation to the innovative effort by the firms, regards the uncertainty (not reducible to the probabilistic risk) that surrounds this process (TEECE, 1996). Any firm can spend resources systematically to increase its innovative capacity, including maintaining labs and research teams, as well as permanent development infrastructure. But, it is necessary to highlight that the results of these efforts are uncertain by nature. Nothing guarantees that the results achieved will be economically interesting for the firm, in any interesting point in time. This way, it is impossible to identify a priori any trajectory, deterministic or not of the innovation process.

In other words, innovation is the result of a search for the unknown. It involves searching, probing and reproducing specific technologies according to the opportunities given by the market. It is relevant to point out that there are many types of uncertainty, but here are highlighted the distinction among two of them: the preliminary uncertainty (or primary) and the secondary uncertainty. The preliminary uncertainty is the result of random actions of nature and of the unpredictable changes of individuals' preferences; hence, the secondary is that results from the lack of communication. Besides this two types of uncertainty it is possible to highlight the behavioral uncertainty that is attributed to the behavior of the opportunistic agents. Among these issues is possible to identify the role of the entrepreneur not only as an agent more risk prone, but capable of removing or minimizing such risks (ROSENBERG, 1994).

Change is a constant. And learning and change are therefore sides of the same phenomenon. And as a result of these factors emerges a new soil for the firms, the economy of knowledge, with the recognition of the importance of the knowledge assets, the intellectual capital, in deterrence of the tangible assets, as well as in regards to the impact of these on the

innovative process and research, which occurs more and more in an uncertain environment, where knowledge wears out fast (Lundvall & Johnson, 1994).

In this society, dominated by knowledge, the static advantages of the natural resources loose importance, based upon the capacity to generate knowledge. The firm and the agents try to protect the knowledge created, restricting its diffusion, keeping it for themselves. But these knowledge disseminates fast, with the introduction of information technology and the network integration, making it difficult to maintain the exclusivity of the developed technical knowledge, destroying rapidly the competitive advantage generated, making the firm and the economical agents search for new sources of knowledge, retro feeding the innovative process (DINIZ & GONÇALVES, 2005).

This way, the firm becomes a “learning organization”, trying to develop its human resources and strengthening relations with the universities, inserting them in the innovative process, broadening its skills (LUNDVALL, 2000). These skills are acquired through the formation of innovation networks that connect the firm to its clients, suppliers, competitors besides the research centers, specially the universities, therefore making the competition a collective learning effort.

Consequently, the firm responds to this constant changing environment by searching for new skills to face new problems. This leads to a selection of better qualified employees and the consequent selection of better prepared companies to face these changes, retro feed the result changes and innovations. These are the basis for the “learning organization” that integrated in networks, engages in a collective effort to generate, diffuse and apply new competencies (LUNDVALL, 2000).

2.1 The Problem

In this collective effort, the universities play a formidable role, as repositories of knowledge, linked to the development of skilled workers, as well as, playing a role in knowledge generation through its research centers. Therefore the development of skilled workers and innovative profiles professionals due to the academic programs of Universities also play a part in the universities role as determinants of regional development. And the entrepreneurial profile developed by their programs impact development by being part of the formatting of local knowledge reservoir and the constituting institutions integrated in the innovation system.

An innovation necessarily implies the existence of an innovator, responsible for the new combination of factors, a revolutionist of production, called the entrepreneurs by Schumpeter. This study aims at finding innovative traits on students' profile, specifically the business and engineering majors; contrasting these profiles to confirm or not the hypothesis that engineering majors display higher entrepreneurial characteristics than business students, as knowledge capital as engineering graduates compose the institutional basis for technological development, as already presented.

3. Methodology

Initially, the original data set was composed of 106 variables, an undergraduate student profile study developed by the Iowa University, and applied to undergraduate students of Federal University of Goiás, majoring in Engineering and Business. Students were asked to rate several statements referring to entrepreneurial attributes. The data was tabulated constructing a matrix. And for the factor analysis using PCA, the variables sex and age were left out to be used as dependent variables when the logistic regression was later applied.

This study used the descriptive research method that allowed describing the characteristics of a population, identifying relations among the variables. The population consists of the students majoring in business and engendering, base of the samples collected. The sample of the business students' populations consists of 200 subjects in a 450 population, while in the engineering area the sample was of 52 students in a population of 500, as it was applied only to the civil engineers. The following formula was utilized to determine the optimal sample size to specific populations, which means that the sample is representative of the population:

When the population researched does not overcome the 100.000 elements, it is necessary to calculate the size of the survey group, and the formula is as follows:

$$n = \frac{\sigma^2 \cdot p \cdot q \cdot N}{e^2(N-1) + \sigma^2 p \cdot q} \quad (01)$$

Where n is the size of the survey group; σ^2 is the level of confidence chosen; p is the percentage of the verification of the phenomenon; q is the complementary percentage (100-p); N is the size of the population and e^2 is the maximum error allowed. For the determination of the sample size for this study adopted the confidence level of 90 to 95%, and probabilities for the occurrence of the event of 0,50, for p, as well as for q, its complement. And the maximum error allowed was of 5%. Both samples were well within the confidence level of 5%.

The research data set included a great number of variables, 106 overall, leading to the use of the Factor Analysis (FA) method to reduce the dimensions of the variables, allowing working with a smaller number of variables, the factors. The Principal Component Analysis was chosen as the Factor Analysis method. According to Simar & Hardle (2007) the main objective of principal component analysis (PCA) is to reduce the dimension of the observations. The principal idea of reducing the dimensions of X is achieved through linear combinations, as the correlation between the variables is explained by the factors that they share. And for all calculations it was used the SPAW(18).

The method should be applied to data that have approximately the same scale in each variable, which is the case with the bank data set of this study. This is necessary as the PCA analysis is very sensitive to a change in the scale of variables, as is demonstrated by Simar and Hardle (2007). Therefore, in this study we used the factor analysis model utilizing the principal component method aimed at describing how the original variables in the data set depend on small number of latent factors $k > p$.

The data for the engineer majors was not very appropriate for a PCA analysis showing very low MSA values, therefore to obtain a similar level of classification as for the Business students, many variables, or questions of the questionnaire, were dropped as their MSA values were very low, following the recommended standard levels permitted according to recent multivariate analysis literature, Corrar, Paulo e Dias Filho (2009),.

4. Results and Discussions

4.1 The Business students

4.1.1 Factor Analysis – PCA method

The factor analysis model utilizing the principal component method was used to reduce the dimension to latent factors. The first results were tested and presented a KMO value of 0,696 (which has to be close to 1 and not below 0,5) and the Bartlett's Test of

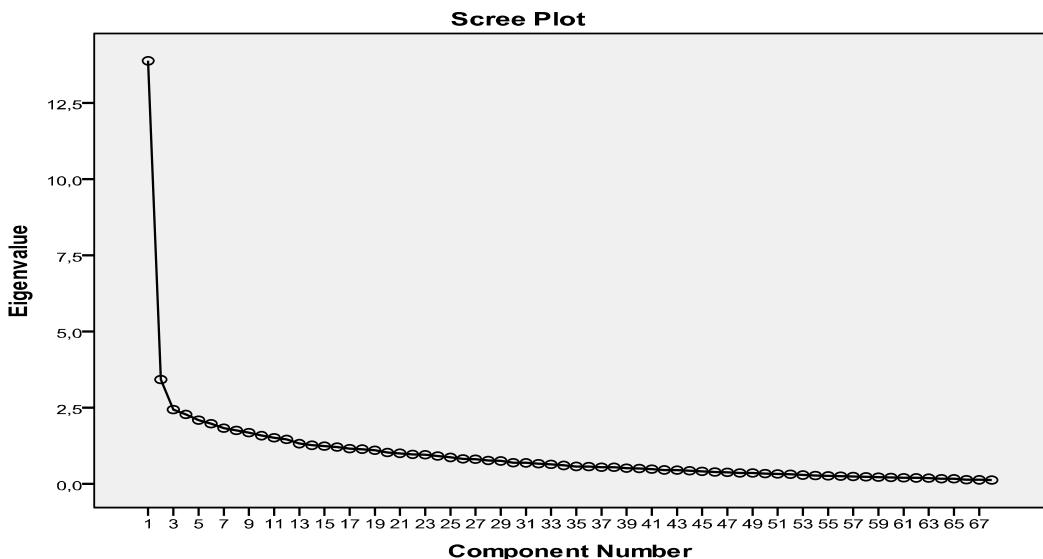
Sphericity showed a Chi-Square factor of 10253.313, significant at a 1% level, according to table 1.

After applying the PCA the results showed that many variables had a very low MSA (Measure of Sampling Adequacy) in the anti-image matrix, therefore all variables with MSA (Measure of Sampling Adequacy) lower than 0,700 were excluded, as they indicated low correlation, being a factor in itself, not able to be reduced to any dimension. But they were only eliminated after confirming that that communality and impact on factors were also low. This procedure reduced variables to 68, plus sex and age.

Table 1 – KMO and Bartlet test applied to the original data set.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,696
Bartlett's Test of Sphericity	Approx. Chi-Square	10253,313
	DF	5356
	Sig.	,000

Table 2 – Scree Plot for PCA



After running the PCA again we reached the result of 21 factors indicated to reach a 68,28% total variance explained. But according to the scree plot shown in table 2, there was very little explanation gained after the third factor. In regards to the nature of the questionnaire we were able to identify five areas of convergence that were: assertiveness, leadership, risk tolerance, dedication and information competence. Therefore in the study five factors were extracted as already specified.

The factor analysis with five factor extraction presented the following results: KMO value of 0,831 (which has to be close to 1 and not below 0,5), being therefore a good indication of the adequacy of the model, and the Bartletts's Test of Sphericity showed a Chi-Square factor of 5683,053, significant at a 1% level, according to table 3, validating the use of the FA.

Table 3 – KMO and Bartlett's Test
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,831
Bartlett's Test of Sphericity	Approx. Chi-Square DF Sig.	5683,053 2278 ,000

4.1.2 Logistic Regression

The next step was the logistic regression (using SPAW, 18) that used sex as the dependent variable (being masculine the reference for analysis) and included all factors, assert, leader, risk, dedication and info as explanatory variables. According to Rabe-Hesketh & Everitt (2007), “the programs logit and logistic are for data where each observation represents a single Bernouilli trial, with probability Binomial(1, π)”.

For the logistic regression, initially the logit model was used which presented a p-value of the coefficient of the variables, as follows: assert of 0.031, lider of 068, risk of 0.157, dedication of 0.239, info of 0.241. This is derived from the Wald-statistic, Z. The p-value of the likelihood ratio is more reliable, according to Rabe-Hesketh & Everitt (2007), and was given by the chi2(1) of 13.01, with a p-value of 0.023.

Following the logistic regression was used stepwise confirming the p-values by running the **lrtest**, using STATA (10.1). The results were significant only for the explanatory variables assert and lider, confirming what we had found for the model in SPAW.

According to statistics of adjustment measurements for the model proposed by Hair (1998), the following tables present a series of tests that corroborates with the decision to accept the regression. According to table 3, the Cox and Snell R² = 0,071, Nagelkerke R²=0,096 indicates that the model is not very strong, as the closer to 1 the better, limiting the prediction capability of our model, the decision was to use the model to describe the relation between sex and the significant explanatory variables, as it will not be utilized for prediction capacities. See below the tables with the test results:

Table 4 – Indicators for tests: -2LL (final), Cox & Snell R² and Nagelkerke R² (SPAW, 18).

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	249,960 ^a	,071	,096

a. Estimation terminated at iteration number 4
because parameter estimates changed by less than ,001.

Table 5 – Hosmer and Lemeshow Test (SPAW, 18).

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	14,146	8	,078

The model increased its prediction capability when the explanatory variables were included; reaching a 65,5%, overall correct prediction percentage. The Homer & Lemershow Test (SPAW, 18) present a Chi2 of 14,146 and a significance level of 0,077, indication that the predicted values are not significantly different from the observed values, therefore conforming the prediction capability of the model, at a 10% level. In this model the higher the level of the significance found the better, according to Corrar, Paulo & Dias Filho (2009).

The logistic regression with bootstrap presented the following equation, considering only the explanatory variables “assert” and “lider”:

$$Z = 0,548 - 0,402 \text{Assert} + 0,289 \text{lider} \quad (2)$$

The equation associated the assertiveness of the undergraduates and their leadership with the sex. For the variable “assert” the level of significance is 0,013, and the variable “lider” is 0,062; therefore significant at 5% and 10%, respectively. Allowing to infer that the variable “assert” indicates the there is a negative relation between sex and assertiveness, therefore permitting to affirm that male business students are less assertive, in contrast to female students.

In regards to leadership the equation presents a coefficient with a positive signal, indicating a higher probability of being a male when the leadership capacity increases. Or it can also be read that the higher the leadership capacity the higher the probability of being a male respondent. Therefore regional development may be dependent on men's assertiveness but on women's leader capacity as key capacity ingredients for economic development.

Tabela 6 – Regression prediction capacity

Classification Table^a

Observed		Predicted		Percentage Correct	
		sex			
		0	1		
Step 1	sex	0	21	54	
		1	15	110	
Overall Percentage				65,5	

a. The cut value is ,500

Besides the results associated with the regression analysis, the logistic regression also allows establishing the probability of a certain event to occur, given the profile characteristics assertiveness and leadership. The model according to table 5 presents a 65% correct prediction rate.

Assuming that a student is highly assertive therefore we define assert = 2 and with the same leadership capacity = 1, what is the probability of this person being male? According to Dias (2008) we can respond that through the equation below:

$$Z = 0,548 - 0,402 \text{Assert} + 0,289 \text{lider} \quad (3)$$

$$p = \frac{e^z}{1+e^z}$$

Substituting we have:

$$Z = 0,548 - 0,402 \text{Assert} + 0,289 \text{lider} = 0,033$$

$$p = \frac{e^z}{1+e^z} = 0,5082$$

In this case the subject has a probability of 50,82% of being of the male gender when the person presents higher assertiveness at a specific leadership level.

For the age variable a linear regression (Stata/SE, 10.1) was used with the lnage as the dependent variable and as explanatory variables the five factors previously defined (assert, leader, risk, dedication and info), using the OLS.

Table 7 – Linear regression (OLS), lnage (STATA/SE, 10.1).

Linear regression	Number of obs = 200 F(5, 194) = 4.29 Prob > F = 0.0010 R-squared = 0.0693 Root MSE = .2039
-------------------	---

lnage	Robust					
	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
assert	-.0103842	.0153556	-0.68	0.500	-.0406696	.0199011
leader	-.0046339	.0107526	-0.43	0.667	-.0258409	.0165731
risco	-.0045981	.0127873	-0.36	0.720	-.0298181	.020622
dedication	.0535367	.0119988	4.46	0.000	.0298718	.0772016
info	-.0015217	.0125593	-0.12	0.904	-.026292	.0232487
_cons	3.066298	.0144182	212.67	0.000	3.037861	3.094734

The regression presented significance only in reference to the dedication variable, with p-value significant at 1%, and F-statistics, significant at 1%, according to table 7. The equation estimated is $Z = 3,066 + 0,053 \text{Dedication}$. The relation between the coefficient for the explanatory variable demonstrates a positive relation between the dedication and age, indication that when the age of the respondent vary a year the dedication increases 5,3%.

4.2 Engineers

4.2.1 Factor Analysis – PCA method

Again the PCA was applied and the results showed that many variables had also a very low MSA (Measure of Sampling Adequacy) in the anti-image matrix, therefore all variables with MSA lower than 0,50 were excluded, as they indicated low explanatory capacity, being a factor in itself, not able to be reduced to any dimension. Of course that elimination took place after confirming that that communality and impact on factors were also low.

This procedure reduced variables to 23 variables, plus sex and age. Much lower number of variables, indicating the elevated number of variables in the data set not capable of explaining the variation of the original data.

After applying the PCA the results were tested by post estimation and presented a KMO value of 0,709 (which has to be close to 1 and not below 0,5) and the Bartlett's Test of Sphericity showed a Chi-Square factor of 578.034, significant at a 1% level, according to table 8, extracted from SPAW (18).

Table 8 – KMO and Bartlett's Test

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,709
Bartlett's Test of Sphericity	Approx. Chi-Square	578,034
	df	253
	Sig.	,000

The total variance explained is much higher with the engineer data reaching now the cumulative level of 63,60% with only five (05) factors, according to the following table, exported and cut from the “Total Variance Explained”, which presents the explanation capacity of factors.

Table 9 – Total Variance Explained (SPAW, 18).

Components	Extraction Sums of Squared Loadings		
	% of Variance	Cumulative %	Total
1	26,997	26,997	3,599
2	13,644	40,641	3,316
3	8,904	49,545	3,193
4	8,187	57,731	2,595
5	5,867	63,598	1,925

The factors defined were identified as referring to the following entrepreneurial characteristics: factor 1 is assertiveness; factor 2 is information competence; factor 3 is leadership; factor 4 is accessibility; and finally, factor 5 is dedication. As is noticeable, there is one factor that differs from the business students' profile, as there is no factor responding for risk tolerance and in its place it was possible to determine an accessibility capacity regarding the engineers' profile. That will not pose any difficulty analyzing the data, as the factor that presented significant in the previous analysis were assertiveness, leadership and dedication, which are also present for the engineering majors.

4.2.2 Logistic Regression

The equation associated the dedication and accessibility of the students with their gender is $Z = 0,8986 - 0,7515 \text{ Dedication} + 0,3610 \text{ Acessib}$. For the variable “dedication” the level of significance is 0,000, and the variable “accessibility” is 0,762; therefore significant at 1% and 10%, respectively. Therefore the variable “dedication” denotes a negative relation with gender, hence describing that male engineering majors are less dedicated, contrasting with female students. In regards to accessibility the equation presents a coefficient with a

positive signal, indicating a higher probability of being a male when the accessibility capacity increases.

Table 10 – Logistic Regression, Sex, presenting the probit regression for purposes of analysis. (STATA/SE, 10.1).

Iteration 0:	log pseudolikelihood =	-29.241428
Iteration 1:	log pseudolikelihood =	-23.556661
Iteration 2:	log pseudolikelihood =	-23.058217
Iteration 3:	log pseudolikelihood =	-23.042928
Iteration 4:	log pseudolikelihood =	-23.042911
Probit regression		
	Number of obs	= 52
	Wald chi2(5)	= 14.09
	Prob > chi2	= 0.0151
	Pseudo R2	= 0.2120
	Log pseudolikelihood =	-23.042911

Sex	Robust Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
assert	.1333674	.1850266	0.72	0.471	-.2292782 .4960129
info	-.2000812	.1880292	-1.06	0.287	-.5686117 .1684493
leader	.0695916	.2490615	0.28	0.780	-.41856 .5577433
acessib	.3610057	.2007452	1.80	0.072	-.0324477 .7544592
dedication	-.7515689	.2172886	-3.46	0.001	-1.177447 -.3256911
_cons	.8986664	.232503	3.87	0.000	.4429689 1.354364

Below find the results of the Hosmer and Lemeshow Test (STATA 10.1) that confirms that the probit regression, according to a Chi-square of 45.33 at a significance level of 0,5001, is a favorable result confirming that the model can be used to estimate probability.

Table 11 - Hosmer and Lemeshow Test (STATA 10.1)

Probit model for Sex, goodness-of-fit test

number of observations =	52
number of covariate patterns =	52
Pearson chi2(46) =	45.33
Prob > chi2 =	0.5001

For the age variable a linear regression (Stata/SE, 10.1) was used with the lnage (the ln of the variable age) as the dependent variable and as explanatory variables the five factors previously defined characteristics: assertiveness; information competence; leadership; accessibility; and, dedication; using the OLS. The results denoting no clear correlation between age and these traits of entrepreneurship, as the p-values were not significant at any acceptable parameter.

5. Considerations

This study is one of the first steps of an ongoing research that will be accompanying, for a period of 10 years, the profiles of the students of business and engineering majors. This will be broken down by junior to senior students, identifying the changes in profile due to the role of the university and its training impacts; the longer the student is subject to higher education training. And it will continue to contrast these two different majors, tracing any differences among the training received by each area, as far as its development of specific entrepreneurial profiles.

The main objective herein is to lay the bases of an initial understanding of how higher education as generator of scientists and engineers, is facing this challenge in the Federal University of Goiás, of educating individuals that will be determinant of the workforce quality of the knowledge-based economy.

The factor reduction analysis denoted that there are four (04) recurrent factors that are representative of the students' profile, which are assertiveness, leadership, dedication and information competence. Among these factors the equations, from the probit regression deduced from the logistic regressions, demonstrated that assertiveness, leadership and dedication are the most relevant factors, and that they indicate a specific relation to gender, which will need further confirmation. Therefore the study was able to find innovative traits in the students of business and engineering, identifying that the university play a role in the entrepreneurial profile of this workforce in the making, revealing one of the roles of the institution "universities", as training professionals with an entrepreneurial perspective.

Understanding the profile of the human capital developed by higher education institutions is key to understanding better the institution "universities", and is also contributing to a much larger study of the science system. Therefore, we believe this first view of the subject will be the basis for comparative analysis of different universities education and training of the research workforce of the knowledge-based economy, and the formation of this figure: the entrepreneur.

6. References

- Birch, K. (2007). **Knowledge, place and power: conceptualizing value creation in knowledge-based commodity chains**. University of Glasgow: Centre for Public Policy for Regions (CPPR). Working Paper n. 13.
- Corrar, L.J.; Paulo, E. & Dias Filho, J.M. (2009). **Análise multivariada**. São Paulo: Editora Atlas.
- Dias, D.C. () **A Importância das incubadoras de empresas no processo de inovação nas empresas de base tecnológica – o caso da incubadora de empresas de base tecnológica**.
- Dosi, G. (1998). **Sources, procedures and microeconomic effects of innovation**. Journal of Economic Literature, vol. 26, n. 3, pp. 1120-1171.
- Freeman, C. (1998). Networks of innovators: a synthesys of research issues. London: Research Policy.
- Godin, B. (2006). **The Knowledge-Based Economy: Conceptual Framework or Buzzword?** Netherlands: Journal of Technology Transfer, 31: 17-30.
- Hair JR., J.F. et al. (1998). **Multivariate Data Analysis**. New York: Macmillan Publishing Company.
- Härdle, W & Sima, L. (2007) **Applied Multivariate Statistical Analysis**. 2nd edition.

Huggins, R.; Johnston, A. & Steffenson, R. Universities, **Knowledge and Regional Policy**. Wales: Oxford University Press.

Lundvall, B.-Å. (1985), Product innovation and user-producer interaction, Aalborg, Aalborg Universitetsforlag.

Lundvall, B.-Å. (1996), 'The Social Dimension of the Learning Economy', DRUID Working Paper, No 1, Aalborg University, Department of Business Studies.

Lundvall, B.-Å. (1999). Det danske innovationssystem - et forskningsbaseret debatoplæg, ErhvervsfremmeStyrelsen, København.

Lundvall, B.-Å. and Borrás, S. (1997). The globalising learning economy: Implications for innovation policy, Bruxelles, TSER-DG XII European Commission.

Lundvall, B.-Å. and Johnson, B. (1994). 'The learning economy', i Journal of Industry Studies, December.

Lundvall, B.Å. and Maskell, P. (2000). Nation states and economic development - From national systems of production to national systems of knowledge creation and learning', Gertler, M. et al (eds.), Geographical Handbook, Oxford, Oxford University Press.

Lundvall, B-A.(2000). **Políticas de Inovação na Economia do Aprendizado**.

Lundvall, B-Å. (2002). **The University in the Learning Economy**. Aalborg, Aalborg Universitetsforlag, DRUID Working Paper No 02-06.

Nelson, R.S. (2006) **A Fontes do Crescimento Econômico**.

Nelson, R.S & Winter, S.G. (2005). **Uma Teoria Evolucionária da Mudança Econômica**.

Organization for Economic Co-operation and Development (1996). **The Knowledge-Based Economy**. Paris: OECD GD/(96) 102.

Rabe-Hesketh, S. and Everitt. B.S. (2007). **A Handbook of Statistical Analyses Using Stata**. Florida: Chapman & Hall/CRC, 4th edition.

Rencher, A. C.(2002). **Methods of Multivariate Analysis**. Canada: John Wiley & Sons, Inc, 2nd edition.

Schumpeter, J. A. (1982). **Teoria do Desenvolvimento Econômico**. São Paulo: Abril Cultural. (Série Os economistas).

Schumpeter, J. A. (1984). **Capitalismo, Socialismo e Democracia**. Rio de Janeiro: Zahar.

EDITORIAL

**FACE – Faculdade de Administração,
Ciências Contábeis e Ciências
Econômicas**

Curso de Ciências Econômicas

Direção FACE

Maria do Amparo Albuquerque Aguiar

Vice-Direção FACE

Mauro Caetano de Souza

**Coordenação do Curso de Ciências
Econômicas**

Cleyzer Adrian Cunha

Endereço

Campus Samambaia, Prédio da FACE –
Rodovia Goiânia/Nova Veneza, km. 0 –
Caixa Postal 131, CEP 74001-970, Goiânia
– GO.

Tel. (62) 3521 – 1390

URL

<http://www.face.ufg.br/eco>

NEPEC – Núcleo de Estudos e Pesquisas

Econômicas

Coordenação

Dnilson Carlos Dias

**TEXTO PARA DISCUSSÃO DO
CURSO DE CIÊNCIAS
ECONÔMICAS DA UFG**

Coordenação

Sandro Eduardo Monsueto

Colaborador Externo

Luciano Martins Costa Póvoa – UNB

Publicação cujo objetivo é divulgar resultados de estudos que contam com a participação de pesquisadores do NEPEC. As opiniões contidas nesta publicação são de inteira responsabilidade do(s) autor(es), não representando necessariamente o ponto de vista do NEPEC ou da FACE/UFG. É permitida a reprodução, desde que citada a fonte.