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## Portuguese Startups: a success prediction model

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# **Portuguese Startups: a success prediction model**

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## **Abstract**

This study analyses the factors that influence the success of Portuguese startups. It aims to develop a success versus failure prediction model regarding the Portuguese entrepreneurship ecosystem. Our empirical study considers four categories that influence the success: characteristics of founders, characteristics of startups, capital and external factors. The sample includes 50 startups established over the period from 2003 to 2015 in Portugal. The explanatory variables that we use are management experience, industry experience, marketing skills, age, education, parents that have their own business (characteristics of founders), capital (capital), record keeping and financial controls, planning, professional advisors, staff, partners, product or service timing (characteristics of startups) and economic timing (external factors). The empirical results show that only the founder's characteristics and external factors have a significant influence in Portuguese startups success. Portuguese startups with young founders, less than 25 years old, and founders with less education, high school education or less, are more likely to be unsuccessful cases. However, and contrarily to the previous literature, marketing expertise is negatively correlated with the success of startups Overall, the success and failure prediction model presents an ability to accurately predict a specific Portuguese startup as success or failure of 82%.

**Keywords:** startup, entrepreneurship, logit model, success, failure, prediction model

**JEL Codes:** L25, L26, M13

## 1. Introduction

In 2015, Portuguese economy registered a Gross Domestic Product growth of 1.5%, in real terms, after an increase of 0.9% in the previous year. This acceleration was characterized by the higher growth of the domestic demand, namely, the acceleration of private consumption from 2.2% to 2.6% in 2014 and 2015 respectively, in a framework of better labor market conditions. There was an increase in the employment and a reduction in the unemployment rate (Banco de Portugal, 2016).

According to the most recent Portuguese Central Bank study about Portuguese companies, there are 390,000 non-financial companies, 89.4% micro enterprises<sup>1</sup>, 10.3% small and medium enterprises<sup>2</sup> and only 0.3% big enterprises. In 2015, the absolute number of Portuguese companies increased 2% due to the increase of micro enterprises which was the unique business group with the ratio (natality/mortality) higher than one. This business group represents 15.4% of national turnover (Banco de Portugal, 2015).

Austerity measures implemented in the last years have driven unemployment to record levels and the entrepreneurship has proven to be an escape route. A new reality has been growing, startups, small organizations in first stages of development, high level of innovation and inherent risk. Governments worldwide have been recognizing micro, small and medium enterprises for their contribution to the economic stability, growth, job creation, social cohesion and development (Zacheus and Omoseni, 2014; Savlovschi and Robu, 2011). At the same time, they are important drivers of innovation, productivity and attraction of investments.

Portuguese economy is characterized by intense and high-quality entrepreneurial activity. In 2013, the startups with headquarters in Science and Technology Park of University of Porto represented € 31.85 million of Portuguese Gross Domestic Product, € 6.25 million of Tax Revenues and € 6.7 million of Investment and Monetary Incentives for business development (UPTEC, 2014). The values show the importance of this new business reality in Portugal.

Given the importance of micro, small and medium enterprises to economy and society, public policy makers and other stakeholders have promoted the creation of new businesses and reducing the incidents of their failure (Savlovschi and Robu, 2011; Carter and Van Auken, 2006).

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<sup>1</sup> Micro Enterprises: entities with less than ten employees and annual turnover/total annual balance sheet does not exceed two million euros

<sup>2</sup> Small and Medium Enterprises: entities with less than 250 and more than 10 employees and an annual turnover between 2 and 50 million euros or a balance sheet between 2 and 43 million euros

Over the last few decades, an extensive body of literature about the factors that influence the business success and failure has been developed. The authors have been trying to explain the success and failure of enterprises around the world, using univariate or multivariate models, financial or non-financial models and studying a large number of explanatory variables. Lussier (1995) designed a model to test non-financial predictors of the success and failure of young firms. The model included fifteen explanatory variables: capital, record keeping and financial controls, industry experience, management experience, planning, professional advisors, education, staffing, product/service timing, economic timing, age of the owner, partners, parents who have owned a business, being a minority and marketing skills. The model has been used to predict success and failure in six different countries in last two decades, for different industries and for companies with different sizes. The model demonstrated a predictive ability between 63% and 85%.

The motivation for studying the factors that influence the Portuguese startups success and failure rely on the lack of consensus regarding the determinants that influence the business success and failure worldwide together with the limited knowledge about Portuguese startups. It is important to continue investigating the factors which affect the business success and to develop a theory which could explain success or failure.

Thus, the aim of this paper is to understand which factors influence the Portuguese startups success and failure improving the Lussier's success and failure prediction model. This research presents several contributions to the Portuguese startups literature. Although Portuguese startups became a focus of attention with numerous news, articles and studies where there are presented success and failure cases, there is no public data available about this reality, namely about the absolute number of startups created in national territory, their characteristics and if they are success or failure cases. In this paper, we contribute to the limited information about Portuguese startups by sharing some information about fifty Portuguese cases. The information includes details about the founder team, the product and economic timing, startup characteristics and information about success or failure of that startup.

Secondly, we contribute to the literature by examining the factors which influence the success and failure of Portuguese startups in a transversal way, including fourteen explanatory variables, which are grouped in four categories: founders' characteristics, capital, startup characteristics and external factors. The following explanatory variables were included: management experience, industry experience, marketing skills, age, education, parents (founders' characteristics), capital (capital), partners, professional advisors, product or service

timing, record keeping and financial control, plan, staffing (startup characteristics) and economic timing (external factors).

Finally, we developed a model to test predictors of the success and failure of Portuguese startups. The present model has three adjustments to the Lussier Model. The first adjustment is the exclusion the variable minority to the model. Analyzing the Portuguese reality, it is possible to conclude that minorities are nonexistent, so it was necessary to adapt the model to the Portuguese reality. The second adjustment, and as mention above, is that all explanatory variables were grouped in four categories. The third adjustment relates to the fact that Lussier (1995) research did not recode discrete variables into dummy variables. In the present research, all the explanatory variables are recoded into dummy variables. This allows easy interpretation and calculation of the odds ratios and increases the stability and significance of the coefficients. Dummy variables have been recognized for its advantages in logistic regression (Oluwapelumi, 2014; Hosmer et al., 2013).

In order to investigate the determinants which most influence the startups success, a sample of startups launched between 2003 and 2015 in Portugal was selected. The sample is composed by 50 Portuguese startups, 33 success cases and 17 failure cases.

The results obtained by the empirical work show that only founders' characteristics and external factors have a significant influence in the Portuguese startup success. According to success and failure prediction model developed, basic education (high school or less), young age (less than 25 years old) and marketing skills have a negative and significant influence in startup success. According to the previous literature, the negative impact of marketing skills in Portuguese startups success is not expected. This result may indicate that marketing skills have been overrated by the founders regarding the path of the startup or the marketing strategies were incorrectly implemented regarding the product and services of the companies. Furthermore, it is also important to note that the marketing strategies do not only influence the perceived value for the clients but also the perceived value for investors and other stakeholders who have a relevant role on the success of the startup.

Regarding startup characteristic and capital, the empirical results reveal that they do not have a significant impact in Portuguese startup success.

This paper is organized as follows: Section 2 presents a brief review of the extant literature related to startups, business success and determinants of business success and failure. According to this, a set of hypotheses is developed in section 3. Section 4 describes the variables and the sample selection process. The methodology used in this paper is evidenced on section

5 and, regarding the hypotheses, the empirical results are exhibited on section 6. To finalize, section 7 presents the conclusions of this study.

## **2. Literature Review**

### **2.1.Startup**

There is no universally accepted definition for startup, several parameters to define it have been used: age, profitability, growth metrics and other categories. In most of the reports about entrepreneurship, every enterprise with less than one year is considered a startup, but not all newly enterprises are startups. Although, startups and new enterprises share some common characteristics, like age and size, they differ in essential points, namely strategy, innovation and ability to grow. Blank and Dorf (2012) defined a startup as a temporary organization formed to search for a repeatable and scalable business model. When the startup finds a suitable, desirably ideal business model, it shifts from exploratory phase towards execution phase, ceasing to be a startup. With a different point of view, Ries (2011) defines a startup as a human institution designed to deliver a new product or service under conditions of extreme uncertainty.

Considering perspectives of multiple authors and the Portuguese reality, in this study, it will be considered a startup, an organization in first stages of development with high level of innovation, inherent risk, extreme uncertainty and scalable business model, normally with headquarters in a Portuguese Business Incubator.

There is a lack of detached information regarding startups and small and medium enterprises, so, in this study, it will be considered that the small and medium enterprises success and failure studies can also be applied to startups, considering their similarities.

### **2.2.Business Success**

Identifying and measuring business success can be difficult because it is a relative measure. Success can be measured in different ways and it will depend on the enterprise goals which can be financial or non-financial, simple pre-defined expectations or founders' behavior. In 1986, Barney (1986) defined success as a measure of performance that occurs when the enterprises create value for its customers in a sustainable and economically efficient manner. Although, other measures of performance have been used: enterprise strategy, the resources and organizational structure, processes and systems, revenues, employment growth (Hmieleski and Baron, 2009; Chrisman et al., 1998), profit and other financial performance measures (Mayer-Haug et al., 2013).

Survival and success are two different concepts, survival is the minimum criteria of entrepreneurial success in all definitions. Survival is an absolute measure of enterprise performance that depends on the ability of the enterprise to continue to operate as a self-sustaining economic entity. The determination of a suitable period of time, after which survival is to be stated, is the most important methodological problem related to survival as a measure of business success. If the period is too short, the success measure is not demanding enough. If a too long reference period is chosen, the focus can be shifted from startups to established companies, considering the assumptions of startup definition.

In this paper, and having into consideration the Portuguese Startup reality, it will be considered a case of success, a startup which operates four or more years whether or not there was a change of ownership. If a startup changed ownership during the period of four years and remained active it is defined as a success case.

### **2.3.Determinants of business success**

Over recent decades, several studies have been developed in order to understand and predict the success and failure of enterprises and evaluate their performance, but there is no generally accepted list of variables which affect their success. Numerous explanatory variables for business success or failure were studied, which were grouped in different categories by different authors. Carter and Auken (2006) grouped the business success factors in four categories: characteristics of the founders, accessibility to capital, characteristics of the enterprises and external markets. In this research, the influence of these four categories in Portuguese startups success will be investigated. The hypotheses developed are mentioned in section 3.

In order to test the four categories stated above, fourteen variables which have been recognized as the most important success factors amongst literature will be used, including studies developed by Robert Lussier. Lussier (1995) designed a generic model to test non-financial predictors of the success and failure of young firms, including fifteen major variables identified in twenty journal articles as contributing to success versus failure. The fifteen explanatory variables are: capital, record keeping and financial controls, industry experience, management experience, planning, professional advisors, education, staffing, product/service timing, economic timing, age of the owners, partners, parents who have owned a business, being a minority and marketing skills.

In table 1, a detailed explanation about each of these variables is presented.

**Table 1 : Variables included in Robert Lussier studies**

The table 1 shows the explanatory variables used by Robert Lussier in their studies.

<b>Variable</b>	<b>Explanation</b>
Record keeping and financial control	Businesses that do not keep updated and accurate records and do not use adequate financial controls have a greater chance of failure than firms which do.
Capital	Businesses that start undercapitalized have a greater chance of failure than the ones which start with adequate capital.
Industry Experience	Businesses managed by people without prior industry experience have a greater chance of failure than firms managed by people with prior industry experience.
Management Experience	Businesses managed by people without prior management experience have a greater chance of failure than firms that are managed by people with prior management experience.
Planning	Businesses that do not develop specific business plans have a greater chance of failure than firms that do.
Professional Advisors	Businesses that do not use professional advisors have a greater chance of failure than firms using professional advisors.
Education	People without any college education who start a business have a greater chance of failing than people with college education.
Staffing	Businesses that cannot attract and retain quality employees have a greater chance of failure than firms which can.
Product/Service Timing	Businesses that select products/services that are too new or too old have a greater chance of failure than firms that select products/services that are in the growth stage.
Economic Timing	Businesses that start during a recession have a greater chance to fail than firms that start during expansion periods.
Age	Younger people who start a business have a greater chance to fail than older people starting a business.
Partners	A business started by one person has a greater chance of failure than a firm started by more than one person.
Parents	Business owners whose parents did not own a business have a greater chance of failure than owners whose parents did not own a business.
Minority	Minorities have a greater chance of failure than no minorities.
Marketing	Business owners without marketing skills have a greater chance of failure than owners with marketing skills.

Source: Own elaboration based on Lussier, 1995.

Over the last two decades, Lussier prediction model has been applied in six different countries: USA (Lussier 1995; Lussier, 1996a; Lussier, 1996b; Lussier and Corman, 1996), Croatia

(Lussier and Pfeifer, 2000), Chile (Lussier and Halabi, 2010), Israel (Lussier and Maron, 2014), Pakistan (Lussier and Hyder, 2016) and Sri Lank (Lussier et al., 2016). The model reveals a predictive ability between 63% and 85%, which validates its global applicability and robustness. This model was tested in a general way, including all companies, and in specific industries: service and retail industry.

Lussier's model is a non-financial prediction model which is more appropriate than financial models for young business researches. Most of the financial prediction models use sales as a predictor which are not appropriate to use with startups. If it is a technological startup it is expectable that the startup spends the early years developing the product without sales, although it can be a successful startup because it survives at first years and achieve the goals proposed by the founders or investment team. For those companies, managerial variables are critical for the company performance.

In order to give an overview of all the Lussier's works, table 2 summarizes the studies related to the author and its main results.

**Table 2 : Business success versus failure prediction – relevant empirical Lussier studies**

Table 2 summarizes the most important studies realized by Lussier. The aim of these studies is analyzed together with the influence of the fifteen explanatory variables in business success versus failure, such as: management experience, industry experience, marketing skills, education, age, minority, capital, economic timing, product or service timing, record keeping and financial control, plan, partners, parents, staffing and professional advisors. The first study was developed in 1995 in USA, which has been reproduced in different countries like: Croatia, Chile, Israel, Pakistan and Sri Lanka.

Author	Subject	Count	Indus	Model	Explanatory Variables	Predict. ability
Lussier (1995)	A nonfinancial business success versus failure prediction model for young firms	USA	All	Logistic Regression	Professional Advisors; Planning; Education; Staffing	70%
Lussier (1996a)	A business success versus failure prediction model for the service industries	USA	Service Indus.	Stepwise discriminant analysis	Professional Advisors; Planning; Staffing; Record keeping and financial control; Parents; Management Experience; Economic Timing; Marketing; Partners.	80%
Lussier (1996b)	A startup business success versus failure prediction model for the retail industry	USA	Retail Indus.	Stepwise discriminant analysis	Professional Advisors; Planning; Record keeping and financial control; Economic Timing; Age; Product/Service Timing	80%
Lussier and Corman (1996)	A business success versus failure prediction model for entrepreneurs with 0-10 employees	USA	All	Stepwise discriminant analysis	Professional Advisors; Planning; Staffing; Record keeping and financial control; Economic Timing; Education; Minority; Parents; Capital; Industry Experience,	75%
Lussier and Pfeifer (2000)	A comparison of business success versus failure variables between U.S. and Central Eastern Europe Croatian Entrepreneurs	Croatia	All	Logistic Regression	Professional Advisors; Planning; Education; Staffing	72%
Lussier and Halabi (2010)	A three-country comparison of the business success versus failure prediction model	Chile	All	Logistic Regression	Planning	63%
Lussier and Marom (2014)	A business success versus failure prediction model for small businesses in Israel	Israel	All	Logistic Regression	Professional Advisors; Planning; Capital; Record keeping and financial control; Age	85%
Lussier and Hyder (2016)	Why businesses succeed or fail: a study on small businesses in Pakistan	Pakistan	All	Logistic Regression	Planning; Staffing; Capital; Partners	82%
Lussier et al., (2016)	Entrepreneurship success factors: an empirical investigation in Sri Lanka	Sri Lanka	All	Logistic Regression	Planning; Staffing; Record keeping and financial control; Product/service timings; Marketing	78%

Source: Own elaboration

According to the studies developed, there is only one variable, planning, with significant influence in business success in all studies developed by Lussier during twenty-one years and in six countries. Specific business plans present a positive influence in success. The capability of attracting and retaining quality employees, staffing, and the presence of professional advisors, professional advisors, have been recognized in six out of nine studies as having significant influence in business success. On the other side, management experience, industry experience and minority are the explanatory variables with significant influence in fewer studies, only one out of nine.

Considering the importance of startups in Portugal, a few authors have made efforts to understand the Portuguese reality and the factors that influence their success or failure, in particular through the study of success cases like Science4you and *Cestos da Aldeia* (Barroca, 2012).

Existing literature has shown that research-based spin-offs<sup>1</sup> firms usually exhibit lower death risks than other startups. So, recently, Faria and Conceição (2014) analyzed the factors that influence the Portuguese research-based spin-offs success and concluded that variables such size, firm age, parent reputation and region characteristics are key determinants of survival, casting doubts on the role played by the incubation process and the social ties with the parent organization. National and international authors present the same explanatory factors which influence business success or failure, although, and as mentioned previously, there is no unique list of factors which explains the business success globally.

It is also important to have into consideration that failure factors are not the opposite of success factors and they are the result of multiple interactions of different factors at different levels. Melo e Silva (2013) presented three levels of success and failure factors that influence the startup success and failure: entrepreneur, organization and environment level. Considering the recent studies and the increasing importance of startups in Portuguese economy, it is crucial to understand the factors that influence the success and failure in a transversal way.

### **3. Hypotheses development**

#### **3.1.Characteristics of the founders**

Founders are the basis of the startups and their characteristics may define the starting point of the startup culture and its interaction with the business environment. Experience, knowledge,

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<sup>1</sup> research-based spin-offs = a kind of startup whose creation is based on the formal and informal transfer of technology or knowledge generated by public research organizations

age and education have been recognized as relevant characteristics of human capital which is considered a critical factor for organizational performance (Felício et al., 2014; Geroski et al., 2010). Although it is recognized a positive relationship, the magnitude of the relationship between human capital and success seems to vary considerably across studies.

Human capital is positively correlated with founders' capabilities of discovering, exploiting business opportunities, developing better plans and venture strategy. It helps founders acquiring resources such as financial and physical capital, which in initial stages helps to mitigate the lack of capital (Unger et al., 2011). Formal education is one of the most widely studied variable related to human capital. This variable is correlated with the entrepreneur ability to successfully discover and exploit a business opportunity, problem solving, motivation and self-confidence. Despite the positive effect in the business survival (Lussier and Pfeifer, 2010) it has been argued that the skills which make a successful entrepreneur cannot, be or are not necessarily obtained through formal education. Founders' experience and skills contribute to entrepreneurial talent and they have been identified as a distinct correlation with performance. It includes management experience, industry experience, marketing skills as well as knowledge and skills since these can be considered as an outcome of the human capital investment associated with experience.

The management know-how has been investigated due to its relevance and its positive effect on business survival (Gimmon and Levie, 2010). It is directly related with the entrepreneur tacit know-how acquired by substantial investment of time in studying, observing and making business decisions. But it can take indirect source, the management know-how embodied in entrepreneurs may result from having parents who owned a business. Entrepreneurs, who have parents who owned a business, perceived the entrepreneurship as a viable career as they see parents as role models. They develop knowledge of what is involved in running a business, a valuable background. So, it is recognized that entrepreneurs with parents who own businesses have a positive relationship with their company's success (Lussier and Corman, 1996). Management experience provide to the entrepreneur the right skills to monitor diverse functions and interact with different stakeholders, namely customers, investors and suppliers.

Other important skills identified in literature which have a positive influence in business success are marketing skills. Inadequate founder's marketing skills may create marketing problems which, in small business, can be determinant in the long term for the business success or not (Lussier et al., 2016).

Knowledge of the products, processes and technology constitutes the industry specific know-how and it is a major determinant of liability of newness, mentioned in section 2.3. The specific

industry know-how reduces the liability of newness, and consequently, the risk of failure. (Gimmon and Levie, 2010). Finally, the founders' age is an indirect catalyzer of all competencies acquired by the founders through both education and prior work experience. The risk aversion and the cost of leaving an employment position are positively correlated with age, considering family concerns and career partners. These are the two main reasons for the young age of majority of the founders. On the other hand, young age is positively correlated with lack of professional and relational skills and financial constraints. Authors have been recognizing the positive relationship between age and business survival (Lussier and Marom 2014; Headd, 2003).

Considering this factors, the first hypothesis proposed on this study is as follow:

H1: The founders' characteristics have significant influence in startup success

### **3.2. Accessibility to capital**

The lack of capital is also mentioned as a common cause of firm's failure (Lussier and Hyder, 2016; Lussier and Marom, 2014). Capital influences directly and indirectly the performance. Direct effects include the ability to undertake more ambitious strategies, change courses of actions and meet the financing demands imposed by growth. In terms of indirect effects, capital accumulation may reflect better training and more intensive planning. Thus, in what regards accessibility to capital, it is proposed in this study the following second hypothesis:

H2: Undercapitalization is negatively and significantly related with startup success

### **3.3. Characteristics of the startup**

The characteristics and nature of the enterprise is another category which influences the business success. As presented in section 3.1, the team's skills and knowledge are crucial for business success. The founder team size is an element which influences the business success because it is a catalyzer of entrepreneurial talent accumulation. When founders with complementary competencies are added, the individual founder's cognitive and managerial capacity expands. Although the positive effect of team founder's size on performance has been recognized, greater team size does not guarantee better performance, it is needed to have into account the challenges of coordination and communication in a larger team (Brinckmann and Högl, 2011, Mayer-Haung et al., 2013). It is also important to mention that the human capital attributes which contribute to business success can have other sources: staff excluding founders or indirect sources as professional advisors. Business that cannot attract and retain quality

employees have a greater chance of failure than firms which can (Lussier et al., 2016; Lussier and Hyder, 2016). The existence of professional advisors provides the access to information networks which provides specific data and encouragement. The act of seeking information may also reflect more comprehensive planning and a higher degree of managerial sophistication. For these reasons, the existence of professional advisors contributes to business success (Lussier and Marom, 2014).

The organizations are composed by human capital but it is important to evaluate the internal activities. Formal planning involves the determination of milestones, the creation and evaluation of different scenarios and strategies as well as implementation controls. The importance of planning and record keeping and financial controls and their relation to performance has been long debated (Mayer-Haung et al., 2013). The existence of a specific business plan is a unique variable that presents a powerful explanation in all Robert Lussier studies, it reveals a positive influence in business success across twenty-one years and six different countries (USA, Chile, Croatia, Israel, Sri Lanka and Pakistan).

At the same time, the relationship between product or service timing and business success has been studied. Businesses which release products or services that are too new or too old have a greater chance of failure than firms which release products/services which are in the growth stage (Lussier et al., 2016). Considering this, the following hypothesis is proposed in this study:  
H3: The startup characteristics have a significant influence in startup success

### **3.4.External factors**

Different stages of the economic cycle affect the operation of businesses and it can be positive or negative. Recessions affect the rate of new firm creation and survival. New enterprises are more likely to suffer from cash constraints than establish ones, as they do not have the time to develop legitimacy in financial markets. So, authors conclude that businesses that start during a recession have a greater chance to fail than firms which start during expansion periods (Sikomwe et al., 2014). However, it is important to mention that startup creation is higher in recession periods as a result of high rate of unemployment (Geroski et al., 2010). Considering this, the following hypothesis is proposed in this study:

H4: External factors are positively and significantly related with startup success

## **4. Variables definition and sample selection**

### **4.1. Variables**

#### **4.1.1. Dependent variable**

In this study, the dependent variable is success. It is considered a success startup, an organization in first stages of development with high level of innovation, inherent risk and scalable business model which operates four or more years. If the startup changes its ownership during the period of four years of survival and remained active, it is considered a success startup. The dependent variable is a binary variable that takes value one if it is a successful startup or zero if it is a no successful startup.

#### **4.1.2. Independent variables**

Several determinants of firms' success were analyzed in the previous literature. In this study we selected fourteen determinants that those studies concluded that affect the business success. They are as follows: capital, record keeping and financial control, industry experience, management experience, planning, professional advisors, education, staffing, product/service timing, age of owner, partners, parents owned a business, marketing skills and economic timing. Lussier (1995) has been studying the influence of these fourteen determinants plus the explanatory variable minority on business success. The variable minority is not included in the present study for two main reasons. Firstly, in studies developed by Robert Lussier the variable minority only reveals a negative and significant influence in one, out of nine studies, which demonstrated a weak significant influence in business success. The second reason, is that considering the Portuguese Startup ecosystem and the information obtained in Business Incubators, the minorities are not relevant in the Portuguese entrepreneurship ecosystem.

In the present study, the determinants were grouped in four categories: startup characteristics, founders' characteristics, capital and external factors. Additionally, all independent variables used in the models are binary variables. The recodification of all discrete independent variables as dummy variables has been recognized for its advantages in logistic regression. It allows easy interpretation and calculation of the odds ratios and increases the stability and significance of the coefficients (Oluwapelumi, 2014; Hosmer et al., 2013). It is also important to mention that all variables are non-financial variables, which are more appropriate than financial variables. The last ones are normally related with sales and for this reason they are not appropriate to be used with startup businesses (Scherr, 1989). The classification of independent variables is provided below.

## Characteristics of founders

In order to test if the founders' characteristics have a significant influence in Portuguese startup success, the following variables are used: industry experience, management experience, education, age, parents and marketing skills.

The variables related with experience, namely industry experience (*inex*), management experience (*maex*), and skills, marketing skills (*mrkt*) are binary variables which take value one if one of the founders has this level of experience or skills, or zero otherwise.

Management know-how is directly measured by the variable management experience, although it is influenced indirectly by the variables parent and professional advisors. The variable parent (*pent*) indicates if the founder team has parents who owned a business, which has been recognized by having a positive effect in success enterprises. This variable takes value one if the team founder has this attribute, or zero otherwise.

Although there were firstly introduced the experience and skills variables, it is important to not forget that the entrepreneurs' expertise is correlated with their education and age, which reflect the investment in their development. So, to capture these two measures, the variables education and age are used. In this study, education was initially divided in five groups: less than high school, high school, bachelor's degree, master's degree and PhD, which are the options available in the questionnaire. The initial groups were transformed into a binary dummy called basic education (*basiceduc*) which takes value one if the founders have, in average, high school or less formal education, or zero otherwise.

For the variable age, it was initially created three groups: less than 25 years old, between 26 and 35 years old, more than 36 years old, which represent young age, middle age and old age, respectively. In general, if a variable has  $k$  possible categories, then  $k-1$  dummy categories are needed (Hosmer et al., 2013). So, there were created two dummy variables related to age: founders with less than 25 years old which represent the young age (*youngage*) and founders with more than 36 years old which represent the old age (*oldage*). Each dummy variable takes value one if the attribute is present, or zero otherwise. In table 3, the independent variables related to founders' characteristics are summarized and, if applicable, the initial variables and the process of recoding in dummy variables are described.

**Table 3 : Independent variables definition related to founders**

Table 3 presents the process of recoding original variables related to founders' characteristics in dummy variables. Original variables are the variables present in the original questionnaire.

Original Variable	Dummy Variable	Variable Name
Founders have industry experience	Industry experience (Yes – 1 ; No – 0)	inex
Founders have management experience	Management experience (Yes – 1 ; No – 0)	maex
Founders have marketing skills	Marketing skills (Yes – 1 ; No – 0)	mrkt
Founders education: - less than high school diploma - high school diploma - bachelor's degree - master's degree - PhD	Founders have high school diploma or less, they only have basic education (Yes – 1 ; No – 0)	basiceduc
Founders Age: - less than 25 years old	Founder's age is less than 25 years old (Yes – 1 ; No – 0)	youngage
- 26-35 years old - more than 36 years old	Founder's age is more than 36 years old (Yes – 1 ; No – 0)	oldage
Founders have parents who have their own business	Parents with background in business (Yes – 1 ; No – 0)	pent

Source: Own elaboration

### Accessibility to capital

The binary variable capital (*capt*) takes value one if the startups began its activity undercapitalized. In other words, if the capital is insufficient to conduct normal business operations and pay creditors, and zero otherwise.

### Characteristics of the startup and external factors

Despite the high importance of founders' characteristics, startup features should be considered. In order to test the third hypothesis, six variables were introduced: professional advisors, staffing, partners, record keepings and financial controls, planning and product and/or service timing.

The founders' team size is a catalyzer of entrepreneurial talent accumulation. When founders with complementary competencies are added, the individual founder's cognitive and

managerial capacity expands. Although the positive effect of team founder's size on performance has been recognized, greater team size does not guarantee better performance. To analyze the influence of founders' team size in Portuguese startup success, the variable partners (*part*) is introduced. This binary variable takes value one if the startup has a unique founder, or zero otherwise.

The startup's human resources is not only composed by the founders, staff and other stakeholders have an enormous influence in startup performance. To evaluate the impact of staff in the business success, another variable is introduced. The variable staffing evaluates the capacity of the startup to attract and retain quality employees. In the questionnaire, the founders evaluate the capability of the startup to attract and retain qualified people with a grade from one to five, where the value one reveals a strong capability to capture and retain quality employees and the value five the opposite. The initial classification was transformed into three categories: easy to attract and retain quality people (classification one or two), average to attract and retain quality people (classification three) and hard to attract and retain quality people (classification four or five). Concerning these groups, the following dummy variables were created: *easyhuman*, if it is easy to attract and retain quality employees or *hardhuman*, if it is hard to attract and retain quality employees.

The level of startup's expertise with external sources namely by professional advisors is introduced in the present study through the variable professional advisor (*prad*), which takes value one if the startup has professional advisors, or zero otherwise.

Regarding the startup internal environment, the following variables are introduced: record keeping and financial controls and planning. The founders evaluated the records and financial controls with a grade from one to five, where the value one indicates that startup keep updated and accurate records and adequate financial controls and five indicates that these actions are weak or inexistent. The initial classification was transformed into three categories: records are updated and accurate and the financial controls are very adequate (classification one or two), records and financial controls are classified as average (classification three) or records are not updated and accurate and the financial controls are not very adequate (classification four or five). Concerning these groups, the following dummy variables were created: adequate record keeping and financial controls (*rkfcadq*) and average record keeping and financial controls (*rkfcavg*), if the evaluation was one/two or three, respectively.

At the same time, planning was initially rated with a grade from one to five, where one represents a specific business plan and five a poor or inexistent business plan. These classifications were grouped according to their evaluation: specific business plans

(classification one or two), average business plans (classification three) or no specific or inexistent business plan (classification four or five). Two dummy variables were created: high level of planning (*planadq*) and weak planning (*planweak*).

The last startup characteristic introduced in the model is related with its product or service, so, the variable product and/or service timing (*psit*) takes value one if it is a new product, or zero otherwise.

**Table 4 : Independent variables definition related to startup**

Table 4 presents the process of recoding original variables related to startup characteristics into dummy variables. Original variables are the variables present in the original questionnaire.

Original Variable	Dummy Variable	Variable Name
Startup has professional advisor	Professional advisor	prad
How the founders evaluate the capacity of attract and retain qualify people: 1- 5, very easy and very hard, respectively	Founders classify that is very easy to attract and retain qualify people (1-2)	easyhuman
	Founders classify that is very hard to attract and retain qualify people (4-5)	hardhuman
Startup has a unique founder	Partners	part
How the founders evaluate the record and financial controls: 1- 5, adequate and weak or inexistent, respectively	Founders classify the startup record and financial controls as adequate (1-2)	rkfcadq
	Founders classify the startup record and financial controls as average (3)	rkfcavg
How the founders evaluate the business plan: 1- 5, very specific or weak or inexistent, respectively	Founders classify the startup business plan as specific (1-2)	planadq
	Founders classify the startup business plan as not specific or inexistent(4-5)	planweak
The product or service is too new/old in the market	Product or service is too new in the market	psti

Source: Own elaboration

The variable economic timing (*ecti*) is introduced in the present study with the aim to test the external environment influence in the startup performance. It takes value one if the startup starts its activity in an expansion period and zero otherwise.

## **4.2. Sample**

Although startups became a new reality of Portuguese businesses with high importance and political attention, the public information available is very limited. To achieve the purpose of understanding the factors which influence the Portuguese startup success, the information was hand-collected close to the startups.

In order to identify and to have knowledge about the Portuguese startup ecosystem, the first step to constitute the sample was to identify Business Incubators and Technology Parks across the country, as for example: UPTEC, Startup Lisboa, Beta-I where most of the startups are based. The next step was to identify the Portuguese startups being incubated or graduated from there which were eligible for the present study. After this step, it was needed to identify the founders of the startups available for the study and one of the founders of each startup was contacted. The founders who accepted the challenge have responded to a set of questions previously prepared by the author. The questionnaire included questions about startup information, founder's personal information, capital and external environment. It is very important to note that the type of questions was always close, where the answers could be dichotomous or multiple choice. This way the objectiveness of the answers is increased since there is no space for ambiguous answers.

The data collected is referred to a set of startups launched between 2003 and 2015 in Portugal.

## **5. Methodology**

### **Logistic regression**

When a dependent variable is dichotomous, the ordinary least squares (OLS) method can no longer produce the best linear unbiased estimator (BLUE) because it is biased and inefficient. There are several regression models for dichotomous dependent variables, for example: logit and probit model. A logit model is a statistical technique which uses the conditional probability when the dependent variable is qualitative and dichotomous. It is also performed on dichotomous independent variables. Another vantage in using a logit model is that it eliminates the disadvantages of discriminant analysis, because it does not assume normal distribution of independent variables and homogeneity of variation-covariance matrices. Thus, it was considered that the logit regression is robust and more suitable to be used in this study. Furthermore, when compared with probit regression, the logit regression is simpler and easier to interpret.

The general estimating equation could be written as follows:

$$Y_i^* = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} + u_i \quad (5.1)$$

Where:

$Y_i^*$  – represents the dependent variable;

$X_{1i}, X_{2i}, \dots, X_{ki}$  – represent the independent variables;

$\beta_0, \beta_1, \beta_2, \dots, \beta_k$  – represent the regression coefficients;

$u_i$  – represents the error of the model, the disturbance term.

The rule for determining Y in Y \* function is:

$$Y_i = \begin{cases} 1, & \text{se } Y_i^* > 0 \\ 0, & \text{se } Y_i^* \leq 0 \end{cases} \quad (5.2)$$

To test the set of hypotheses regarding the founders' characteristics (5.3), capital (5.4), startup's characteristics (5.5) and external factors (5.6) which influence the startup success, four regressions models are presented. The following equations represent the initial point of investigation according to the literature and considering the hypotheses developed in section 3.

$$\begin{aligned} SUC_i = & \beta_0 + \beta_1 maex_i + \beta_2 inex_i + \beta_3 basiceduc_i + \beta_4 youngage_i + \beta_5 oldage_i \\ & + \beta_6 pent_i + \beta_7 mrkt_i + u_i \end{aligned} \quad (5.3)$$

$$SUC_i = \beta_0 + \beta_1 capt_i + u_i \quad (5.4)$$

$$\begin{aligned} SUC_i = & \beta_0 + \beta_1 rkfcadq_i + \beta_2 rkfcavg_i + \beta_3 planadq_i + \beta_4 planweak_i + \beta_5 prad_i \\ & + \beta_6 easyhuman_i + \beta_7 hardhuman_i + \beta_8 psti_i + \beta_9 part + u_i \end{aligned} \quad (5.5)$$

$$SUC_i = \beta_0 + \beta_1 ecti_i + u_i \quad (5.6)$$

Where  $i$  is related to each startup ( $i=1\dots N$ ), the error terms are represented by  $u_i$ . As previously explained, SUC is a dummy variable which takes the value of one when the startup is a success case and the value of zero when it is a failure startup.

In a second phase, a reduced model is tested, which is composed only by the explanatory variables which revealed to be significant variables in the models presented above.

$$SUC_i = \beta_0 + \beta_1 youngage_i + \beta_2 basiceduc_i + \beta_3 mrkt_i + \beta_4 prad_i + \beta_5 ecti_i + u_i \quad (5.7)$$

Where  $i$  is related to each startup ( $i=1\dots N$ ), the error terms are represented by  $u_i$ . SUC is a dummy variable which takes the value of one when the startup is a success case and the value of zero when it is a failure startup, the same of the first four models.

## **6. Empirical results**

### **6.1. Univariate Analysis**

With the aim of studying the factors which influence the Portuguese startup success, a sample of fifty Portuguese startups located throughout the country was obtained. The sample used is composed by two different groups, thus, it is expected that the groups have different characteristics.

In order to determine these differences, it is presented in this subsection the descriptive statistics for the explanatory variables.

**Table 5 : Descriptive statistics**

Table 5 summarizes univariate statistics for the fourteen explanatory variables. All variables are dummy variables which are related with founders' characteristics (1-6), capital (7), startup characteristics (8-13) and external factors (14).

Explanatory Variable		Success Startups (n=33)		No Success Startups (n=17)	
		Frequency	%	Frequency	%
<b>1.Industry Experience</b>					
Yes		19	58%	11	65%
No		14	42%	6	35%
<b>2.Management Experience</b>					
Yes		16	48%	10	59%
No		17	52%	7	41%
<b>3. Education</b>					
Less than high school diploma	Basic Education	0	0%	2	12%
High school diploma		1	3%	2	12%
Bachelor's degree	High Education	11	33%	4	24%
Master's degree		17	52%	9	53%
PhD		4	12%	0	0%
<b>4. Age</b>					
Less than 25 years old	Young age	2	6%	5	29%
Between 26-35 years old	Middle age	19	58%	10	59%
More than 36 years old	Old Age	12	36%	2	12%
<b>5.Marketing Skills</b>					
Yes		9	27%	9	53%
No		24	73%	8	47%
<b>6.Parents</b>					
Yes		16	48%	6	35%
No		17	52%	11	65%
<b>7.Capital</b>					
Yes		21	64%	12	71%
No		12	36%	5	29%
<b>8.Record keeping and Financial control</b>					
1	Adequate rkfc	4	12%	1	6%
2		14	42%	4	24%
3	Average rkfc	8	24%	7	41%
4	Weak rkfc	4	12%	4	24%
5		3	9%	1	6%
<b>9.Planning</b>					
1	Adequate/spec ific business plan	9	27%	3	18%
2		8	24%	1	6%
3	Average business plan	7	21%	4	24%
4	Weak business plan	3	9%	8	47%
5		6	18%	1	6%

<b>10. Professional Advisors</b>					
Yes		14	42%	11	65%
No		19	58%	6	35%
<b>11. Staffing</b>					
1	Easy human	6	18%	1	6%
2		7	21%	4	24%
3	Average human	11	33%	5	29%
4		6	18%	5	29%
5	Hard human	3	9%	2	12%
<b>12. Product/Service Timing</b>					
Too new		9	27%	7	41%
Growth Stage		24	73%	10	59%
<b>13. Partners</b>					
No		29	88%	13	76%
Yes		4	12%	4	24%
<b>14. Economic Timing</b>					
Expansion Period		6	18%	7	41%
Recession Period		27	82%	10	59%

Source: Own elaboration

The variables one to six represent the variables related to founders' characteristics. As shown in table 5, successful startups have founders with higher level of education (Bachelor's degree, Master's degree or PhD). According to the literature, it is expected that successful cases have founders with high levels of skills and experience. However, table 5 shows that Portuguese no success startups reveal a high level of management and industry experience and marketing skills. A reason found for having success startups with a low level of management and marketing skills is that the sample is mainly related to companies of engineering areas, where usually this gap of expertise is found.

Unsuccessful startups have younger founders. The majority of the founders are between 26 and 35 years old, including successful and no successful startup founders. In successful startups, the second group with more importance is more than 35 years old, while in no success startup it is the age group less than 25 years old.

In general, the startups initiate their activity with insufficient capital to conduct normal business operations and pay creditors, undercapitalized, and in a recession period.

Considering the startup characteristics, the success startups have better record keeping and financial controls, more specific plans and they have better power of attraction and retention of better quality employees. The founders of success startups evaluate their internal activities, record keeping and financial controls and business plans, with 2.64 and 2.67, respectively.

While founders of no success startups classify the same variables with a poorer rate of 3 and 3.18 respectively as showed in table 6.

Simultaneously, the capacity of attraction and retaining qualified people in success startups is higher than in failed startups, 2.79 against 3.18 respectively.

**Table 6 : Record keepings and financial control, plan and staff**

Table 6 presents the classification average of record keepings and financial control as well as business plan and staff attraction and retaining.

Variable	Success Startups	No Success Startups
Record keeping and financial control	2.64	3
Plan	2.67	3.18
Staff	2.79	3.18

Source: Own elaboration using EViews®

Table 5 and 6 show once again that there are differences between the two groups. Contrarily to what was expected, in the sample, the larger percentage of success startups do not have professional advisors. Most of the successful startups have more than one founder which is recognized in the literature as a positive relationship with the business success because the interaction between founders increases know-how, expertise and external relationships. Finally, it is important to mention that success startups have mainly products in growth stage.

Prior to estimating the logit models, the associations between all the variables are investigated by determining the correlation among each pair of variables. Considering that all the variables are dichotomous, phi coefficient is the most suitable method to determine the correlation between variables (Chedzoy, 2006). The phi coefficient computation is normally not provided in logistic regression routines, as it happens in EViews® software. For this reason, the phi coefficient has to be computed by hand and its results are summarized in Table 7.

The correlation matrix shows that most of the correlations are relatively low. Only five out of one hundred and seventy one are greater than 0.50. As expected, the variable marketing skills presents a positive correlation with management skills and weak planning has a negative relationship with adequate record keeping and financial controls. According to the results, there is a low level of multicollinearity which should not be problematic in the model.

In this section it is notorious the differences between success startups and no success startups.

**Table 7 : Correlation Matrix**

In each cell, the numbers give the phi correlation results

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
<b>1.maex</b>	1,00																		
<b>2.inex</b>	0,28	1,00																	
<b>3.basiceduc</b>	0,19	0,27	1,00																
<b>4.youngage</b>	-0,19	-0,26	-0,13	1,00															
<b>5.oldage</b>	0,15	0,24	-0,21	-0,25	1,00														
<b>6.pent</b>	0,05	-0,26	-0,16	-0,13	0,25	1,00													
<b>7.mrkt</b>	0,55	0,36	0,17	-0,30	0,00	-0,25	1,00												
<b>8.capt</b>	0,16	0,02	0,24	0,29	-0,12	0,04	0,01	1,00											
<b>9.ecti</b>	0,20	-0,26	0,11	0,29	-0,27	-0,07	0,22	0,04	1,00										
<b>10.rkfcadq</b>	0,16	0,02	-0,17	-0,26	0,14	-0,01	0,31	-0,02	0,00	1,00									
<b>11.rkfcavg</b>	-0,16	-0,09	0,22	0,11	-0,02	0,12	-0,13	0,01	0,01	-0,60	1,00								
<b>12.planadq</b>	0,17	-0,22	-0,28	0,01	0,10	0,06	0,12	0,01	0,05	0,52	-0,20	1,00							
<b>13.planweak</b>	-0,03	0,02	0,03	0,18	-0,10	-0,16	-0,04	0,10	0,22	-0,53	0,05	-0,64	1,00						
<b>14.prad</b>	-0,16	0,08	0,07	0,06	0,09	0,00	0,00	-0,13	0,14	0,04	0,04	0,20	-0,17	1,00					
<b>15hardhuman</b>	-0,03	0,04	0,06	0,22	0,05	0,00	-0,07	0,31	-0,11	-0,29	0,02	-0,24	0,20	-0,26	1,00				
<b>16.easyhuman</b>	-0,11	0,02	0,17	-0,06	-0,10	-0,16	0,05	-0,08	0,03	0,06	0,15	0,21	-0,04	0,17	-0,51	1,00			
<b>17.psti</b>	-0,03	0,04	-0,23	-0,03	0,15	0,08	0,02	-0,32	-0,11	0,06	0,11	0,11	-0,07	0,09	-0,10	-0,07	1,00		
<b>18.part</b>	0,09	0,02	0,40	-0,18	-0,15	-0,17	0,13	0,20	0,24	-0,07	0,19	-0,04	0,01	0,00	0,05	0,24	-0,30	1,00	

Source: Own elaboration

## 6.2. Multivariate Results

In order to test which founders' characteristics, capital, startup characteristics and external factors influence the Portuguese startup success, the equations (5.3), (5.4), (5.5) and (5.6) are estimated, respectively, using the logit model. The four equations constitute the initial point of analysis. Thereafter, it is presented the reduced model (5.7) with the significant explanatory variables included in the equations mentioned.

Table 8 exhibits the regression results for equation (5.3) which only includes explanatory variables related to the founders' characteristics. As expected, the regression coefficients for the variables: basic education and young age, evidence a negative and significant association with the Portuguese startup success ( $\beta = -3.1580$ ,  $z = -1.9739$  and  $\beta = -3.6616$ ,  $z = -2.8500$ , respectively). These results are consistent with previous literature findings and they are in line with the importance of education and accumulated years of experience.

Another variable, which results revealed a positive, although, insignificant association with Portuguese startup success ( $\beta = 1.0505$ ,  $z = 0.9113$ ) is management experience. This result is consistent with previous findings (Lussier 1996a.) which demonstrates the importance of management experience in early stages. It implicitly cultivates skills for monitoring diverse functions, interact with different stakeholders and to develop contacts with potential customers and suppliers.

On the other hand, and contrary to what was expected, regression coefficient for marketing experience (*mrkt*) has a negative and significant effect in startup success ( $\beta = -3.1172$ ,  $z = -2.1582$ ). Though it is expected a positive effect, the results may indicate that marketing skills have been overrated by the founders regarding the path of the startup or the marketing strategies are incorrectly implemented regarding the product and services of the startups. Furthermore, it is also important to note that the marketing strategies do not only influence the perceived value for the clients but also the perceived value for investors and other stakeholders who have a relevant role on the success of the startup.

In order to account for influence of founders' parents who have their own business and, indirectly, have developed management skills, the variable *pent* was included. A negative and insignificant relationship between startup success and parents ( $\beta = -0.9859$ ,  $z = -1.0405$ ) was found, contrary to what is expected.

**Table 8 : Regression coefficients: founders characteristics**

Table 8 presents the coefficients estimated with logit regression. The dependent variable is Success and the explanatory variables used are management experience (*maex*), industry experience (*inex*), basic education (*basiceduc*), young age (*youngage*), old age (*oldage*), parents (*pent*) and marketing skills (*mrkt*). All variables are dummy variables which take the value one if the founders have this characteristic, or zero otherwise. The standard errors are represented in the second column and the statistical significance is illustrated with the common symbols \*\*\*, \*\* and \*, which denotes a significance at the 1% 5% and 10% level, respectively.

<b>Independent Variables</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>z-statistics</b>
$\beta$	2.7444**	1.0944	2.5076
maex	1.0505	1.1528	0.9113
inex	-0.0632	0.9937	-0.0636
basiceduc	-3.1580**	1.5998	-1.9739
youngage	-3.6616***	1.2848	-2.8500
oldage	0.6550	1.0892	0.6014
pent	-0.9859	0.9476	-1.0405
mrkt	-3.1172**	1.4444	-2.1582
<b>McFadden R-squared</b>	0.320989		
<b>LR - statistic</b>	20.57651		
<b>Prob(LR-statistic)</b>	0.004450		
<b>Number obs.</b>	50		

Source: Own elaboration using Eviews

With the exception of industry experience (*inex*), parents (*pent*) and marketing skills (*mrkt*), all the results found for the relations between founders' characteristics and startup success are in line with the expectations. Moreover, it can be observed an adjusted McFadden R-squared of 32%, which means that the Portuguese startup success can be explained in 32% by these explanatory variables. Additionally, the estimation output presents a value for LR-statistic of 0.0044, meaning the variables are jointly significant. This result confirms the hypothesis H1 as it is found a significant relationship between Portuguese startup success and founders' characteristics.

Concerning the influence of capital in Portuguese startups success, the results of equation (5.4) summarized in table 9, presents a negative although insignificant relationship ( $\beta = -0.315$ ,  $z = -0.4907$ ).

The LR-statistic presents a value of 0.62087, which indicates that the model has no explanatory capacity and it is not relevant. This result does not confirm the hypothesis H2. Although the

undercapitalization in the early stages of startup has a negative influence in startup success that is not significant.

**Table 9 : Regression coefficients: Capital**

Table 9 presents the coefficients estimated for the logit regression. The dependent variable is Success and the explanatory variable used is capital. The variable is a dummy variable which takes the value one if the startup initialized its activity undercapitalized or zero, otherwise. The standard errors are represented in the second column and the statistical significance is illustrated with the common symbols \*\*\*, \*\* and \*, which denotes a significance at the 1% 5% and 10% level, respectively.

<b>Independent Variables</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>z-statistics</b>
$\beta$	0.8755	0.5323	1.6447
capt	-0.3159	0.6437	-0.4907
<b>McFadden R-squared</b>	0.003816		
<b>LR - statistic</b>	0.244636		
<b>Prob(LR-statistic)</b>	0.620878		
<b>Number obs.</b>	50		

Source: Own elaboration using Eviews

The other group of characteristics which has been recognized for its influence in the business success is the startup characteristics. In the results presented in Table 10 it is possible to observe that the variable *planadq* ( $\beta = 1.2812$ ,  $z = 1.1718$ ), the variable which represents the development of specific and adequate business plan, and *easyhuman* ( $\beta = 0.5998$ ,  $z = 0.6246$ ), the variable which represents the ability of easily attract and retain qualified employees, present a positive relationship with startup success, though insignificant. On the other hand, the variable *planweak* ( $\beta = -0.9027$ ,  $z = -0.8602$ ), which represents the development of weak business plan, and *hardhuman* ( $\beta = -0.5781$ ,  $z = -0.5996$ ), which represents the weak ability of easily attract and retain qualify employees, present a negative relationship with startup success, though insignificant. These findings are consistent with the previous literature.

The explanatory variable plan is the unique variable which is significant in all Lussier's studies, which are summarized in Table 2, demonstrating its importance in countries like USA, Croatia, Chile, Israel, Pakistan and Sri Lanka. However, the results demonstrate that this is not significant in Portuguese reality. At the same time, the staff is viewed as a success catalyzer and it is the second explanatory variable that reveals to be significant in more Lussier's studies, six out of nine studies. Businesses that cannot attract and retain qualified employees have a

greater chance of failure than firms which can. Like in the case of Chile and Israel, the variable staff is not significant in Portugal as well.

Human resources are included in the present study by including the variables staff and partners. The last variable is a dummy variable which takes the value one if there is a unique founder or zero otherwise. As expected, the results reveal a negative although insignificant relationship between the variable partners and success ( $\beta = -1.5780$ ,  $z = -1.4335$ ). A business started by one person has a greater chance of failure than a firm which was started by more than one person. The share of know-how between founders and decisions based on careful consideration are important facts for business success.

The variables related to record tracking and financial controls (*rkfcadq* and *rkfcavg*) and professional advisors (*prad*) demonstrate contradictory results. It has been recognized in literature that businesses that do not keep updated and accurate records and do not use adequate financial controls have a greater chance of failure than firms which do. The results do not support these predictions because there is a negative relationship between record keeping and financial controls classified as adequate ( $\beta = -0.1777$ ,  $z = -0.1392$ ) and average ( $\beta = -0.1675$ ,  $z = -0.1483$ ). Despite the fact of being negatively related, these variables are not significant in Portugal, as well as in Croatia, Chile and Pakistan (Lussier and Pfeifer, 2000; Lussier and Halabi, 2010; Lussier and Hyder, 2016).

According to the model developed and to the results summarized in Table 10, only the variable professional advisor (*prad*) is statistical significant in the equation which only included the startup characteristics ( $\beta = -1.7984$ ,  $z = -2.1074$ ). However, it presents a negative effect in startup success, contrarily to what is expected. Businesses which have professional advisors have a greater chance of being well succeeded than companies which do not have. The professional advisors are recognized for their expertise related with the business and their network which is very important to overtake the liability of newness. This variable reveals to be significant in six out of nine Lussier's studies, being significant in USA, Croatia and Israel. With the exception of record keeping and financial controls (*rkfcadq* and *rkfcavg*) and professional advisors (*prad*), all the results found for the relations between startup characteristics and startup success are in line with the expectations. Moreover, a McFadden R-squared of 22% can be observed, which means that the Portuguese startups success can be explained in close to 22% by the explanatory variables. Additionally, the estimation output presents a value for LR-statistic of 0.1150, meaning that the variables are jointly insignificant. As a result, the hypothesis H3 is not corroborated. It was not found a significant association between Portuguese startup success and the startups characteristics.

**Table 10 : Regression coefficients: Startup characteristics**

Table 10 presents the coefficients estimated for the logit regression. The dependent variable is Success and the explanatory variables used are record keeping and financial control (*rkfcadq* and *rkfcavg*), planning (*planadq* and *planweak*), professional advisors (*prad*), staff (*hardhuman* and *easyhuman*), product or service timing (*psti*) and partners (*part*). The standard errors are represented in the second column and the statistical significance is illustrated with the common symbols \*\*\*, \*\* and \*, which denotes a significance at the 1% 5% and 10% level, respectively.

<b>Independent Variables</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>z-statistics</b>
B	2.3986*	1.4385	1.6674
Rkfcadq	-0.1777	1.2762	-0.1392
Rkfcavg	-0.1675	1.1290	-0.1483
Planadq	1.2812	1.0934	1.1718
planweak	-0.9027	1.0494	-0.8602
Prad	-1.7984**	0.8533	-2.1074
hardhuman	-0.5781	0.9643	-0.5996
easyhuman	0.5998	0.9603	0.6246
Psti	-1.3469	0.8755	-1.5385
Part	-1.5780	1.1008	-1.4335
<b>McFadden R-squared</b>	0.221688		
<b>LR - statistic</b>	14.21099		
<b>Prob(LR-statistic)</b>	0.115016		
<b>Number obs.</b>	50		

Source: Own elaboration using Eviews

Concerning the results of equation (5.6) summarized in table 11, the explanatory variable economic timing (*ecti*), variable which indicates if the startup has initiated its activity in an expansion period, does not evidence the expected sign. The variable presents a negative and significant relationship with the startup success ( $\beta = -1.1474$ ,  $z = -1.7170$ ). It is important to mention that, in spite of the literature mention that businesses which start activity during a recession period have greater chance to fail than firms that start during expansion periods, the creation of startups is an escape from unemployment which increases in recession periods.

Analyzing the LR-statistic, it is possible to see that it presents the value 0.0844, which indicates that the model has explanatory capacity at a level of 10%. This result does not confirm the hypothesis H4 as it is found a negative and significant relationship between Portuguese startup success and external factors.

**Table 11 : Regression coefficients: Economic Timing**

Table 11 presents the coefficients estimated for the logit regression. The dependent variable is Success and the explanatory variable used is economic timing (*ecti*). The variable is a dummy variable which takes value one if the startup initializes its activity in a period of economic expansion or zero, otherwise. The standard errors are represented in the second column and the statistical significance is illustrated with the common symbols \*\*\*, \*\* and \*, which denotes a significance at the 1% 5% and 10% level, respectively.

<b>Independent Variables</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>z-statistics</b>
$\beta$	0.9932	0.3702	2.6831
<i>ecti</i>	-1.1474*	0.6683	-1.7170
<b>R-Squared</b>	0.046451		
<b>LR - statistic</b>	2.977687		
<b>Prob(LR-statistic)</b>	0.084420		
<b>Number obs.</b>	50		

Source: Own elaboration using Eviews

When the models (5.3) to (5.6) are tested, all explanatory variables are tested and only five variables are significant predictors of success or failure. Thus, it was constructed a Portuguese startup success prediction model which only includes the five variables from previous models which are significant predictors of success or failure. The model includes the following variables: young age (*youngage*), basic education (*basiceduc*), marketing skills (*mrkt*), professional advisors (*prad*) and economic timing (*ecti*).

Regarding the methodology and the logit regression model it is important to mention that the statistical significance criterion for a variable to be included in the reduced model is considered in a range up to 0.10 of significance level. Literature suggests that 0.05 is too low and often excludes important variables from the model, so in this study a wider range of significance level was considered but it is still a prudent approach (Hosmer et al., 2013)

Table 12 shows the regression results, by taking into consideration only the significant variables in the previous models. Regarding the variables young age (*youngage*), basic education (*basiceduc*) and marketing skills (*mrkt*), results evidence a negative and significant influence in the Portuguese startup success ( $\beta = -3.4820$ ,  $z = -2.8241$ ;  $\beta = -2.9700$ ,  $z = -2.1316$ ;  $\beta = -2.2309$ ,  $z = -2.3642$ ; respectively). These results are consistent with the results of the previous models. The relevance of founders' formation and know-how are essential for the startup success, being age an indirect indicator of know-how acquired.

Contrarily to what was expected, a negative and insignificant coefficient for professional advisors (*prad*) is found in this regression ( $\beta = -1.0764$ ,  $z = -1.3934$ ), as well as a positive and

insignificant coefficient for economic timing ( $\beta = 0.0567$ ,  $z = 0.0633$ ). The last result appears in opposition to the first model, but it is consistent with the literature that mentions that businesses which start during a recession period have greater chance to fail than firms that start during expansion periods.

**Table 12 : Regression coefficients: Reduced model**

Table 12 presents the coefficients estimated for the logit regression. The dependent variable is Success and the explanatory variables used are the variables which demonstrate significant level in the models estimated previously: young age, basic education, marketing skills, profession advisors and economic timing. The standard errors are represented in the second column and the statistical significance is illustrated with the common symbols \*\*\*, \*\* and \*, which denotes a significance at the 1% 5% and 10% level, respectively.

<b>Independent Variables</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>z-statistics</b>
c	3.0911***	0.9196	3.3614
youngage	-3.4820***	1.2329	-2.8241
basiceduc	-2.9700**	1.3934	-2.1316
mrkt	-2.2309**	0.9436	-2.3642
prad	-1.0764	0.7725	-1.3934
ecti	0.0567	0.8947	0.0633
<b>R-Squared</b>	0.321906		
<b>LR – statistic</b>	20.63531		
<b>Prob(LR-statistic)</b>	0.000949		
<b>Number obs.</b>	50		

Source: Own elaboration using Eviews

With exception of marketing skills (*mrkt*) and professional advisors (*prad*), all the results found are in line with the expectations. Moreover, it is possible to observe an adjusted McFadden R-squared of 32%, indicating that 68% of the variance in the model is explained by other variables not included in the model. The Portuguese founders need to focus on these factors in order to improve their chance of success and decrease their chance of failure. Additionally, the estimation output presents a value for LR-statistic of 0.0009, thus the variables are jointly significant.

As showed in table 13, the ability of the model to predict a specific startup as successful or failed accurately has an overall percentage of 82%. The model has a different prediction level for startup failure (76.47%) and startup success (84.85%).

Comparing these results with the literature, it is possible to conclude that the predictive results are more accurate than in USA (Lussier 1995, Lussier 1996a, Lussier 1996b, Lussier 1996c), Croatia (Lussier and Pfeifer 2000), Chile (Lussier and Halabi 2010) and Sri Lanka (Lussier et al., 2016). Only the model developed in Israel demonstrates a higher prediction level than the model developed in the present study, 85%.

**Table 13 : Expectation-Prediction Classification**

Table 13 presents the ability of the model to predict a specific startup success or failure (cut-point =0.5).

	<b>Dep=0</b>	<b>Dep=1</b>	<b>Total</b>
<b>% Correct</b>	76.47%	84.85%	82.00%
<b>% Incorrect</b>	23.53%	15.15%	18.00%

Source: Own elaboration using Eviews

The value of the Hosmer-Lemeshow goodness of fit statistic computed from the frequencies in table 14 is  $C = 5.32$  and the corresponding p-value computed from the chi-square distribution with 8 degrees of freedom is 0.722. This indicates that the model seems to fit quite well.

**Table 144: Hosmer-Lemeshow Test**

Table 14 presents the results of Hosmer – Lemeshow - goodness of fit

	<b>Quantile of Risk</b>		<b>Dep=0</b>		<b>Dep=1</b>		<b>Total</b>
	<b>Low</b>	<b>High</b>	<b>Obs</b>	<b>Exp</b>	<b>Obs</b>	<b>Exp</b>	
<b>1</b>	0.0419	0.1961	5	4.42455	0	0.57545	5
<b>2</b>	0.1961	0.4035	3	3.52290	2	1.47710	5
<b>3</b>	0.4172	0.4462	3	2.79812	2	2.20188	5
<b>4</b>	0.4462	0.7027	2	2.40048	3	2.59952	5
<b>5</b>	0.7027	0.7144	1	1.47474	4	3.52526	5
<b>6</b>	0.7144	0.8823	1	0.92419	4	4.07581	5
<b>7</b>	0.8823	0.8823	1	0.58836	4	4.41164	5
<b>8</b>	0.8823	0.9565	0	0.43421	5	4.56579	5
<b>9</b>	0.9565	0.9565	0	0.21738	5	4.78262	5
<b>10</b>	0.9565	0.9588	1	0.21508	4	4.78492	5

Source: Own elaboration using Eviews

The results reveal important information which can be taken into consideration by current and future entrepreneurs who may benefit from that, as well as a variety of other stakeholders, investors, institutions, communities and society as a whole.

## 7. Conclusions

In the last decades, several studies worldwide have been developed in order to understand and predict the success of enterprises, however there is no generally accepted list of variables that affect their success. Therefore, the aim of this study is to understand which factors influence the Portuguese startups success considering four categories of explanatory variables: characteristics of the founders, accessibility to capital, characteristics of the startups and external factors. Another purpose of this study is to develop a success prediction model able to predict the Portuguese startups success.

In order to examine what affects Portuguese startup success, we chose the following explanatory variables which are consistent with the previous literature: industry experience, management experience, education, age of owner, parents owned a business, marketing skills, (characteristics of the founder), capital (accessibility to capital), record keeping and financial control, planning, professional advisors, staffing, product or service timing, partners (characteristics of the startups) and economic timing (external markets). The method used to estimate the models is the logistic regression. The sample is composed by fifty Portuguese startups, thirty-three success cases and seventeen no success cases. All information is hand-collected through person meetings and phone calls due to the limited available information.

The results obtained by empirical work demonstrate that founders' characteristics and external factors are significant in the startup success, in contrast to startup characteristic and their accessibility to capital. Considering, an isolated study of each category, only five variables from the initial fourteen are significant predictors of success or failure of Portuguese startups: young age, basic education, marketing skills, professional advisors and economic timing. Considering only these five variables, a reduced success prediction model is developed. The Portuguese startup success prediction model results reveal that young age, basic education and marketing skills have a negative and significant association with the Portuguese startup success. Age and education are two catalyzers that indirectly measure the knowledge, skills and network contacts which have been recognized as positive factors to overtake de liability of smallness and newness that these organizations face in first stages and it can be crucial to their survival. The model presents an ability to predict a specific startup as successful or failed accurately with an overall percentage of 82%. The model has different prediction levels for startup failure (76.47%) and startup success (84.85%).

Although this model presents a good capability of prediction, result of a rigorous methodology and an extensive model with fourteen variables to analyze Portuguese startup success strongly based in an exhaustive literature review, it is important to mention that the presented research

has a few limitations. In first place, this research does not provide numerical guidelines for variables distinguishing success from failure. Judgment is needed when applying the model, namely because most of the variables are based on self-reporting data. Obtaining data from interviews is a tough job, it gets even harder if an in person interview approach is considered. Despite that, all the efforts were put on conducting in person interviews with Portuguese incubators and accelerators as well as startup founders. Only this way was possible to ensure more quality and accurate data. In third place, the study is not a longitudinal study, including only data collected at a single point in time. This may lead to the assumption that if the same study would be conducted at different time and with a larger sample, results might be different. Considering the limitations previously mentioned, future research may be developed upon this study.

Future studies may consider additional effort to collect a larger sample and a data collection less subjective by measuring more objectively some of the variables. It is also important to develop a longitudinal study, considering different external conditions and the development of Portuguese startup environment. On this line this academic study constitutes a very strong base line for future studies on this matter not only for the Portuguese reality but also for other country realities.

Our findings may also be useful for current and future entrepreneurs who may benefit from that, as well as a variety of other stakeholders including parties who assist and advise them, investors and institutions who provide them with capital, communities and society as a whole.

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## Attachments

### 1. A Comparison of Variables Identify in the Literature as Factors Contributing to Business Success versus Failure

Senior Author	Independent Variable														
	capt	rkft	inex	maex	plan	prad	educ	staf	psti	ecti	age	part	pent	mior	mrkt
Bruno	F	F	-	F	F	-	-	F	F	F	-	-	-	-	F
Cooper 90	F	-	N	N	F	F	N	-	F	F	F	F	-	F	-
Cooper 91	F	-	F	N	-	F	F	-	N	N	N	N	F	F	-
Crawford	-	-	F	-	-	F	F	-	-	N	N	-	-	-	-
D + B St.	F	F	F	F	-	-	-	-	-	F	-	-	-	-	-
Flahvin	F	F	F	F	-	F	-	F	-	-	-	-	-	-	-
Hoad	-	-	F	N	N	F	F	-	-	-	-	-	-	-	-
Kennedy	F	-	-	F	F	-	-	-	-	F	-	-	-	-	-
Lauzen	F	F	-	F	F	-	-	F	-	-	-	-	-	-	-
McQueen	F	-	F	F	-	-	-	-	-	-	-	-	-	-	F
Reynolds 87	F	F	-	-	F	-	-	N	F	-	-	-	-	-	N
Reynolds 89	F	F	-	-	F	-	N	N	F	-	N	F	-	-	-
Sommers	-	-	-	F	F	-	-	F	-	-	-	-	-	-	-
Thompson	N	-	-	F	F	-	-	F	F	-	-	-	-	-	F
Vesper	F	F	F	F	N	F	F	-	F	F	-	F	-	-	F
Wight	F	F	-	F	-	F	-	-	-	-	-	-	-	--	-
Wood	-	F	F	F	F	-	F	-	-	-	-	-	-	-	-
<b>Total F</b>	12	9	9	11	9	7	5	5	6	5	1	3	1	2	4
<b>Total N</b>	1	0	1	3	2	0	2	2	1	2	3	1	0	0	1
<b>Total -</b>	4	8	8	3	6	10	10	10	10	10	13	13	16	15	12

Independent Variables. capt: capital; rkft : record keeping and financial controls; inex: industry experience; maex: management experience; plan: planning; prad: professional advisors; educ: education; staf : staffing ; psti: product or service timing; ecti: economic timing; age: founder age; part: partners; pent: parents; mior: minority; mrkt: marketing. F supports variables as a factor contributing to failure; N does not mention variable as a contributing factor

Source: Own elaboration based on Lussier, 1995

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