Integrating different factors into the construct of employability for engineering students and graduates

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ABSTRACT: In the current world of work, employability is an important tool for graduates who enter the workforce. In this article, the author proposes a model composed of six key elements for graduates' employability: generic skills, career success, career commitment, organisational support, impact of the university and job satisfaction. A questionnaire was administered to students and graduates from five undergraduate engineering programmes in Colombia, and 470 responses were selected for analysis. Structural equation modelling (SEM) was used to analyse the collected data. The results revealed that the six constructs in the model are positively associated with graduates' employability. These findings are significant for engineering professionals who wish to meet the increasingly challenging expectations of the labour market because they provide insight into the generic skills that their career requires, graduates' satisfaction with their career, universities' planning strategies and the possible impact of university reputation in the productive sector.

INTRODUCTION

The current situation of the labour market poses different challenges for employment. The United Nations (UN) has claimed that one of the main problems caused by Covid-19 has been unemployment due to restrictions and the suspension of activities to stop the spread of the virus. Such restrictions have had a strong multidimensional impact on the workforce entry of young people in Latin America and the Caribbean. More specifically, recent graduates in this region face hardship, such as job cuts, lower salaries or awful working conditions for employees [1]. These phenomena widen the gap between graduates' expectations and the real situation in the current world. Thus, it is necessary to find strategies to keep young people motivated in this new scenario.

Nowadays, globalisation, digitisation, consumerism and mercantilism, which constitute part of the new socioeconomic model, have brought along some unprecedented challenges in terms of communication, information management and storage, and knowledge. As a result, industry-university relations have changed, and, in turn, teaching-learning processes have done so as well. Consequently, to achieve general economic growth and have a bidirectional conversation with the productive sector, higher education institutions (HEIs) should develop the employability skills and aptitudes that employers are worried about [2] and bridge the gap between the skills required by businesses and those proposed by the higher education system [3].

Several recent reports offer convincing reasons why undergraduate education should change so that graduates develop the capabilities imposed by the complex challenges of the 21st Century [4]. Therefore, the advanced technologies of Industry 5.0 will dominate training in engineering programmes, providing a more engaging learning experience [5]. However, students should be trained in employability skills, particularly non-technical skills, and understand how to incorporate or integrate them into their engineering knowledge [6]. The main aim of this study is to connect six important factors that compose the construct of employability based on the self-reports of engineering graduates that are currently employed. It combines theoretical foundations and empirical evidence from different authors to clear a path for future studies in this field, which should be conducted in an integrated way rather than a fragmented one.

The concept of employability first appeared in the 1997 Dearing Report [7] to explain why higher education curricula should include other skills besides cognitive knowledge to ensure better job performance [7][8]. However, universities often associate quality assurance and results with pragmatic measures. For example, they insist on measuring employability in terms of the employment rate of recent graduates and tend to see employability as an institutional achievement instead of an individual result of a student who got a job. Few institutions clearly define employability as being equipped for a job, and many of them prioritise the fact of getting a job because it is easier to measure. Nevertheless, when they do so, they are only measuring their institutional efficiency and leaving actual graduate employability aside [9].

One of the most important educational objectives of HEIs is to prepare graduates for the world of work, which has been addressed by the theory of human capital when it refers to the effect of education on graduates' preparation for the labour market. However, according to Formichella and London, income, job satisfaction, and time to find a job change from individual to individual [10]. Even if students have the same educational attainment, some stand out more than others in terms of employment rate. These differences may be due to their immediate interest according to their life-long personal predisposition toward educational processes or the environment where they live. Education and environment can produce new aptitudes (regarding formal contents) and attitudes (regarding how contents are communicated) to make an individual more employable.

But the current context is discouraging for senior students and recent graduates because, due to Covid-19, young unemployment is a growing trend. This kind of unemployment has produced major changes in many groups in the population, especially in higher education students. Aristovnik et al conducted a study with 31,000 students from six continents, 100 countries and 160 universities [11]. Their results indicate that higher education students have specific concerns. For instance, during the lockdowns, many students around the world (42.6%) were, most of the time or all the time, concerned about the future of their career and employment.

The impacts of the Covid-19 pandemic on human capital include high death rates, rising dropout rates and job losses. For example, in 2020 in all the OECD member countries, 22 million jobs were lost compared to 2019. The global economic recovery of recent months has not generated enough jobs to restore the pre-pandemic employment rate. In the first quarter of 2021, the average employment rate in all OECD member countries was around 66.8%, which is still not enough jobs; and there is a risk of rapid accumulation of unemployment in the long term. In March 2021, the employment rate in Colombia reached 60.7%, which is significantly lower than the OECD average (i.e. 66.8%) [12].

One of the most hotly debated topics in the field of education is if HEIs are the right place to effectively develop employability skills, and even if they can do it [13]. Governments and employers expect HEIs to be responsible for preparing graduates for the workforce; as a response, HEIs have incorporated employability into their programmes. Cranmer holds that, although there is no proof that demonstrates that developing employability skills at universities has any effect on employment rates in contrast with employment-based training and experience, which do have positive effects - graduates are aware of the power that work experience has over their development of employability skills. Indeed, 90% of them agree with the following statement: *Work experience is the best way to acquire the skills I need to work* [14].

The relationship between perceived employability and employees' subjective well-being (which includes career commitment, career success and job satisfaction) has drawn increasing attention in recent years [15]. Success and failure, which are psychological states, depend on individuals' subjective interpretation of the outcome [16]. They cause individuals to direct their behaviour, self-efficacy and knowledge toward self-fulfilment, whether in their academic, personal, professional or family spheres. Thus, career success is defined as …*the experience of achieving goals that are personally meaningful to the individual, rather than those set by parents, peers, an organization, or society* [17]. It is the result of accumulating personal work-related achievements.

METHODOLOGY

Sample and Procedure

The study participants included: 1) senior students enrolled, from January to June 2022, in the different engineering programmes offered by a public HEI in Colombia; and 2) graduates of the same programmes from the previous two academic years (2020 and 2021) from the Faculty of Engineering of the Metropolitan Institute of Technology (Instituto Tecnológico Metropolitano) in Medellin, Colombia. For sample selection in this study, probabilistic sampling was used, particularly stratified random sampling - a technique in which every individual in the study population has the same probability of being included in the sample.

A questionnaire was administered to 505 participants; however, after discarding the questionnaires with missing information due to lack of work experience, the final number of valid questionnaires for analysis was 470. Regarding the sociodemographic characteristics of the 470 respondents, 86.1% were men and 13.9% were women. Half of them were between 26 and 35 years of age, and only 6% were aged over 45. Probably because the sample represented a relatively young population, 58.8% of the respondents were single. Moreover, 85.2% of the respondents belonged to the lowest socioeconomic strata (i.e. strata 1, 2 and 3), while 14.8% came from strata 4 to 6. This is in line with data on the student population reported by HEIs in Colombia, according to which 86.5% of students come from socioeconomic strata 1, 2 and 3 [18].

Measurements

The model proposed in this study is composed of three factors: individual attributes or employability skills, career development and external factors (opportunities).

Employability skills were measured using four of the five dimensions suggested by Fugate and Kinicki: work and career proactivity (two items), career motivation (two items), work and career resilience (three items), optimism at work (two items) [19]. Along with these four dimensions, an extra dimension was added: professional knowledge (three items) proposed by Bennett and Ananthram [20].

On a 5-point Likert scale, respondents rated the extent to which they displayed each behaviour in the workplace (e.g. *I apply the knowledge and skills acquired during my undergraduate studies in the workplace*). With a Cronbach's alpha within the acceptable range (between 0.70 and 0.86), the reliability of this scale ($\alpha = 0.70$) indicated acceptable internal consistency.

Professional development was assessed using three variables: career success, career commitment and job satisfaction. To measure career success three traditional indicators were used: salary, career advancement and relevant hierarchical positions. Data were collected using a 5-point Likert scale with responses ranging from 1 - *considerably below my colleagues* to 5 - *considerably above my colleagues*. The Cronbach's alpha of this scale was 0.86. To the original three items, the author added two more social capital-related items proposed by Verbruggen and Sels in order to evaluate this variable more thoroughly [21]. Such two items were: *I can establish and maintain contact with people who can help me with my career* and *I know people who can help me with my career.* The Cronbach's alpha in this case was 0.90. To measure career commitment, four of the nine elements suggested by Rothwell and Arnold were used (e.g. *I am glad I chose this career path over others I was considering at the time I enrolled at the university*) [22]. In this case, the response options were the same as in the other scales, and the internal reliability coefficient was 0.80. Finally, to measure job satisfaction, the five items proposed by Chew and Chan were used (e.g. *My current job meets my career expectations*) [23]. For this scale, the response options were the same as in the previous ones, and the internal reliability coefficient was 0.80.

External factors (opportunities) were assessed using two dimensions: the impact of the university and organisational support. To measure the perceived impact of the university, the five items proposed by Rothwell et al were adapted [24]. In addition, the perceived programme relevance factor (three items) from Bennett and Ananthram was included [20]. On a 5-point Likert scale, respondents indicated the strength of their university's brand and reputation in the field of engineering (e.g. *The status of my university is a great asset in my search for employment*). The internal reliability coefficient of this scale was 0.75. To measure organisational support, four items were used from Van Dam [25]. On a 5-point Likert scale, respondents rated the extent of the support they received from their employers to do their work, gain expertise and be promoted (e.g. *The company makes an effort to provide employees with the resources they need to do their work properly*). The Cronbach's alpha of this scale was 0.84.

The questionnaire contained a total of 41 items to measure the different constructs mentioned above, as well as five additional questions about sociodemographic information.

Analytical Strategy

The hypothetical model was tested via covariance structure analysis - a statistical technique also referred to as structural equation modelling (SEM) - and solved using IBM SPSS AMOS (version 26). Such statistical technique offers goodness-of-fit measures that can be applied to sample sizes of greater than 200. Considering that the proposed model includes less than 100 items, it does not exhibit large complexity. In all the analyses, a covariance matrix and the maximum likelihood estimation method were also used. Correlations between factors and item errors were allowed.

The overall goodness-of-fit of the proposed model was calculated based on a combination of various fit indices, including the goodness-of-fit index (GFI), Bentler's comparative fit index (CFI), and the root mean square error of approximation (RMSEA) [26]. GFI and CFI values above 0.90, RMSEA values below 0.08 and a ratio of goodness-of-fit to chi-square degrees of freedom below 3 were considered acceptable [27].

RESULTS

Prior to performing SEM, a descriptive statistical analysis was performed, the results of which are presented in Table 1.

Table 1: Mean, standard deviation and correlation analysis.

Factors	Mean	SD	1	2	3	4	5	6
1. Employability skills	4.16	0.592	1					
2. Career success	3.23	1.108	0.494**	1				
3. Career commitment	4.21	0.675	0.456**	0.267**	1			
4. Organisational support	3.71	0.966	0.531**	0.590**	0.349**	1		
5. Impact of the university	3.59	0.788	0.398**	0.227**	0.479**	0.310**	1	
6. Job satisfaction	3.51	1.197	0.175**	0.160**	0.064	0.283**	0.052	1

Note: **Correlation is significant at the 0.01 level (2-tailed). Source: own work

As can be seen in Table 1, employability skills exhibited a mean of 4.16, with the score of each item in this factor being above this value, which indicates a high level of employability skills among respondents. The overall mean of employability skills in men was 4.17, with a standard deviation of 0.60, while that in women was 4.07, with a standard deviation of 0.47. These values were not found to be statistically significant ($t = -1.26$, df = 468, $p = 0.20$). As observed in Table 1, there is a positive significant correlation between employability skills and both the two external factors (organisational support and impact of the university), and the three variables of career development (career success, career commitment and job satisfaction).

Confirmatory factor analysis (CFA) was used to evaluate the validity and reliability of the items in the questionnaire. According to the CFA results, all model fit indices were acceptable ($X^2/DF = 2.07$; CFI = 0.954; TLI = 0.947; RMSEA = 0.048; SRMR = 0.076). The obtained Cronbach's alpha and composite reliability (CR) values exceeded the required threshold of 0.70 [28], whereas the standardised factor loadings of all items were statistically significant. In terms of discriminant validity, the CFA revealed that the average variance extracted (AVE) values were increasingly greater than 0.50 and that the square root of the AVE of each construct was higher than the correlation coefficient between each pair of items (CR = 0.93; AVE = 0.623). Figure 1 shows the standardised factor loadings of the model.
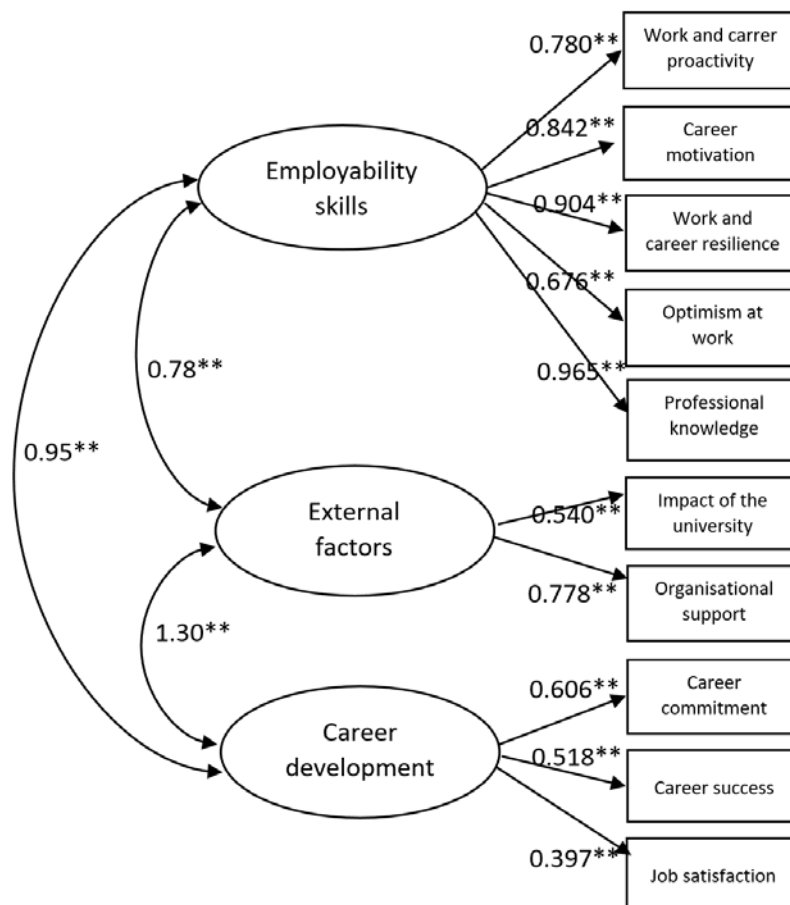

Figure 1: Standardised path coefficients of the correlations between employability skills, perceived external factors and career development (N = 470). Source: own work.

CONCLUSIONS

This study gathered concepts and dimensions proposed by different authors in order to construct a model that encompasses the individual components of employability, as well as its external factors which HEIs frequently overlook when designing curricula. This integrated rather than fragmented approach, thus, represents a contribution to the field of employability.

The way this article addresses perceived employability contributes to the social debate on how to build a stable career in a changing and unpredictable world. In fact, this study confirmed how complex perceived employability is due to the several factors that influence individuals' perception of it, which affects both its results and most significant effects. Importantly, such complexity results from its subjective nature; i.e. from the way professionals - based on their experiences, personal traits and characteristics of the labour market - perceive the extent to which they have developed the necessary skills to find a job, keep it and be promoted.

In line with this, the perceived employability construct was shaped based on theoretical foundations and empirical evidence from authors like [20][22][24][25] and [29]. It was approached not only from its individual characteristics,

but also from a multifunctional structure that considers external factors and the career development that employees have achieved. Therefore, it was characterised as consisting of three factors: 1) individual attributes to proactively face the challenges of the labour market; 2) external factors like organisational support and the impact of the university; and 3) employees' subjective well-being, which includes job satisfaction and career commitment and success. Considering the relationships suggested in the structural equation model, the proposed model managed to integrate these three variables, and such integration was supported by the observed coherence of both the concepts (factors and items) and the designed instrument.

Regarding the individual attributes that allow individuals to (pro)actively adjust to their work and career contexts and produce successful outcomes, these were divided into five competencies: 1) work and career proactivity, which helps to identify where to focus efforts and lower uncertainty and anxiety; 2) career motivation, which enables employees to set goals and deal with the challenges and boredom at work; 3) work and career resilience, which inspires a positive mind-set regarding future changes and reflects individuals' confidence to handle setbacks; 4) optimism at work, which allows employees to view career success as the result of their efforts to attain the desired goals; and 5) professional knowledge, which enables employees to continue learning in order to improve their personal adaptability and, thus, their employability. According to our findings, employable individuals with these particular traits are more likely to find a job that they desire and matches their preferences. This might be due to the influence their academic programme and university have had on the productive sector and the support they have received from employers or organisations who wish to retain their best employees [30].

As for the external factors, a highly significant correlation was found between employability skills and the impact of the university and academic programme. This, however, is not consistent with the results of Rothwell, who removed, from their analysis, the factors related to the status and credibility of the field of study and the reputation of the university in that field of study because of their weak relationship with the other components of employability [24]. Regarding organisational support, the findings are in line with those of Van Dam, who states that organisations can have an impact on employees' career development and activities by offering career support and adopting a learning and growth culture [25]. This would help employees to overcome potential barriers and perform the required tasks, without affecting their willingness to develop employability skills. In addition, the author adds that employees who receive more organisational support are more satisfied with their job and, as a result, less anxious to accept changes.

Furthermore, the findings of this study confirm the existing relationships between the three factors under analysis. For instance, a correlation was found between employability skills and career development, which is consistent with Rothwell and Arnold's assertion that self-perceived employability is correlated with career commitment and success [22]. According to these authors, employability is associated with individuals' perceptions of the past, present and future, considering the circumstances faced, whether positive (e.g. promotions and selection processes) or negative (e.g. downsizing and career stagnation).

In this study, the different organisational factors were found to have a major impact on the results, which suggests that organisations could help individuals develop employability skills by paying attention to their career preferences and offering career support. By doing this, organisations may more effectively align their needs and objectives with those of their employees. In light of this, future studies should further examine participants' work-related traits, as this would restrict the generalisation of these findings and set limits on the traits under analysis. Likewise, in order to identify the gap in the graduate-university-industry relationship, it would be interesting to analyse the role of the other two key stakeholders in the field of employability (i.e. employers and universities).

Finally, from a practical perspective, HEIs should include, in the curricula of their programmes, the generic skills required by graduates to improve their employability, as well as devise career counselling initiatives - run by the career services department - to help graduates find better and more fulfilling jobs.

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