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Career Success in University Graduates: Evidence from an Ecuadorian Study in Los Ríos Province

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Citation: Pico-Saltos, R.; Bravo-Montero, L.; Montalván-Burbano, N.; Garzás, J.; Redchuk, A. Career Success in University Graduates: Evidence from an Ecuadorian Study in Los Ríos Province. *Sustainability* **2021**, *13*, 9337. <https://doi.org/10.3390/su13169337>

Academic Editors: Gabriela Topa, Xuesong Zhai and Juan Carlos Pérez-González

Received: 1 July 2021

Accepted: 13 August 2021

Published: 20 August 2021

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Abstract: Career success and its evaluation in university graduates generate growing interest in the academy when evaluating the university according to its mission and social mandate. Therefore, monitoring university graduates is essential in measuring career success in the State Technical University of Quevedo (UTEQ, acronym in Spanish). In this sense, this article aims to identify the predictive career success factors through survey application, development of two mathematical functions, and Weka's classification learning algorithms application for objective career success levels determination in UTEQ university graduates. Researchers established a methodology that considers: (i) sample and data analysis, (ii) career success variables, (iii) variables selection, (iv) mathematical functions construction, and (v) classification models. The methodology shows the integration of the objective and subjective factors by approximating linear functions, which experts validated. Therefore, career success can classify university graduates into three levels: (1) not successful, (2) moderately successful, and (3) successful. Results showed that from 548 university graduates sample, 307 are men and 241 women. In addition, Pearson correlation coefficient between Objective Career Success (OCS) and Subjective Career Success (SCS) was 0.297, reason why construction models were separately using Weka's classification learning algorithms, which allow OCS and SCS levels classification. Between these algorithms are the following: Logistic Model Tree (LMT), J48 pruned tree, Random Forest Tree (RF), and Random Tree (RT). LMT algorithm is the best suited to the predictive objective career success factors, because it presented 76.09% of instances correctly classified, which means 417 of the 548 UTEQ university graduates correctly classified according to OCS levels. In SCS model, RF algorithm shows the best results, with 94.59% of instances correctly classified (518 university graduates). Finally, 67.1% of UTEQ university graduates are considered successful, showing compliance with the university's mission.

Keywords: career success; objective and subjective career success factors; classification learning algorithms; university graduates

1. Introduction

Being a successful professional is an aspiration of college students [1]. It, for many, means getting a job with a reputable company [2] and earning a good salary [3]. However, some professionals who meet these goals do not consider themselves successful because the economic aspect does not necessarily influence their perception of career success [4,5].

Career success is defined as the achievement of individual happiness [6,7] and is contextualized in four dimensions: personal, professional, business, and family [8], with a certain degree of temporality [9]. In the professional field, success in the professional career is bilateral [10]. It is considered as a social construction rather than an objective reality [11,12]. Career success has been widely studied in recent years [8]. Various conceptions were presented based on the values of the human being [5,13,14], who constantly seek self-development [15,16]. That is why obtaining an integral definition is a complex task. Recently, it is related to objective positive achievements and their perception, based on work experience [17].

Career success is addressed in different fields of science, such as administration [14,18,19], organization and work [20,21], education [22,23], vocational psychology [24–27], and human resources [28]. In general, the success of professional career measures in terms of external (objective) and internal (subjective) criteria. Objective criteria refer to real or observable aspects [29–31]. In contrast, subjective criteria are subject to individual personality traits [32].

In the literature, career success presents different approaches depending on its area of knowledge, making its quantification and efficiency difficult [31]. Some predictive variables of the objective career success are salary [33], employment status [34], hierarchical level in the company [35], age [36], and leadership [37]. On the other hand, subjective career success factors include job or salary satisfaction, career adaptability, and personality traits [24,38,39]. These factors can substitute for the meaning of subjective career success [14,38,40–42].

For this reason, it is essential to analyze career success in greater depth. Determining the level of success or the probability that a professional can be successful can be done employing an output (dependent) variable produced by a series of independent variables. For this, it is necessary to have some tool that allows the monitoring of university graduates to measure the level of career success according to the influence of the intervening variables regarding the degree of relative importance in career success. Furthermore, it is relevant to conceptualize the objective and subjective results of an individual in her career. Therefore, the research question purposed is: Will it be possible to establish a methodology that brings together objective and subjective aspects for assessing the career success of a university graduate, which approximates their condition and recognized status?

This article aims to identify the predictive career success factors through survey application, development of two mathematical functions, and Weka's classification learning algorithms application for subjective and objective career success levels determination in UTEQ university graduates. This identification makes it possible to reduce data dimensionality, correlation, and career success prediction to be more accurate. Furthermore, it seeks to establish the most influential variables of subjective and objective professional success to improve the career success prediction accuracy.

Experts group and a high hierarchical level are considered a set of career success attributes to define those attributes of greater significance. Subsequently, two mathematical functions will measure the Objective Career Success (OCS) and Subjective Career Success (SCS) levels. These functions will analyze success from the data obtained from the follow-up of university graduates (alumni). Finally, the proposal was validated to verify its performance. The results confirm that the functions obtained can be applied to databases of graduates, allowing to segment and characterize graduates according to their career success level.

2. Research Context

UTEQ university locates in Los Ríos province (Ecuador), as shows Figure 1. This university began its activities on 22 January 1976, as an extension of the “Luis Vargas Torres” university. After multiple efforts by the Quevedo community, the UTEQ creation was on 1 February 1984, with the Faculty of Agricultural Sciences.

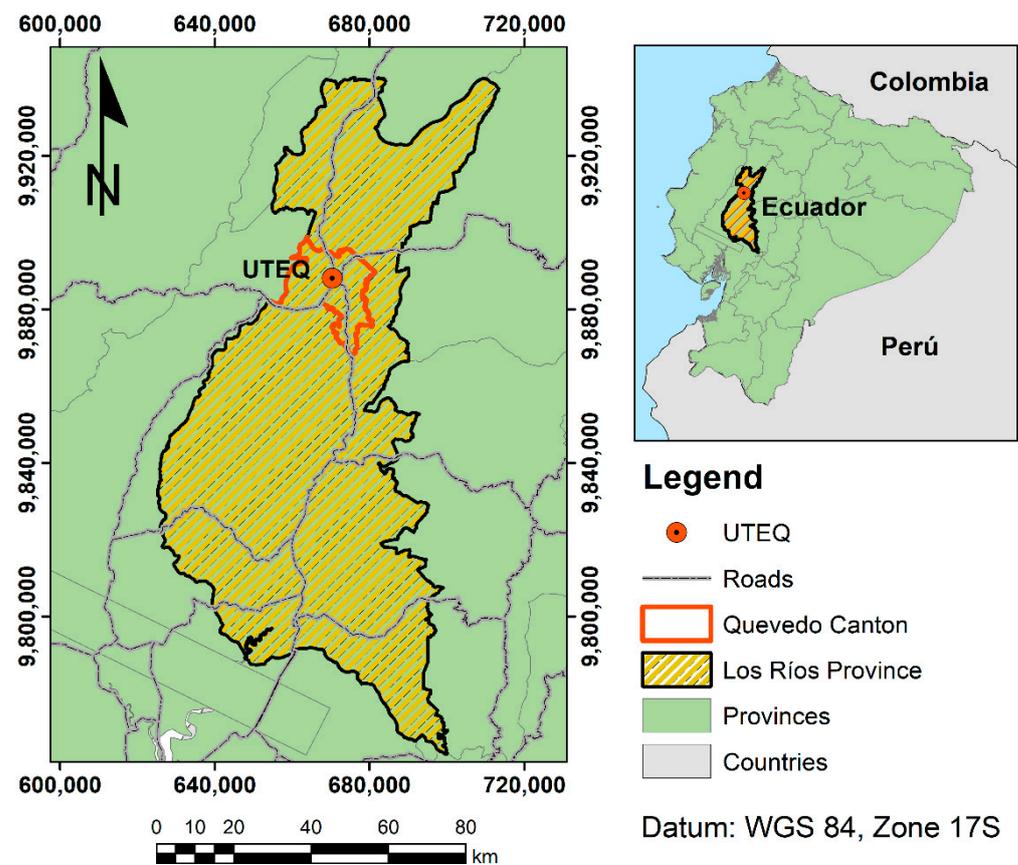


Figure 1. Study area location.

Nowadays, there are 15 engineering degrees (e.g., Agroindustries, Forestry, among others) and 5 bachelor's degrees: (e.g., Nursing, Ecotourism, among others), with approximately 10,000 students taking part, with a graduation rate of 48%. Currently, UTEQ has accreditation from the Higher Education Quality Assurance Council (CACES), a government body that regulates the operation of universities in the country.

2.1. Literature Review

This section is essential for career success variables selection because there are many career success predictors. The researchers' goal is to determine the most crucial career success predictive factors used in the literature review.

Career success is an important research topic in management [43–45] and psychology [46–48]. In addition, career success is the real or accumulated achievements of the individual over time [38,49], which respond to a historical and cultural process [50,51]. Similarly, Arthur et al. [52] consider that career success is achieving desirable results related to long-term work activity. Getting success in the race allows the individual to obtain a sense of identity and meaning [19], happiness by obtaining work satisfaction [53,54], personal well-being and success of the company [55,56]. In short, it shows the interaction between individuals, organizations, and society based on a variety of behaviors and practices [27].

According to Gattiker and Larwood [57], career success is a construct consisting of five factors related to work, interpersonal relationships, finances, business hierarchy, and aspects of life. Danziger and Wiener [58,59] relates to career success based on competencies (technical and managerial), independence, creativity, service, challenges, and lifestyles. According to Parker and Chusmir [60], it is related to six factors of status, contribution to society, family relationships, personal and professional fulfilment, and security. So too, Judge et al. [61] studied dispositional characteristics by relating mental capacity and

personality, using five factors. Finally, Dyke and Murphy [62] related four factors around its meaning: balance, relationships, recognition, and material success.

In the literature, initial investigations consider two approaches: subjective and objective [38,57,63,64] or extrinsic and intrinsic [27,65,66]. However, in the first studies on career success, only objective success was analyzed, ignoring subjective success for several decades. These approaches (objective and subjective) differ in their concept [41,52], and therefore, there was a criterion to analyze it independently [14]. Over the years, some authors have considered using these criteria together [61,66–69]. Finally, Big Five personality traits were included to explain subjective career success factors [70–72].

2.1.1. Objective Career Success Variables

Objective Career Success (OCS) considers tangible and directly observed, measurable, and verifiable by impartial third person career success facets [8,47,55]. Some researchers consider the OCS based on quantifiable criteria that may be available to the human resources area of the company. The variables considered in this study are the following:

First, “remuneration” refers to the economic income that an individual receives within an organization [27,69]. Remuneration includes salary, bonuses, and other cash compensation; it is one of the most used variables in the career success literature [31,73]. Remuneration is a notable indicator in contemporary society [74]. Some authors consider a good salary as a material success [62], wealth and status when obtaining a salary increase [60], equitable pay and fair income [57,75], financial security [58] and economic rewards [65].

Second, the variable “job promotion” increases the company’s job level responsibilities [47] or the material reward due to work [38]. This variable considers an organizational perspective, evaluating their hierarchical position and promotions received [44]. Other studies show it as the development of opportunities (job success), and promotion opportunities (Hierarchical success) [57], recognition [45,75,76], hierarchical level [65,77], and the number of promotions received [64]. Third, this article considers “education” as the investment that would represent the future income of the professional. Therefore, it uses to determine the rates of return on this investment [78,79].

Finally, this study considers other variables, such as: “finding the first job in less than a year of graduation” [80]; “graduate in the shortest time possible”; and “have your own house” [63]; “good level of parents professional training” [81,82]; “influence of marital status on career success” [83,84]; “school type in secondary education” [63]; and “emotional-financial support from parents” [81].

Under this research approach, the hypothesis is the following:

Hypothesis 1 (H1). *Is it possible to obtain an effective objective career success classification model to identify successful professionals using the predictors obtained from the research instrument?*

2.1.2. Subjective Career Success Variables

Subjective career success (SCS) measures subjective, internal, or extrinsic criteria [52,68]. SCS is the perception that individuals have about their careers and measured in terms of satisfaction [8,56]. It also represents an individual self-assessment of their careers [57,85]. The central element is the person and not the organization for which they work [71]. SCS is the most important determinant of career success [65,86], since it allows the individual to acquire greater security, motivation, and the pursuit of development goals, which will lead to objective career success [42]. Some researchers who contributed to the development of the subjective career success considered the following variables:

First, “*professional vitality*” is a characteristic of consistent work with work done with passion, strength, and satisfaction [87]. Self-perceived vitality implies how the individual fits into the organization [28,88]. Next, “*satisfaction with life*” is one of the dimension variables of work well-being [89], which considers that the greater the well-being at work, the greater the satisfaction [90]. On the other hand, ‘*professional satisfaction*’ is related to the variables of business sponsorship such as training, development opportunities, mentoring

and career support [44]. Other authors consider it relates to rank and salary [68,69] and one of the dimensions of job well-being [89].

“Goals fulfilment” is achieved when the person feels self-confident and motivated [42]. Persistence and being organized are related to goal setting, allowing them to be scrupulous in their work activities [27]. Employees interact and present competitive goals in this work environment, positively evaluating their organization [28,53]. On the other hand, “satisfaction with helping society” is also considered one factor for success in life [60,91]. Some authors consider this satisfaction part of interpersonal affections [31], service [58,59,92]. According to Parker and Chusmir [60], contributing to society means helping others or being useful. It represents making a difference and promoting workplace wellness. In the company, the satisfaction of helping with the occupation and job performance are the contributors to the occupational status [8,38].

The “organizational hierarchy” is one of the components of career success in terms of the company’s position as responsibility and power [8]. Work experience provides knowledge and experience related to the career, allowing the person to achieve hierarchy in the organization [46]. Grimland et al. [28] consider the organizational hierarchy as external progress in the career. Recently, Rossenkhan et al. [93] consider that this hierarchy is part of the sequential process of success, constituted by success in interpersonal relationships, work, hierarchy, and finances. The “identification with work” is important because it considered this variable a signifier for life [19]. In some cultures, professional benefits inculcate that do not include remuneration, fostering a sense of fraternity, significance, and identification with an organization [8].

The “financial success” represents the perception of success based on the financial rewards obtained [46] and represents the high income of the individual compared with their peers in similar jobs [57,94]. This variable is the result of hierarchical, work and interpersonal success [93]. On the other hand, “success at work”, which is related to feeling successful in the professional carry out a career, was also considered. Other authors consider that job satisfaction does not lead to career success when it represents a high cost for the individual in terms of family relationships, health, or personal values [8], not fitting into the organization when accessing a new job [48].

The “interpersonal success” represents the interpersonal skills or social competence that allows the individual’s employability in an organization [48]. In work activities that require high interpersonal skills, there is a positive relationship between agreeableness and job performance [46,47]. Likewise, “teamwork” is considered as the ability to be available and to be able to collaborate for a group in which a team spirit is strengthened [95]. In certain work activities, teamwork is essential since cooperation between people can develop career success [61].

The “optimism” is an indispensable element when it is tasted in solitary activities [53]. This variable presents a positive correlation with the levels of occupation, salaries, and work success [27]. The “achievement” represents the success of a career, which is slightly related to academic achievement [48]. According to Judge et al. [38], achievement orientation allows labor promotions. On the other hand, Heslin [8] considered that people with professional guidance not only consider as an achievement the monetary without promotions in the structure of the organization. Finally, this study considered other minor variables such as: “recognizing strengths and limitations” [61,96]; the “own control of emotions” [61,96]; “persuasion at work” [57,61,96], and “satisfaction with the knowledge acquired at the university” [97,98].

For this success type, researchers have defined the following hypothesis:

Hypothesis 2 (H2). *Is it possible to obtain an effective subjective career success classification model to identify successful professionals using the predictors obtained from the research instrument?*

3. Method

This study contemplates a rigorous six-phase process (see Figure 2), which allows establishing the objective and subjective career success: (i) sample and data analysis; (ii) career success variables; (iii) variables selection; (iv) mathematical functions construction; and (v) classification models.

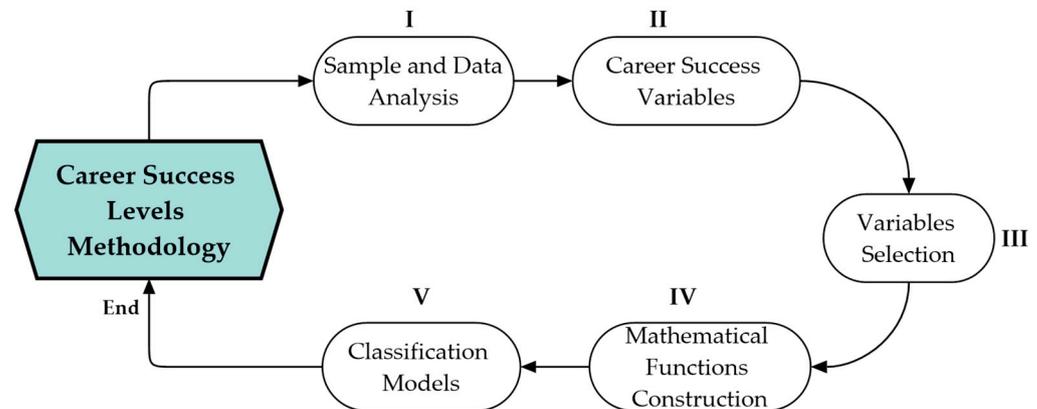


Figure 2. Methodological scheme.

3.1. Sample and Data Analysis

Periodic surveys are the evaluation instrument used to analyze the academic quality of higher education institutions [99,100]. This methodology is used in 98% of the universities in the United States [101,102]. Which is why a survey was constructed to follow-up professional graduates who have completed their studies for at least one year. Systematic follow-up studies of university graduates allow measuring graduates' performance in the labor market, their levels of job-related satisfaction, and possibilities. In addition, it is possible to have direct information on the expectations of employers at the job skills [103].

The self-administered survey directed at UTEQ graduates was the research method selected. The population comprised 2079 graduates, and researchers decided to study all of them. The data collection process was between June and December 2017. During this period, the total population was contacted on up to three occasions by email. This process ended with the receipt of 561 questionnaires, of which 548 were considered valid, representing a response rate of 26.35%. The survey responses were tracked by email control messages every month and a half. As a result, researchers worked with a sample of 548 UTEQ university graduates, comprising a study period between 1990 and 2017.

Sampling techniques are classified into "probability" and "non-probability" samples. For this study, the researchers chose the probability sampling method, which present three main properties: (1) The sampling units' selection is random; (2) each potential sampling unit has a known probability of being selected for the sample, which is different from zero; and (3) it is possible to identify all potential samples of a given size, that can be extracted from the population before the actual selection process begins [104,105]. Probability sampling method allows the investigator to generalize the findings of the sample to the target population (i.e., statistical inferences) [106,107]. This method includes: (i) simple random sampling, (ii) systematic random sampling, (iii) stratified random sampling, (iv) cluster sampling, among others.

Stratified sampling was applied because the population from which the sample was drawn is not a homogeneous group. This method allows obtaining a meaningful representation of the sample [108]. The stratified probability sampling method allows to determine the objective career success and subjective career success levels. Career success levels of university graduates are classified into three categories: successful, moderately successful and unsuccessful.

3.2. Career Success Variables

As a result of literature review 51 variables were selected as career success predictor variables, divided into two mean groups: 29 objective career success variables (see Table 1), and 22 subjective career success variables.

Table 1. Variables or factors selected to objective career success.

N°	Objective Career Success Variables	References
R1	Job concerning the professional training field studied (third level degree)	[58,60,62,63,73,74]
E2	Diplomas, masters or doctorates	[63,78,79]
E3	A high degree of participation in research, development and innovation	[78–80]
E4	High level of knowledge of Information and Communication Technologies	[78–80]
R5	A correct choice of professional career	[58,60,62,73,74,83]
R6	Have a good salary	[30,58,60,62,73,74,109]
LP7	Have a good hierarchical level in the company	[44,47,57,64,65,110]
LP8	Work in a prestigious company or institution	[38,44,47,57,64,65,80]
LP9	Job experiences related to previous studies	[38,44,47,57,64,65,111]
E10	Have a high level of foreign language knowledge	[78,79,111]
LP11	Age or time allows for professional development	[38,44,47,57,64,65,112]
E12	Have graduated from the university with good grades	[63,78,79]
O13	Finding the first job in less than a year of graduation	[80]
O14	Graduate in the shortest time possible	[63]
R15	Monthly household income level	[58,60,62,73,74,111]
O16	Have own home	[63]
O17	Good level of professional training of parents	[81,82]
LP18	Attitude person, building their self-esteem	[38,44,47,57,64,65,84]
LP19	Personal and professional satisfaction	[38,44,47,57,64,65,113,114]
O20	Influence of marital status on career success	[83,84]
O21	Type of secondary school (fiscal, private)	[63]
E22	Have graduated with excellent grades from high school	[78,79,84]
E23	Practice ethical principles and values	[78,79,115,116]
O24	Emotional and financial support from parents	[81]
LP25	Have good interpersonal relationships and leadership	[38,44,47,57,64,65,113,117]
LP26	Be a good practitioner of spiritual principles	[38,44,47,57,64,65,84]
LP27	Coaching and conflict management	[38,44,47,57,64,65,118]
LP28	Possess emotional intelligence	[38,44,47,57,64,65,117,119]
E29	University of higher education	[63,78,79]

Note: Remuneration: R; labor promotion: LP; education: E, and other variables: O.

Table 2 includes the most prominent subjective success variables. These indicators are operationalized and considered factors such as job and life satisfaction [120,121].

Table 2. Variables or factors selected to subjective career success.

N°	Subjective Career Success Variables	References
1	Professional vitality: energy during work	[8,28,39,87,88,90]
2	Satisfaction with life: life close to the ideal	[8,39,89,90,121]
3	Professional satisfaction: satisfaction with career success	[8,39,42,44,65,89,90]
4	Goals fulfilment: achieve professional career goal	[8,27,28,42,53,122]
5	Satisfaction with helping society: career success is the personal satisfaction and the contribution of work to the society	[8,31,38,58–60,91,122,123]
6	Organizational hierarchy: satisfaction with organizational hierarchy	[8,28,46,57]
7	Identification with work: job, meaning to my existence and identity	[8,18,19,124,125]
8	Financial success: earn as much as person think the work is worth	[8,46,57,93,126]
9	Hierarchical success: satisfaction with promotions	[57,124,126]
10	Interpersonal success: confidence from my superior at work	[46–48,57,97]
11	Success at work: feel supported by administration	[8,48,57,126]
12	Success at work: liking for the job that person does	[8,48,57,90,121,123]

Table 2. Cont.

N°	Subjective Career Success Variables	References
13	Interpersonal success: an attitude of detecting the feelings and perspectives of others and taking an active interest in their concerns	[46–48,57,61,96]
14	Interpersonal success: the person has the skills to negotiate and resolve disagreements at work	[46–48,57,61,96]
15	Teamwork–interpersonal success: create group synergies	[57,61,95,96,126]
16	Optimism: persistence in the achievement of the objectives	[27,53,113]
17	Interpersonal success: apply persuasion tactics at work	[57,61,96]
18	Achievement: effort to achieve a standard of excellence	[8,38,48]
O19	Recognizing strengths and limitations at work	[61,96]
O20	Own control of emotions: keep control of disruptive emotions and impulses	[61,96]
O21	Interpersonal success: persuasion at work.	[57,61,96]
O22	Satisfaction with the knowledge acquired at the university during their studies, and research and development participation	[97,98]

Note: Other variables: O.

3.3. Variables Selection

Study variables discretization was carried out to transform them from continuous to categorical variables using the Likert scale, measured from 1 to 5. Then, this criterion applies to career success and objective career success variables. After that, career success variables analyzed each variable's relative importance or weight, defined as (w_i). Knowing variable weights allows calling them according to their relative importance for each client (expert), showing the key factors to improve quality [95].

Methodology lets career success assessment through 50 surveys aimed at highly experienced professionals, who validated career success variables assigning weights for each variable considered. Expert professionals sample considered professionals with more than 15 years in the professional practice, high income, and managerial positions, such as company managers, entrepreneurs, university authorities, executives, and researchers. In addition, an expert from the Catholic Church also contributed to his experience regarding the attributes that best define career success.

Experienced professionals' ages vary between 38 and 60 years, with an average of 46.3 years and a standard deviation equal to 3.2. Consequently, each variable average requires Pareto analysis application, ordering each variable from highest to lowest according to importance degree. The Pareto analysis applies to both mathematical models (objective career success and subjective career success).

3.4. Mathematical Functions Construction

Career success functions construction used a model based on experts' criteria, who assigned a level of importance to the variables. Therefore, this phase consists of implementing two functions to measure Objective Career Success (OCS) and Subjective Career Success (SCS), respectively. For that reason, it considered the 51 variables of career success previously described, and the attributes with the greatest weight are selected. It matches with the most relevant variables to consider professionals as successful. For example, customer service and quality are inherent issues in education, so it proposed to use the linear quality of service indicator to measure the career success [127].

There are different methods to determine the weights of each career success predictor. In this study, the method that distributes 1 point (100%) among the applied attributes was selected. However, method reliability must be adjusted according to the type of survey data because the number of variables is large [128–130]. Survey application as an interview helps minimize the number of variables. Therefore, it is necessary to read all attributes, organize a list in decreasing order of preference, and assign the weights of the variables until giving a total of one point or 100% and were applied to the 548 university graduates. Measuring and evaluating the quality of undergraduate or graduate programs

and student satisfaction is a relatively new topic [131–133]. Therefore, higher education programs are growing as a proportion in the education market, so they are evaluated for their quality [134].

Service quality measurement began many years ago, and it became a driving force in the business world [135]. Interest in quality has spread to the public sector and higher education institutions [136], such as universities [137–139]. The quality of services is the product of the reorganization and re-establishment of new principles in higher education institutions; both education and training are imperative for survival in a competitive environment [127].

In the student-customer concept, Ritzer's approach [140] considers the student as any buyer who demands a good service. Applying this concept of the student as customer to measure its qualities, it must be considered the concept of product/service in university education [141]. According to the European Foundation for Quality Management (EFQM) [142], the product is defined in terms of value added to the student's knowledge, skills, and personal development [143]. The product quality is linked to the process quality. Therefore, assessing the quality of the product in teaching entails analyzing the quality of the educational processes and identifying its key elements [144,145].

Quality measurement in graduate education has used such a tool as an option to measure the level of career success of university graduates. There is a population of clients n , and the vector whose elements are the Q_i (perceived quality of a given service) by the i client of the population is called Q . It is common to assume that the customer's evaluation will be a function of different k , $X_1 \dots X_k$ quality attributes that determine the overall evaluation of the service. The vector whose elements are $X_{i1} \dots X_{ik}$ is called X_i . The evaluation of the career success attributes carried out by the professional i of the group of experts. So, career success CS_i definition is on the base of these attributes:

$$CS_i = f(X_{i1} \dots X_{ik})$$

To measure the service quality or career success used the linear approximation indicator [146] through the following expression:

$$CS_i = \sum_{j=1}^k (w_{ij} X_{ij})$$

In the matrix W , w_{ij} coefficients are the weights defined by each professional in the experts group (i). These weights are positive and must add up to one:

$$w_{ij} \geq 0 \quad \forall i, j \geq 0 \quad \forall i, \forall j$$

$$\sum_{j=1}^k w_{ij} = 1 \quad \forall i = 1, \dots, 50 \quad j = 1, \dots, 20$$

X_j : objective career success attribute.

These weights are the relative importance of X_i 's attribute in determining the OCS of the relatively successful professional [146]. For each professional surveyed (i) there is an objective career success function. Additionally, with the 29 OCS attributes, it is necessary to know the average degree of importance of each one. Therefore, it is required to obtain the means of each attribute:

$$\bar{k}_i = \frac{\sum_{j=1}^n w_{ji}}{n}$$

\bar{k}_i = the average weight assigned by the expert's group to the OCS attribute x_i ;

w_{ij} = the weight assigned by experienced professional (i) to attribute x_{ij} ;

n = 50 professionals surveyed.

3.4.1. Objective Career Success Function

The objective career success function is defined considering 29 success factors and it is defined by the following equation (Equation (1)).

$$OCS_i = f(x_1, \dots, x_n) = \sum_{i=1}^n (\bar{k}_i x_i) \quad \begin{matrix} \bar{k}_i \geq 0 & \forall i \\ \sum_{i=1}^n \bar{k}_i = 1 & \forall i \end{matrix} \quad (1)$$

where,

OCS_i = OCS level achieved by the individual i ;

n = number of objective career success variables;

\bar{k}_i = average weights of each predictor of career success (positive values);

x_i = objective assessment for the individual (i) to the performance of an OCS attribute.

3.4.2. Subjective Career Success Function

The subjective career success function defines considering 22 success factors (Equation (2)). For this, a survey questionnaire conducted for 50 expert professionals, including the question "The successful professional is the one who", requesting to distribute 100 points among the attributes of subjective career success.

$$SCS_i = f(y_1, \dots, y_n) = \sum_{i=1}^n (\bar{k}_i y_i) \quad \begin{matrix} \bar{k}_i \geq 0 & \forall i \\ \sum_{i=1}^n \bar{k}_i = 1 & \forall i \end{matrix} \quad (2)$$

where,

SCS_i = SCS level achieved by the individual (i);

n = number of subjective career success variables;

\bar{k}_i = average weights of each predictor of career success (positive values);

y_i = subjective assessment for the individual (i) to the performance of an SCS attribute.

3.5. Classification Models

With the collected data about objective and subjective career success, classification models construction estimates whether a university graduate can be objectively and subjectively be successful. Career success variables discretization was divided into three categories (successful, moderately successful, and unsuccessful). The discretization intervals were obtained from experts criteria on the distribution of the variables. There are some mathematical methods to validate the variables of professional success. Initially, researchers tested with factor analysis, but it did not work as it presented a very low correlation. Therefore, classification models were applied using Weka's classification learning algorithms for subjective and objective career success mathematical model validation.

This study performed a multivariate analysis using Waikato Environment for Knowledge Analysis (WEKA), developed by the University of Waikato, New Zealand, in 1993. The 3.8.1 Windows version was used in this article. This software comprises a Java libraries group that use machine learning and data mining algorithms, presenting an intuitive interface to analyze large volumes of data [147,148]. This program allows the application of multivariate algorithms to the data set and analyze the effect produced by the variables that measure career success. In addition, this allows to relate the variables to each other and the class variables of the career success. However, these interpretations must be made individually without considering the career success function variables. Weka allows adequate handling of the data, allowing its analysis, modelling, and predictivity. Furthermore, it is considered one of the open-source data mining tools with the highest performance and functionality [149]. Weka covers standard data mining tasks such as preprocessing, classification, regression, clustering, and association rules [137,138], and it is used in various academic disciplines [150–152]. Many classification techniques are similar to the predictive accuracy basis, speed, robustness, scalability, and interpretability criteria [153]. For example, in data mining classification tree is a supervised learning

algorithm [154]. Four Weka classification learning algorithms were used to career success modelling validation: (i) Logistic Model Tree (LMT), (ii) J48 pruned tree, (iii) Random Forest Tree (RF), and (iv) Random Tree (RT) [155].

Select attribute supervised technique was used in this study, and the technique uses the CFS Subset Evaluator criterion function and Best First Decision tree (BF) classification method. Best First decision tree nodes are expanded by using best-first-order method. The impurity is default in all the nodes and all the impurities are reduced by using best node. Best first tree has many attributes, and root nodes are placed based on those attributes [156]. Best First Decision tree allows choosing the best attributes associated with the career success variables. Weka selected three objective career success variables (age, company type, and the company economic sector). Objective career success is strongly related to age; the over 31 years and threshold of the successful are from 35 to 45 years. Company type is the “public sector”, and the economic sector is “educational”.

4. Results

4.1. Survey Results

This study considered a random sample of 100 of the 548 university graduates. Consequently, objective career success levels of university graduates will be classified into three categories: successful (n_3), moderately successful (n_2), and unsuccessful (n_1), as shown in Table 3. The distribution of the sample size by the proportional method among the strata described below:

$$100 = k \times 548 \Rightarrow k = \frac{100}{548}$$

Table 3. Sample size for the objective career success strata.

Success Level	Sample Size	Total
$n_1 = \text{not successful}$	$n_1 = \frac{100}{548} \times (N_1) = \frac{100}{548} \times 180$	$n_1 = 33$
$n_2 = \text{moderately successful}$	$n_2 = \frac{100}{548} \times (N_2) = \frac{100}{548} \times 318$	$n_2 = 58$
$n_3 = \text{successful}$	$n_3 = \frac{100}{548} \times (N_3) = \frac{100}{548} \times 50$	$n_3 = 9$

Success probability (p) was calculated to define the career success levels. If p is greater than or equal to 0.8, then it is successful (n_3). If p is between 0.5 and 0.8, it is moderately successful (n_2). Finally, if $p < 0.5$, then it is not successful (n_1). The three were responsible for the follow-up to graduates compared with the value determined by the success functions. The success represented when at least two of those responsible for monitoring graduates coincide with each function. Results are related to professionals’ achievements before, during, and after their time at the university and professionals perceptions.

4.2. Career Success Variables Assignment

The average order importance analysis by determining objective career success factors through adapted Pareto criterion (relation 70–30%) application. As a result, it was selected the most relevant variables to define the OCS linear function by weights redistributing in such a way that their sum reaches unity. From the Pareto criterion application, 30% of the accumulated variables represent the 68.4% cumulative weight of the objective career success factors. It means that only nine variables are the most representative OCS factors (see Table 4).

Table 4. Pareto analysis application for objective career success.

OCS Factors	\bar{k}_i	\bar{k}_i Accumulated	$w_i = \frac{\bar{k}_i}{68.4\%}$
x ₁ . Work about your professional training	13.0%	13.0%	19.1%
x ₂ . Level of academic improvement	9.6%	22.6%	14.0%
x ₃ . Level of participation in I & D + I	8.9%	31.5%	12.9%
x ₄ . Information Technology Knowledge	7.6%	39.0%	11.1%
x ₅ . Choose the right professional degree the first time	6.4%	45.4%	9.4%
x ₆ . Income—Salary	6.4%	51.8%	9.3%
x ₇ . Company hierarchical level, professional achievements	5.7%	57.5%	8.3%
x ₈ . I work in a prestigious company or institution	5.6%	63.1%	8.2%
x ₉ . Work-studies relationship in the training process	5.3%	68.4%	7.7%

From the 22 subjective career success variables, adapted Pareto criterion (60–40%) was applied to select the most significant weights variables ($w_i > 10.7\%$). As a result, seven variables were selected by adapted Pareto criterion application (see Table 5).

Table 5. Pareto analysis application for subjective career success.

SCS Factors	\bar{k}_i	\bar{k}_i Accumulated	$w_i = \frac{k_i}{56.3\%}$
Y ₁ .—He likes the job he does	10.9%	10.9%	19.4%
Y ₂ .—Satisfaction with your career success achieved	9.0%	19.9%	16.1%
Y ₃ .—Job satisfaction and contribution to society	8.8%	28.7%	15.6%
Y ₄ .—Persistence in the objectives achievement	8.6%	37.6%	15.2%
Y ₅ .—Scope of the goal set in your professional career	6.8%	44.1%	12.0%
Y ₆ .—The effort to achieve a standard of excellence	6.1%	50.2%	10.9%
Y ₇ .—Work gives meaning to your existence and identity	6.1%	56.3%	10.8%
Total	100%	100%	100%

4.3. Career Success Mathematical Functions

4.3.1. Objective Career Success Function

Objective career success function definition was based on the new selected variables according to Pareto criterion. As a result, the equation is the following:

$$OCS = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9) = \sum_{i=1}^9 w_i x_i$$

$$OCS = 0.191x_1 + 0.140x_2 + 0.129x_3 + 0.111x_4 + 0.094x_5 + 0.093x_6 + 0.083x_7 + 0.082x_8 + 0.077x_9$$

Objective career success function evaluation at its maximum and minimum values represents the following values $f(5, 5, 5, 5, 1, 5, 5, 5, 5)$ and $f(1, 1, 1, 1, 0, 1, 1, 1, 1)$, depending on the information of each of the graduates OCS will be in the interval $OCS \in [0.91; 4.54]$.

4.3.2. Subjective Career Success Function

This same procedure, but with Pareto analysis in 60–40% relationship, ordered according to degree importance from highest to lowest was applied to define the SCS function described below.

$$SCS = f(y_1, y_2, y_3, y_4, y_5, y_6, y_7) = \sum_{i=1}^7 w_i y_i$$

$$SCS = 0.194y_1 + 0.161y_2 + 0.156y_3 + 0.152y_4 + 0.120y_5 + 0.109y_6 + 0.108y_7$$

Subjective career success function evaluation at its maximum and minimum possible values represents these values $f(5, 5, 5, 5, 5, 5, 5)$ and $f(1, 1, 1, 1, 1, 1, 1)$ respectively. So, according to the information of each of the graduates, the subjective career success will be within the interval $\in SCS \in [1, 5]$. As a result, OCS scores are in the range between [0.91, 4.54] (variables weight scale from 1 to 5) and the range between [1, 5] for the subjective career success. The methodology validation required the collaboration of three people in charge of monitoring university graduates. As a result of the survey and the assignment of weights of all variables analyzed for OCS and SCS, nine variables were selected for OCS and seven variables for SCS.

4.4. Career Success Levels

The evaluation functions results of OCS and SCS to UTEQ university graduates sample allowed classifying the graduates as “successful”, “moderately successful”, and “unsuccessful” (see Table 6). In the descriptive analysis data, results of the functions were contrasting, made value judgments, and differences of each group of graduates were highlighted.

Table 6. A rating scale for objective career success.

Category	Value	Criterion—Success Level	Function Interval
Successful	2	$f \geq (4.54)$ (80%)	$3.632 \leq f < 4.54$
Moderately successful	1	(4.54) (80%) $< f \leq (4.54)$ (50%)	$3.632 \leq f < 2.27$
Unsuccessful	0	$f < (4.54)$ (50%)	$f < 2.27$

Note: f: career success function.

Table 7 contains successful, moderately successful, and unsuccessful objectively professionals number by the academic unit. Results show that 9.1% of professionals are successful, 58% moderately successful, and 32.8% are unsuccessful. Successful professionals belong to the oldest academic units degrees such as agrarian (30%), livestock (24%), and environmental (18.2%). The most successful careers degrees are forest engineering, animal science, agricultural business administration, systems and software, and agronomy. In this group, computer systems stand out, which despite the low technological development of the region in the last 20 years, had a significant boom. About 9.1% represent objectively successful graduates; 58% moderately successful; and 32.8% are objectively unsuccessful (see Table 7).

Table 7. Objective career success by faculties.

OCS Level	Faculties/Academic Units							Total
	E	B	A	L	E	S	La	
0	50	66	16	10	19	17	2	180
1	79	109	34	29	36	30	1	318
2	9	3	15	12	11	0	0	50
Total	138	178	65	51	66	47	3	548

Note: 0 = unsuccessful, 1 = moderately successful and 2 = successful. Faculties: Engineering (E); Business (B); Agrarian (A); Livestock (L); Environmental (E); Semi-presential (S) and Law (La).

Subjective career success levels are represented in Table 8, it shows the number of “successful”, “moderately successful”, and “unsuccessful” professionals, subjectively with their respective percentages per academic unit. About 9.1% represent successful graduates; 58% moderately successful; and 32.8% are unsuccessful.

Table 8. Subjective career success by faculties.

SCS Level	Faculties/Academic Units							Total
	E	B	A	L	E	S	La	
0	0	4	1	0	0	0	0	5
1	79	89	26	18	30	26	1	269
2	67	79	41	39	31	15	1	274
Total	113	132	53	44	47	32	1	548

Note: 0 = unsuccessful, 1 = moderately successful and 2 = successful. Faculties: Engineering (E); Business (B); Agrarian (A); Livestock (L); Environmental (E); Semi-presential (S); and Law (La).

4.5. Mathematical Models Validation

4.5.1. University Graduates Tracking

A random sample of 100 university graduates was selected for validating the career success functions. As a result, 74.6% represent objective career success and 70.3% subjective career success. According to functions and acceptance, at least two of three results are required for leaders, followers, or graduates.

Pearson correlation coefficient between objective career success and subjective career success was 0.297, and significance of 0.000. It means that the OCS and SCS functions have a low correlation, which corroborates with meta-analysis studies showing that the variables should be treated independently if they have correlations of less than 0.30. [157,158]. For that reason, objective and subjective career success mathematical models were validated separately.

Table 9 shows that 38 of the 50 graduates classified as successful objectively are also successful subjectively, and it represents 76% of coincidence. The remaining 12 graduates are successful objectively but moderately successful subjectively, and none of them was successful objectively, and unsuccessful subjectively.

Table 9. Career success levels.

Levels	0 (SCS)	1 (SCS)	2 (SCS)	Total
0 (OCS)	33	87	60	180
1 (OCS)	0	144	174	318
2 (OCS)	0	12	38	50
Total	33	243	272	548

Note: 0 = unsuccessful, 1 = moderately successful and 2 = successful.

From the 318 graduates classified as moderately successful objectively, 174 feels successful subjectively and 144 represents moderately successful subjectively. From the 180 graduates classified as unsuccessful objectively, 60 are also successful subjectively, 87 are moderately successful subjectively, and 33 are unsuccessful subjectively. In general, from the 548 university graduates sample, 180 were classified as successful objectively and subjectively, 318 are moderately successful objectively and subjectively, and 50 are successful objective and subjectively.

4.5.2. Career Success Classification Models

Four classification models (LMT, J48 pruned, RF, and RT) were applied using Weka classification learning algorithms application allowed to validate objective career success mathematical model. The Logistic Model Tree (LMT) algorithm creates a tree with binary and multiclass target variables, numeric and missing values [112]. MT uses a logistic

regression tree and produces a single tree-shaped result containing binary divisions into numeric attributes [159].

The pruned tree J48 is the implementation of the decision tree C4.5 [160,161]. According to Dangare and Apte [162] they are models of class construction from records that contain class labels. The pruned tree J48 uses a decision tree algorithm to find the possible behavior of the attribute vector for an array of instances. The algorithm generates rules for predicting objective variables and shows the missing values present in the model and the output [163].

In recent years, Random Forest Tree (RF) [164] has received increasing interest from academia due to its excellent classification results and processing speed [165]. RF is considered a decision tree set classifier where a sample can be selected multiple times or cannot be selected [166]. It shows better predictions in other methods, especially decision trees [167]. Finally, Random Tree (RT) is an algorithm that randomly extracts a tree from a set of possible trees, uniformly distributed since they have the same probability of being sampled [166,168]. A clustering of RT can successfully describe the given input [9].

As a result, for objective career success model LMT algorithm shows the best results, with 76.09% (417 university graduates) of Correctly Classified Instances (CCI), as shown in Table 10. Moreover, J48 pruned tree has the 74.09% of CCI, which represents 406 university graduates. Random Forest Tree (RF) has 69.53% of CCI (381 university graduates). Finally, the Random Tree (RT) has 59.48% of CCI, it means 326 university graduates.

Table 10. Objective career success classification model validation.

Algorithm	KS	MAE	RMSE	CCI (%)	Average ROC Area
Logistic Model Tree (LMT)	0.513	0.2574	0.344	76.0949	0.543
J48 pruned tree	0.472	0.2465	0.351	74.0876	0.805
Random Forest Tree (RF)	0.3499	0.3059	0.383	69.5255	0.392
Random Tree (RT)	0.2396	0.2853	0.501	59.4891	0.232

Note: Kappa Statistic (KS); Mean Absolute Error: (MAE); Root Mean Squared Error (RMSE); and Correctly Classified Instances (CCI).

In subjective career success model RF algorithm shows the best results, with 94.59% (518 university graduates) of CCI, as shown in Table 11. Furthermore, LMT tree shows 94.37% of CCI, which represents 516 university graduates. J48 pruned tree has 89.41% of CCI (489 university graduates). Finally, the Random Tree (RT) has 80.63% of CCI, it means 441 university graduates.

Table 11. Subjective career success classification model validation.

Algorithm	KS	MAE	RMSE	CCI (%)	Average ROC Area
Logistic Model Tree (LMT)	0.8881	0.0564	0.1732	94.3694	0.892
J48 pruned tree	0.7886	0.0923	0.2528	89.4144	0.690
Random Forest Tree (RF)	0.8921	0.1144	0.2038	94.5946	0.749
Random Tree (RT)	0.6133	0.1253	0.3431	80.6306	0.575

Note: Kappa Statistic (KS); Mean Absolute Error: (MAE); Root Mean Squared Error (RMSE); and Correctly Classified Instances (CCI).

5. Discussion

Job satisfaction is related to professional satisfaction, although they are different constructs. The professional satisfaction is more associated with the emotional reaction about the current job. Otherwise, professional satisfaction is a broader reflection on satisfaction with the past, present, and future work as a whole [169]. External factors such as prestige, power, money, and progress influence the meaning of career success [9]. However, career success is sometimes considered a balance between professional and personal life [170,171]. That goes beyond of objective career success criteria [172,173].

The measuring discretized of the objective career success variables was according to the five-points Likert scale. For example, salary was measured in intervals or ordinal

variables, academic improvement courses, and hierarchical levels. However, these forms of measurement could generate a partial loss of information [174]. Otherwise, asking the graduate to report an accurate and sensitive figure, such as salary, can promote socially desirable responses [175]. Therefore, interval or ordinal measures may be more valid. The subjective career success variables also were collected on this scale to homogenize the calibration of our instruments. In addition, the evaluation of subjective career success is considered, which is made by the university graduate himself, “self-referential evaluation” [42].

Among the study’s limitations, there is a lack of validation of the self-referential results with those of other reference persons who know about the benefits of psychological achievements in the graduate’s career success [5]. As well as the relationship between age and career success [176]. It is possible that the graduate, out of complacency, overstates his status as subjective career success. Social comparisons have affective consequences [177–179]. Another limitation was social context and geographic environment which should have been considered in the study because this study was carried out in an eminently agricultural region and suffers from sustained agro-industrial development located in Latin America. This differs from other related studies developed in first world countries. In addition, in Latin America, job types are mostly full-time and not part-time, which allows them to have financial freedom. Differences in these social contexts must consider in a proper career success study because that could influence in career success definition described by experts.

Within the article advantages, data collection on the objective and subjective career success was independent. Therefore, there is no affection on information quality since the survey was very extensive. However, a possible correlation between these two constructs (OCS and SCS) is not ruled out. In addition, identifying career success predictors and establishing the concept itself is becoming more relevant in vocational and organizational career research [70,180]. Satisfaction with career success differs according to different career development models [181,182]. This study provides empirical evidence of this variance, further refining the construct of university graduates career development. Employers and employees are interested in why some people are more successful than others. Consequently, employees have begun to rely on predictive career success factors that help them promote their career success [183].

Future research lines could analyze correlations degrees and existing associations of psychological determinants (subjective variables) and economic determinants (objective variables) together with the objective and subjective success functions, trying to determine a single process, reaching similar results in other samples. However, item numbers addressed in this study suggest that the pattern of results is solid and can be generalized to different contexts.

6. Conclusions

Researchers designed a methodology to measure objective and subjective career success. This methodology uses a survey as measuring instrument. Study’s sample consists of 548 university graduates, which was a non-probabilistic sample. Survey’s questionnaire received 25.18% of responses from engineering degree students, 32.48% in business and administrative area; 11.86% agronomy; 9.30% livestock; 12.04% environmental; 8.60% blended organizational business; and 0.55% law.

From 548 university graduates 307 are men, it represents 56.02% of the sample, and 241 are women. As a result, 60% of university graduates who achieve both types of career success (OCS and SCS) are men and the remainder are women. University graduates ages vary between 25 and 55 years (mean = 37.2 years and standard deviation = 8.2). From 548 university graduates, the 99.4% are Ecuadorians and 38.9% are married. Employability rate was 93.6%, and 56.2% of university graduates work in jobs related with their studies. According to university graduates location, 91.9% were from Los Ríos province, place where UTEQ university is located, and the remaining were from Guayas province. Otherwise, 91.4% of university graduates belong to the face-to-face study modality and the blended

modality. It demonstrates the relationship between the OCS and SCS variables, which together measure career success levels.

In career success functions construction, a selection of the most significant variables by experts discretion and Pareto criterion analysis organizing variables from the greatest weight or relevance was necessary. These functions applied linear functions definition, where 50 professionals validated the career success predictors meaning. As a result, 29 OCS factors and 22 SCS factors were analyzed. These two linear functions represent the career success mathematical models: objective career success function and subjective career success function respectively.

Career success (objective and subjectively) categorization level was distributed in three levels: (i) successful, (ii) moderately successful, and (iii) unsuccessful. As a result, there are 50 university graduates classified in successful category, 318 in moderately successful, and 180 in an unsuccessful category. According to experts, in the career success mathematical functions validation from a sample of 50 university graduates, 38 were classified as successful (objective and subjectively), 12 had high objective success and low subjective success. Despite the extrinsic achievements (objective career success), it still leaves professionals with a feeling of dissatisfaction. Therefore, they will continue to strive each day to achieve their intrinsic satisfaction or subjective career success. Some academic units have a relatively higher objective and subjective success ranges, simultaneously. For example, agricultural faculties 34.2% and livestock 23.7%. While 7.9% in semi-presential business faculty and 0% in law's faculty.

Regarding to career success levels, "moderately successful objectively" is one that reaches a certain level of success from the first year of their professional career. In this context, 43% of university graduates have their own home. Otherwise, the 80.4% of university graduates choose rightly the career related to their study. This category corresponds preferably to systems engineering degrees (17.7%); business management (10.4%); forestry (10.4%); and authorized public accounting (9.5%). About their work experiences during university studies, 41.8% were unrelated or not at all, and 46.6% of them have a fourth level degree. However, 28.5% took only short courses and 76.6% have a high and very high knowledge in computer utilities.

University graduates categorized as moderately successful (77.2%) generally work in low and middle hierarchical positions in their organizations. Average salary for a moderately successful professional is 1657 USD (United States Dollar); mostly 1501 to 3000 USD. In this category (moderately successful), the 88.3% do not have production and development in research, median household income is 2087 USD, and 45.3% of household income is between 1501 and 3000 USD.

First, career success mathematical models validation consists of three responsible for monitoring graduates of the UTEQ university, who assessed the functions of a proportional stratified subsample of 100 graduates. It was correctly classified in objective career success function; 72.5% of graduates and 82.2% in subjective career success. Therefore, the instrument used to determine the SCS demonstrates appropriate psychometric properties, reliability, and validity. Second, four Weka's learning classification algorithms were applied for mathematical models validation.

As a result, LMT algorithm was selected in objective career success mathematical model evaluation, which showed 76.09% well-classified instances. While, in subjective career success mathematical model evaluation showed the best results with the Random Forest Tree algorithm application, which represents 94.59% well-classified instances. Similarly, it was evidenced that the learning models were more effective in estimating subjective success than for the objective (higher values in the indicators), which means that subjective information is more descriptive of success than objective.

Experts focus group suggests that OCS is guaranteeing when the university graduate meets the following conditions, in the next order of priority: (1) Perform their duties related to their professional field (19.1%); (2) their academic training is as high as possible (14%); (3) greater participation in research and development; and (4) greater knowledge

of ICTs. Monthly remuneration (money) and hierarchical level in the organization are part of the role, but they are not the most important in meeting graduates' aspirations for success. For subjective career success experts suggest the university graduates require the following conditions: (1) They like the work they do (19.4%); (2) satisfied with the success achieved in their professional career (16.1%); (3) feel personal satisfaction and contribute their work to society (15.6%); and (4) they are persistent in achieving their goals despite obstacles (15.2%).

The study's main contribution was that objective and subjective mathematical functions validation was proved in an Ecuadorian university, which has a certain coastal socio-economic environment, giving new research lines for career success modelling in similar contexts (developing countries), in another universities or even master programs focused on university graduates tracking, adapting with their own factors.

Author Contributions: Conceptualization, L.B.-M., N.M.-B. and R.P.-S.; methodology, N.M.-B., L.B.-M. and R.P.-S.; writing—original draft preparation, L.B.-M., N.M.-B. and R.P.-S.; writing—review and editing, L.B.-M., N.M.-B., R.P.-S., J.G. and A.R.; supervision, R.P.-S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: Thanks to CIPAT-ESPOL for the support and accompaniment in the development of this publication and specially to Ing. Paúl Carrión-Mero (CIPAT Director), Ing. Amilkar Puris-Cáceres, and Eng. Paulo Escandón for their collaboration. The preparation of this study counted with the collaboration of various scientific research projects, such as the academic projects of the ESPOL University (Escuela Superior Politécnica del Litoral) with code no. CIPAT-01-2018 "Registro del Patrimonio Geológico y Minero y su incidencia en la defensa y preservación de la geodiversidad en Ecuador" (Registry of Geological and Mining Heritage and its impact on the defense and preservation of geodiversity in Ecuador); the support of NOVA Science Research Associates and UTEQ project "Predicción y valoración del éxito profesional de graduados universitarios" (Prediction and assessment of the professional success of university graduates), with code 44.

Conflicts of Interest: The authors declare no conflict of interest.

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