

RESEARCH PAPER

Modelling Entrepreneurial Intentions and Attitudes towards Business Creation among Emirati Students Using Bayesian Networks

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ABSTRACT

PURPOSE: Entrepreneurial intentions (EI) have been a major focus of research studied using generic models. This paper will use Bayesian Networks (BN) to model entrepreneurial intentions as they provide an advantage over classical methods.

METHODOLOGY: A cross-sectional study was conducted among a random sample of 324 Emirati University students by implementing the Unsupervised Structural Learning algorithm to build the model.

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FINDINGS: Entrepreneurial intentions are highly affected by attitude, self-efficacy, subjective norms, and opportunity feasibility, while obstacles and university opportunity feasibility are the variables whose influence on entrepreneurial intention is less.

ORIGINALITY: This study looked at entrepreneurship intention and attitudes among students who are not yet entrepreneurs using Bayesian Networks as a new technique to discover how this can affect students' intention in starting a business. Conclusions stem from the existing Emirati social construct (people-centric society of the Arab world, rather than system-centric society of the Western world). This has created value-added contributions of the paper to the research questions.

KEYWORDS: *Bayesian Network; Entrepreneurship; Intention; Attitudes; Self-Efficacy; Subjective Norms*

INTRODUCTION

Economic growth in most advanced countries is driven by large numbers of small and medium enterprises across all sectors, and most countries prioritise the importance of entrepreneurship for economy growth and innovation. Therefore, it is vital for a country's advancement to stimulate a culture of entrepreneurship at an early age through the education system. In addition to economic growth, entrepreneurial activity is a key driver of employment, innovation and productivity, and it is generally assumed to be a vital driver of economic development and transformation through the prevalence of an innovative environment. Indeed, entrepreneurship not only adds to entrepreneurs themselves, but also adds to the overall economy through job creation in the market at all levels (Al Saiqal, 2017). This starts with universities whose role is to provide their students with entrepreneurial skills and supply the country with qualified entrepreneurs who can create new innovative businesses and contribute to the country's economic growth (Chrisman *et al.*, 2012; Henderson and Robertson, 2000).

Entrepreneurial attitudes refer to the extent to which students think there are good opportunities for starting a business, or the degree to which they attach high status to entrepreneurs. Measuring entrepreneurial attitudes is important because they express general feelings towards entrepreneurs and entrepreneurship. Other relevant attitudes may include the level of risk that individuals might be willing to bear and individuals' perception of their own skills, knowledge and experience in business creation. Entrepreneurial attitudes can both influence and be influenced by entrepreneurial activity.

Although entrepreneurial attitudes and intentions are not new phenomena, they have always been studied using generic entrepreneurial intention models (Aljuwaiber, 2021). This paper uses Bayesian Networks (BNs) as a relatively new technique that can model entrepreneurial intentions and attitudes, and provides some advantages compared to classical methods.

BNs are a set of statistical methods used to model problems, extract information, and make decisions. They are a formalism of probabilistic reasoning increasingly used in several fields such as industry, health, finance and image processing.

LITERATURE REVIEW

Attitudes towards entrepreneurship have become an important factor in not only describing but also explaining entrepreneurial behaviour in recent entrepreneurship research. There are

several models that were developed to study entrepreneurial attitudes since the introduction of the Theory of Planned Behavior (TPB) by Ajzen in 1982. Another proposed model that takes into consideration desirability and feasibility was introduced in Shapero and Sokol (1982). This model argues that the Entrepreneurial Intentions (EI) variable depends on perceptions of desirability, feasibility, and propensity to act. It was later updated in McMullen and Shepherd (2006) to point out the role of the societies in which an entrepreneur lives. Perceived desirability was defined as a subjective norm regarding the perceived social support and personal interest to perform the entrepreneurial behaviour, while perceived feasibility was defined as the perceived ease or difficulty of performing the entrepreneurial behaviour and the perceived self-competence regarding entrepreneurship.

In Krueger *et al.* (2000), *Subjective Norm* was defined as a person's perception of a specified behaviour, such as starting a business, that may be influenced by family, friends, society, educators, etc. Furthermore, role models, usually associated with parents and friends, have been established as a factor that positively affects entrepreneurial behaviour. Other models suggest adding additional factors they consider important in entrepreneurial intentions and attitudes. Obstacles or barriers to business creation and the support available to entrepreneurs are examples of such factors. Regardless of the model used to study entrepreneurial intentions among students, there is a need to promote entrepreneurship and understand the role of universities in fostering entrepreneurship among students.

Several studies exist that analyse the entrepreneurial attitudes of university students (Ruiz-Ruano and Puga, 2019; Moriano *et al.*, 2012; Luiz and Mariotti, 2011; Sánchez-Escobedo *et al.*, 2011; Harris and Gibson, 2008). Several studies have been conducted in the Middle East (Saleh and Salhieh, 2014), in Saudi Arabia (Aloulou, 2016), in Kuwait (Elali and Al-Yacoub, 2016), in Bahrain (Al-Shammari and Waleed, 2018), in Jordan (Abualbasal and Badran, 2019), in Oman (Bakheet, 2018), and in Egypt (Hattab, 2014; Sharaf *et al.*, 2018). In the UAE, there are a limited number of research studies directed towards entrepreneurship attitudes and intentions (Al Saiqal, 2017; Jabeen and Faisal, 2018; Vracheva *et al.*, 2019; Pauceanu *et al.*, 2018, Mohammed, 2019).

At the world level, there are a limited number of studies that have investigated entrepreneurial attitudes using BNs (Ruiz-Ruano and Puga, 2019; García *et al.*, 2014; López *et al.*, 2012).

All the studies in the UAE were conducted using generic models. To our knowledge, no study in the UAE has ever used the BN framework to model entrepreneurial intentions. The close exception is one study (Sohn and Lee, 2013), where the authors examined the dynamic relationship among early-stage entrepreneurial attitudes, activities, and aspirations using BNs. Therefore, this study will be the first to use BNs as a tool to investigate entrepreneurship intention and attitudes among students who are not yet entrepreneurs, and discover how this can affect their intention in starting a business. Conclusions stem from the existing Emirati social construct (people-centric society of the Arab world), rather than system-centric society of the Western world.

BAYESIAN NETWORKS

Bayesian Networks (BNs) (also known as probabilistic graphical models) are statistical tools to represent and handle uncertainty in different domains (Pearl, 1988). BNs represent the joint probability distribution (JPD) of a set of selected random variables of an area of knowledge and can handle both qualitative and quantitative dimensions of any domain. The qualitative part consists of the structure of the BNs that consist of a set of random variables (nodes) and directed edges connecting the nodes to form a directed acyclic graph. The quantitative part of the BNs consists of the conditional probability tables associated with each node. Each edge between two nodes A and B in the BN structure indicates a statistical dependence between the two variables. If the edge is directed from A to B, it describes the probability distribution of A conditioned by B ($P(A|B)$). This conditional probability distribution is represented as a probability distribution table (PDT) as all variables in the BN will be discretised.

BNs can be built either by using experts' knowledge or learned from data. Learning a BN from data means finding the BN structure that best represents the JPD that is sampled by the data. There are two families of methods for learning BNs: the constraint-based methods and the score-based methods. The Minimum Description Length (MDL) score is one of the well-known and used scores in BN learning. The learning algorithms will build the BN that minimises the MDL, considering not only the structure capacity to encode the data but also the BN complexity. The BN output is based solely on the collected data and no expert knowledge was used to determine any type of association between the variables.

METHODOLOGY AND DATA ANALYSIS

Materials and Methods

A cross-sectional study was conducted among a random sample of 324 Emirati students attending a university in the UAE. The average age of participants was 22.7 years with a standard deviation of 3.1 years. Most participants were from the Emirate of Dubai (52.2%), followed by Abu Dhabi (28.4%).

After ethical clearance was obtained from the University Research and Ethics Committee, students were recruited by choosing classes randomly through Excel from the list of 2020 Summer and Fall semesters, briefed about the study aim, and were asked to fill out the survey instrument that measured their perceptions of entrepreneurship and entrepreneurs, attitudes towards entrepreneurship, entrepreneurial opportunities, entrepreneurial environment within the university and the country, and limitations of starting a new business. In each question, students were able to choose their answers on a Likert scale of 1 to 5, 1 being "strongly disagree" to 5 being "Strongly agree".

The different survey statements were taken from Ruiz-Ruano and Puga (2019), Moriano *et al.* (2012), Luiz and Mariotti (2011), Abualbasal and Badran (2019), and Moriano *et al.* (2008). Some of the items were reformulated, added and/or deleted to suit our population.

Validity and Reliability of the Questionnaire

A professional translator translated the English version of the questionnaire into Arabic. A second bilingual speaker cross-checked the Arabic version word by word with the English version. Content validity of the Arabic version of the questionnaire was assessed by a panel of experts in the field to evaluate the items' readability, language simplicity and suitability, and to evaluate the relationship of each item to the whole scale. The internal consistency reliability of the Arabic version of the questionnaire was assessed using Cronbach's α , which was 0.976.

METHOD

The scales generated from the different statements included in the survey are entrepreneurial intentions (INT), entrepreneurial attitudes (ATT), entrepreneurship self-efficacy (SE), subjective norms (SN), opportunity feasibility (OF), university opportunity feasibility (UOF), country opportunity feasibility (COF), perceived risk (PR), obstacles (OBS), and family and friend support (FFS). All study variables are summarised in Table 1.

Table 1: Descriptive Statistics and Internal Consistency Coefficients

Variables	Number of Statements	Cronbach's α	Mean	SD
INT	7	0.79	3.34	0.54
ATT	10	0.89	3.83	0.69
OF	5	0.79	3.40	0.59
SE	11	0.79	3.07	0.61
SN	14	0.92	3.83	0.64
PR	5	0.74	3.00	0.69
COF	5	0.89	3.86	0.84
UOF	15	0.94	3.52	0.74
OBS	10	0.86	3.26	0.72
FFS	1	–	3.99	1.03

Source: Constructed by authors

DATA ANALYSIS

There are several BN learning algorithms. This paper used the Unsupervised Structural learning implemented within BayesiaLab (Bayesia, 2021). Several unsupervised learning algorithms were tried before selecting the one that minimised the "Minimum Description Length" (MDL) score defined on BNs. Maximum Weigh Spanning Tree, Taboo, and SopEQ algorithms were considered; it was found that SopEQ provided the lowest MDL score.

The SopEQ algorithm is a search algorithm based on heuristics. It first identifies the set of potential parents of each node, then, for the addition of edges, it explores the equivalence class

space where both edges' orientations are equivalent with respect to the encoded joint probability. Edges' directions are then added after all conditional dependencies have been identified.

We used the mutual information and the logarithmic loss to evaluate the goodness of fit of the BN model and carried out a sensitivity analysis to evaluate the impact of each variable in the model on the intention variable.

The scores of the different scales were discretised into three bins using R2-GenOpt for discretising continuous variables available within BayesiaLab (Bayesia, 2021).

RESULTS

The fitted BN is shown in Figure 1. According to the obtained BN model, ATT, SE, and OF play an important role in shaping entrepreneurial intentions. Additionally, ATT is directly affected by SN; therefore SN has an influence on INT that is mediated by ATT. On the other hand, the SN is a direct parent of the PR variable and a direct descendant to the FFS; this is an indication that FFS has an impact on intention, which is mediated by attitude. The same applies to the COF as a direct parent to the FFS. Furthermore, COF influences both FFS and UOF. The strength of the relationships represented by the arcs of the BN is given in Table 2.

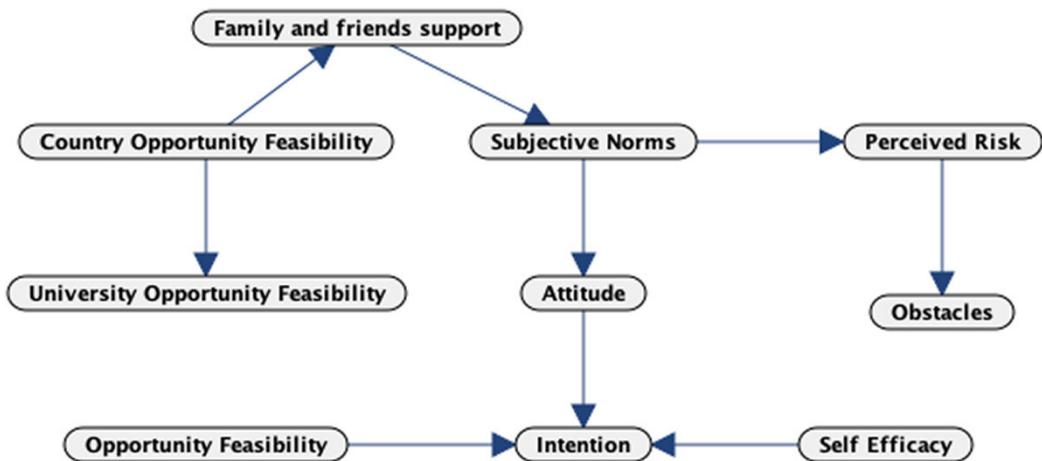


Figure 1: The Learned BN Structure

Source: Constructed by authors

Table 2: Relationships Analysis

Parent	Child	KL Divergence	Mutual Information	G _{KL} -test	Pearson Correlation
SN	ATT	0.62	0.62	276.97*	0.78
COF	FFS	0.45	0.45	203.67*	-0.21
FFS	SN	0.39	0.39	176.11*	-0.21
PR	OBS	0.37	0.37	168.03*	0.62
ATT	INT	0.23	0.12	103.66*	0.30
COF	UOF	0.23	0.23	103.17*	0.50
OF	INT	0.17	0.08	76.74*	0.30
SE	INT	0.16	0.05	88.44*	0.22
SN	PR	0.10	0.10	44.08*	0.12

GKL-test: The independence test G is computed from the Kullback-Leibler divergence of the relationship

*Significant at P-Value <0.0001

Source: Constructed by authors

The probability distribution of intention conditional to attitudes, self-efficacy, and opportunity feasibility is given in Table 3. It appears from this table, as an example, that there is a 60.87% chance of an intention average higher than 3.57 (high intention) given that attitude is higher than 4, self-efficacy is between 2.64 and 3.36 (moderate), and opportunity feasibility is higher than 3.5 (high).

Table 3: Conditional Probability Table of INT given ATT, SE, and OF

		INT			
ATT	SE	OF	≤ 2.86	≤ 3.57	>3.57
≤ 3.2	≤ 2.64	≤ 2.67	64.71	35.29	0.00
		≤ 3.5	33.33	66.67	0.00
		>3.5	33.33	33.33	33.33
	≤ 3.36	≤ 2.67	40.00	60.00	0.00
		≤ 3.5	31.82	68.18	0.00
		>3.5	0.00	100.00	0.00
	>3.36	≤ 2.67	33.33	33.33	33.33
		≤ 3.5	33.33	66.67	0.00
		>3.5	33.33	33.33	33.33
≤ 4	≤ 2.64	≤ 2.67	33.33	66.67	0.00
		≤ 3.5	23.08	73.08	3.85
		>3.5	0.00	100.00	0.00
	≤ 3.36	≤ 2.67	100.00	0.00	0.00
		≤ 3.5	18.60	74.42	6.98
		>3.5	13.04	82.61	4.35
	>3.36	≤ 2.67	33.33	33.33	33.33
		≤ 3.5	7.69	76.92	15.38
		>3.5	5.88	58.82	35.29

(continued)

Table 3: Conditional Probability Table of INT given ATT, SE, and OF (continued)

ATT	SE	OF	INT		
			≤ 2.86	≤ 3.57	>3.57
>4	≤ 2.64	≤ 2.67	83.33	16.67	0.00
		≤ 3.5	26.67	66.67	6.67
		>3.5	0.00	66.67	33.33
	≤ 3.36	≤ 2.67	33.33	33.33	33.33
		≤ 3.5	9.09	54.55	36.36
		>3.5	8.70	30.43	60.87
	>3.36	≤ 2.67	33.33	33.33	33.33
		≤ 3.5	6.25	37.50	56.25
		>3.5	0.00	15.22	84.78

Source: Constructed by authors

Table 4 shows the nodes in descending order according to the information they bring to the knowledge of the target node Intention using sensitivity analysis. Mutual information represents the amount of information brought by each node to Intentions, Relative Significance represents the ratio between the mutual information and the maximum mutual information value (0.118). The independence X^2 -test is computed from the BN structure for each of its variables that target Intention.

Table 4: Overall Analysis with Intention

Node	Mutual Information	Relative Significance	X^2 -test
ATT	0.118	1.000	53.178*
OF	0.085	0.718	38.155*
SN	0.056	0.470	24.982*
SE	0.054	0.455	24.187*
FFS	0.021	0.178	9.438*
COF	0.009	0.077	4.082*
PR	0.003	0.028	1.492*
UOF	0.002	0.018	0.936*
OBS	0.001	0.006	0.323*

*Significant at P-Value <0.0001

Source: Constructed by authors

Tables 5 shows, in descending order, the variables according to their relative contribution to high intention. Bayes Factor represents the impact of observing high INT on the other variables.

Table 5: Local Analyses with Target node set to High Intention

Node	Mutual Information	Max Bayes Factor			Min Bayes Factor		
ATT	0.113	>4	76.24%	1.843	≤ 3.2	5.95%	0.344
SE	0.053	>3.36	49.65%	1.693	≤ 2.64	10.81%	0.412
SN	0.053	>4.14	48.85%	1.721	≤ 3.29	6.99%	0.365
OF	0.024	>3.5	54.21%	1.417	≤ 2.67	7.08%	0.675
FFS	0.020	Strongly Agree	52.50%	1.339	Disagree	2.50%	0.477
COF	0.009	>4.2	38.08%	1.272	≤ 3.2	18.79%	0.742
PR	0.003	>3.25	30.33%	1.143	≤ 3.25	35.21%	0.864
UOF	0.002	>3.73	43.29%	1.113	≤ 2.6	7.50%	0.838
OBS	0.001	>3.6	28.91%	1.077	≤ 3.6	54.83%	0.955

Source: Constructed by authors

The results from Tables 4 and 5 indicate that ATT, SE, SN, and OF are the four most influential variables in the model. These variables are followed by FFS, COF, and PR that account for relatively important degree of influence whereas OBS and UOF influence on INT is less.

When the high level of SE variable was set to 100% using ‘what-if’ analysis, INT target (above 3.57) increased from 23.56% to 39.86%, while when the ATT was set to the highest level (above 4), INT increased from 23.56% to 43.42%. Furthermore, when SN was set to the highest level (above 4.14), ATT increased sharply from 41.36% to 91.30% while INT increased from 23.56% to 40.53%. Therefore, the most probable explanation for INT to be above 3.57 is as follows: AT above 4, SE between 2.64 and 3.36, OF above 3.5, OBS above 3.6, SN above 4.14, PR above 3.25, COF above 4.2, and strong FFS. This means that high intention requires high degrees of attitude, subjective norms, country opportunity feasibility, obstacles, and perceived risk and family and friends’ support, and moderate degrees of self-efficacy.

DISCUSSION

The most important result of the study found that entrepreneurial intentions among Emirati youth, represented by the sampled group of Emirati students, are highly affected by attitudes towards entrepreneurship, self-efficacy, and opportunity feasibility. Other studies using BNs, such as López *et al.* (2012), found that opportunity feasibility was shown to directly affect intention. Further studies using traditional methods of hypothesis testing, such as Shapero and Sokol (1982) and Krueger *et al.* (2000), reach the same conclusions. Additionally, our results agree with the emphasis on the opportunity feasibility of entrepreneurship (McMullen and Shepherd, 2006). Our results agree with the Theory of Planned Behaviour (Ajzen, 1982) that claims that entrepreneurial intention is the product of attitudes towards entrepreneurship, subjective norms, and locus of control (Ajzen and Fishbein, 2005).

In this study's BN model, the SN has a direct effect on ATT and an indirect effect on INT through ATT as mediator; this supports the findings of Shapero and Sokol (1982) and Sampedro *et al.* (2014). Knowing that SN directly affects ATT and indirectly affects INT, with ATT as a mediator, will help policy-makers emphasise the factors that can improve someone's subjective and social norms. This study does not assume any hypothesis to build the model. This result, like Sampedro *et al.* (2014), was found directly by the BN model, showing the strength of the BN framework from one side and validating the theory on the other.

One of the strengths of our study is the inclusion of SE and ATT in the intention model, and to show that both have direct effects on INT. This result is different from the conclusion of Ruiz-Ruano and Puga (2019) in which ATT had an influence on INT that is mediated by SE. However, it is important to note that the study by Ruiz-Ruano and Puga (2019) was undertaken among an older group of university faculty compared to our sample of youth, which may explain the difference.

In this study's BN model, the attitudes variable has a direct relationship with intentions, a common result found in almost all traditional models such as TPB. The direct relationship between self-efficacy and intentions was also proposed by different models, such as McMullen and Shepherd (2006), Sampedro *et al.* (2014), Heuer and Liñán (2013), and Schlaegel and Koenig (2014). Furthermore, no direct relationship was found between COF and INT, but an indirect relationship that was mediated by ATT, while in López *et al.* (2012), resource feasibility was a direct influencer of INT. Also, OBS and PR were connected in our BN model, a common result in traditional methods. However, in López *et al.* (2012), they were found to be independent. In fact, they should be connected since the multiple risks faced by entrepreneurs and other obstacles may be magnified by the same or similar factors.

The FFS plays an important role in intentions as indicated by our BN model. It directly affects SN, and indirectly affects ATT and INT, a similar result to López *et al.* (2012). The results showed that one or both parents of 48.5% of the students were entrepreneurs; 21% stated that their mothers were entrepreneurs. Furthermore, 70.7% of the participants agreed or strongly agreed about the important role of family and friends in supporting entrepreneurs.

UOF is a direct answer to COF; this is a strong indication of the role of governments in fostering entrepreneurship. Therefore, universities should be encouraged to do the same by strengthening their education programmes and training.

The role of education in enhancing entrepreneurship attitudes and intentions, and how Entrepreneurship Education programmes can be effectively embedded into the university curricula, should be looked into in more detail to enhance our knowledge and propose specific programmes that help build future entrepreneurs. Moreover, improving attitudes and self-efficacy can be achieved through education. The role of early school experience and its impact on intentions and attitudes towards entrepreneurship is already shown in research (López *et al.*, 2012).

CONCLUSIONS AND POLICY IMPLICATIONS

This study adds to the knowledge and understanding of entrepreneurial intentions and attitudes of Emirati students using an innovative BNs framework. It not only helped to find relationships among the different factors related to entrepreneurship, but also assessed the effects of changes in these variables on intentions, a noted advantage of using BNs instead of the traditional methods of hypothesis testing. This study is useful and needed for the development of new hypotheses related to factors that affect entrepreneurial intentions and attitudes, which can be tested in a predictive context. The BN model can be used to simulate the results of implementing policies without the need to collect new data.

With the BN framework, the study explicitly presented the relationships between intentions, attitudes, and all other factors, and how intention changes with the change in those factors. These results can be used by professionals and academics while proposing entrepreneurship training and courses. Higher education institutions must play a key role in developing entrepreneurial skills among their students. This should be through well-designed programmes and tailored courses to answer their students' requirements on specific topics related to entrepreneurial activities. In collaboration with industry, universities can have a leading role in improving opportunity feasibility. Moreover, universities should act as facilitators and fund faculty research, help students to secure funds to start their projects and, of course, pay-back to the community and the country by hiring other students. Researchers in this field are encouraged to increase their efforts to investigate the factors affecting entrepreneurial intentions and think outside the box as non-traditional businesses are today the backbone of the economy.

Self-efficacy has an impact on entrepreneurial intentions; this means that empowering youth with practical skills for preparing a business plan, running and financing a business, knowing market research techniques and threats, having a good understanding of intellectual property, equity finance, and being alert to business opportunities and new ideas are of great importance to advance entrepreneurial intentions among Emirati youth. There are a number of measures that help improve self-efficacy, such as continuously offering training and entrepreneurship courses by experts. Furthermore, the collaboration between universities and industry will increase students' exposure to business ideas and opportunities.

As subjective norms directly impact attitudes, which in turn impact intentions, policy-makers should recognise entrepreneurs for their contribution to the national economy and to job creation for Emiratis. Local and federal authorities can help foster entrepreneurship intentions among students by implementing incentives to help newly and future entrepreneurs to reach their expectations while contributing to employment and the economy.

Since Family and Friends' Support has a positive impact on Emirati youth subjective-norms, involving families and friends in programmes designed at universities and other entrepreneurial youth hubs may help enhance youth attitudes towards entrepreneurship. The inclusion of families

in strategies related to improving students' entrepreneurial intentions will have a strong positive impact to direct youth towards entrepreneurial activities rather than lining-up for jobs in the government sector.

This study may have some limitations as a result of excluding other influential variables, such as skills, motivations, and other relevant environmental, economic and policy factors such as GDP growth rate impact in terms of expectations and labour mobility in the UAE. However, we focused on the main factors that may have direct effects on intentions according to theory and left out the explorations of the effects of other factors, such as risk, innovation and motivation, to future studies on the topic.

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