"Academic entrepreneurship in Sudanese universities: explaining entrepreneurial intention using the Theory of Planned Behavior (TPB)"

| **AUTHORS** | Selma Abedelrahim ⓘD https://orcid.org/0000-0003-4372-6736 |

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
43	**2**	**7**

BUSINESS PERSPECTIVES

businessperspectives.org

Selma Abedelrahim (Saudi Arabia)

ACADEMIC ENTREPRENEURSHIP IN SUDANESE UNIVERSITIES: EXPLAINING ENTREPRENEURIAL INTENTION USING THE THEORY OF PLANNED BEHAVIOR (TPB)

Abstract

This study aimed to fill the literature gap of entrepreneurial intention antecedents from the academic staff's perspective using the Theory of Planned Behavior (TPB) in an underdeveloped country context. Empirical results were derived from a quantitative approach based on a survey method with a selected academic staff sample of 97 Sudanese public universities. Hypotheses testing was done using the structural equation modeling (SEM) through the partial least squares (PLS) method to test the impact of attitude, subjective norms, and perceived control as the antecedents of entrepreneurial intention. The study results revealed the applicability and consistency of the Theory of Planned Behavior (TPB) in explaining Sudan's academic entrepreneurial intention. The results indicated that attitude, subjective norms, and perceived control explained 61.70% of the entrepreneurial intention (EI) variance. Perceived control (PC) proved to be the primary antecedent of EI, which explained 42.20% of EI variance, while the business environment and experience were the leading influencers of perceived control. This result can guide the authorities to formulate policies that encourage the transformation of the Sudanese universities to be entrepreneurial.

Keywords	entrepreneurship, academicians, attitude, subjective norms, perceived control, underdeveloped country
JEL Classification	L26, L32

INTRODUCTION

In the last few decades, entrepreneurship has gained attention universally as an essential instrument to improve economic growth. Numerous studies have stated that entrepreneurship in developing countries, including Africa, is a creative solution to resolve and counter the significant challenges and enhance economic growth, create employment, and reduce poverty (Omoruyi, Olamide, Gomolemo, & Donath, 2017). The policymakers should consider the technological knowledge that the publicly funded research institutions such as universities, laboratories, and research centers produce and transfer as drivers of this development and guarantee economic growth sustainability.

As an underdeveloped country, Sudan, suffering from widespread unfavorable conditions at all levels, entails serious initiatives to overcome its drawbacks. From an economic viewpoint, the country faced high inflation rates and broad segments of unemployment. Despite these crises, there are initiatives oriented towards entrepreneurship to create and overcome unemployment problems. Many studies emerged in this field (Ibrahim, EssaEshag, & Afifi, 2018; Mansour & Omer, 2020; Atiya, Bilal, Abulhamid, & Shoaib, 2019). These studies focused on undergraduate students or master's degree candidates' entrepreneurial

intention and the factors impacting it. This study is the first attempt to consider the issue of entrepreneurial intention from the academic staff perspective. The research problem was examining the influence of perceived control, attitude, and subjective norms on academic entrepreneurial intention.

1. LITERATURE REVIEW

The most common theories used at entrepreneurship and entrepreneurial intention studies are Reasoned Action, Cross-Cultural Cognitive Model, Shapero's Model of Entrepreneurial Intention, Integrated Model of Entrepreneurial Intention, and Theory of Planned Behavior (Mwange, 2018). TPB is becoming central in social psychology studies concerned with explaining behavior (Lucas & Cooper, 2012). According to Ajzen (1985), the researchers extended the Theory of Reasoned Action to the Theory of Planned Behavior, which deals with the type of behavior that people have limited control over attempting to perform or not a given behavior. TPB relies on the intention to determine the intensity of an attempt to perform a given behavior.

TPB proved that three antecedents influence the intention: the attitude toward trying, the subjective norm concerning trying, and the perceived behavioral control of internal and external factors (Ajzen, 2012). Esfandiar, Sharifi-Tehrani, Pratt, and Altinay (2019) indicated that attitude refers to an individual's appraisal of the outcomes of behavior in question and the degree of favorability. Social/subjective norms refer to the individual's perception toward the other's role in performing a given behavior and to the extent his behavior is consistent with a leading person or group's thoughts. Perceived behavioral control refers to the individual ability to perform a given behavior and the perception of the controllability of the behavior (Liñán & Chen, 2009). In the psychological literature, intentions have proven to be the best predictor of planned behavior. Accordingly, the intention models ideally suited entrepreneurship as it is a type of planned behavior (Krueger, Reilly, & Carsrud, 2000). Consequently, entrepreneurial intention (EI) would be the key to understand the complicated entrepreneurial process and explain entrepreneurial behavior (Miranda, Chamorro-Meraa, & Rubiob, 2017).

F. Guo, Zou, J. Guo, Y. Shi, Bo, and L. Shi (2019) defined academic entrepreneurship as "found-

ing of companies by academicians who had previously worked in laboratories or university departments that are technology originated". From this perspective, academic entrepreneurship encompasses activities beyond the traditional roles of the academic or research institutions that generate financial and social benefits for entrepreneurial academicians or the university (Abreu & Grinevich, 2013). Such activities imply innovation and risk (Urban & Chantson, 2019). Entrepreneurial intention is the most relevant predictor of entrepreneurial behavior. It indicates how much effort one plans to prepare and commit to perform entrepreneurial behavior (Goethner, Obschonka, Silbereisen, & Cantner, 2012), while academic entrepreneurial intention (EI) is the intention of scientists to create a business venture based on their research knowledge (Goethner, Obschonka, Silbereisen, & Cantner, 2011).

Sudan's entrepreneurial environment is still at the infantry stage; this weakness can partially be attributed to the government's failure to implement a suitable policy for entrepreneurship development besides its failure to implement macroeconomic policies for maintaining stable economic conditions. This failure manifested in high inflation rates, massive budget deficit, fluctuating exchange rates, and inadequate education and infrastructure (Gangi & Timan, 2013). Musa (2012) indicated that businesswomen have huge problems in accessing financing from the traditional banking system. These problems are mainly due to the collateral requirements, high finance cost, and short lending period. These businesswomen have also experienced similar problems with the government's funding programs, such as the microfinance initiative.

The future of entrepreneurial activities in Sudan depends mainly on the improvement of the political and economic conditions. The government needs to revise and fine-tune its regulatory and institutional measures to facilitate and expedite starting new businesses. As far as the cultural barriers are concerned, training and develop-

ment of potential entrepreneurs can change their attitudes and empower them with the necessary skills to successfully manage an investment project (Gangi & Mohammed, 2017). In the same direction, Khattab, Sid Ahmed, and Mohamed (2017) stated that entrepreneurship requires a favorable environment to grow and nourish. Start-ups require low barriers at the outset. Moreover, to achieve scale, they require a legal and regulatory framework that rewards entrepreneurial initiative, ensures fair competition, and protects private property rights. Thus, a robust policy environment must encourage sustainable entrepreneurship, financial, educational, legal, and other support.

Regarding the triggering factors that motivate entrepreneurship, Mansour and Omer (2020) stated that the respondents' entrepreneurial intention is predictable from the attitude towards becoming entrepreneurs, perceived behavioral control, and subjective norms. Their findings revealed that TPB is a valuable tool in understanding university students' entrepreneurial intention in Sudan. Similarly, Ibrahim et al. (2018) suggested that subjective norms and perceived control significantly predicted entrepreneurial intention. Moreover, Mansour and Omer (2020) stated that TPB was a valuable tool in understanding university students' entrepreneurial intention in Sudan. They emphasized that the students' attitudes towards entrepreneurship and perceived behavioral control positively influenced entrepreneurial intention.

The previous studies concerned about the entrepreneurial intention and its antecedents' in the Sudanese universities were entirely focusing on students and the postgraduates, and neither of them discussed the issue from the academic staff perspective.

2. AIMS AND HYPOTHESES

The study aims to evaluate the applicability of the intention model in underdeveloped countries, mainly in Sudan as well as to study the entrepreneurial intention and its antecedents from the academic staff viewpoints in the Sudanese universities.

2.1. Hypotheses

The theoretical framework stood on TBP; according to Aizan (2012), the TBP model suggests that intentions guide behavior. The paper by Krueger and Carsrud (1993) is probably responsible for making the TPB the "reference" theory in EI research (Liñán & Fayolle, 2015). According to the Theory of Planned Behavior, the intention to perform entrepreneurial behavior is influenced by attitude toward the behavior (EA), subjective norms (SN), and perceived behavioral control (PC) (Aizan, 1991, 2012). The higher attitude, subjective norm, and perceived behavioral control, the stronger the person's intention to perform the behavior in question (Vamvaka, Stoforos, Palaskas, & Botsaris, 2020).

This study replicated the intention-based model, which was elaborated by Miranda et al. (2017) who integrated various entrepreneurial intention predictors into one cohesive framework. The model included the antecedents of entrepreneurial attitude (creativity, self-confidence, perceived utility, and business experience).

Having stated the above, the study hypotheses were formulated as follows:

H1: Attitude positively influences academicians' entrepreneurial intention.

H1a: Creativity positively influences academicians' entrepreneurial attitude.

H1b: Perceived utility positively influences academicians' entrepreneurial attitude.

H1c: Self-confidence positively influences academicians' entrepreneurial attitude.

H1d: Business experience positively influences academicians' entrepreneurial attitude.

H2: Perceived behavioral control positively influences academicians' entrepreneurial intention.

H2a: Business experience positively influences academicians' perceived control.

H2b: Training positively influences academicians' perceived control.
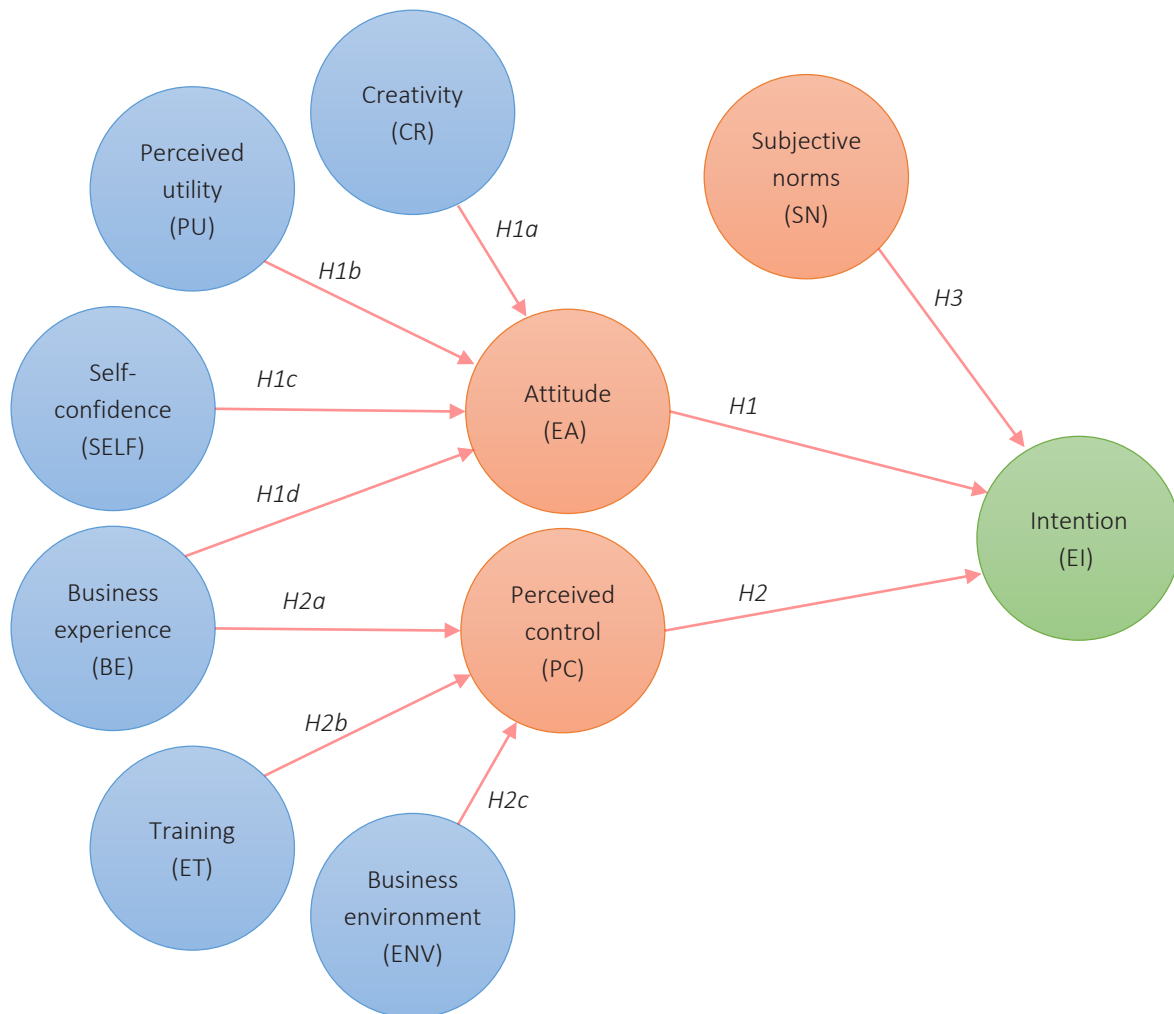
317

Figure 1. Hypothetical framework

H2c: *Business environment positively influences academicians' perceived control.*

H3: *Subjective norm positively influences academician's entrepreneurial intention.*

3. DATA AND METHOD

This study's population was the Sudanese teaching staff of agriculture, animal production, and veterinary medicine faculties, which is more promising to lead the country's entrepreneurship ventures. The Sudanese economy's main characteristic is that it depends mainly on the agricultural sector (Gangi & Mohammed, 2017). About 40 percent of Sudan's population is involved in the agricultural sector (The GlobalEconomy.com, 2019), which contributes by 30 to 35 percent of the annual country Gross Domestic Product (GDP) (The World Bank, 2017), as the country is rich in agricultural capabilities and natural resources. Due to time and budget constraints, the sample respondents were the academic staff of the mentioned faculties of Omdurman Islamic, Sudan, El Nilain, and Khartoum universities, located within Khartoum State, the capital of Sudan. The survey faced some constraints in accessing the academic staff as live at Khartoum was still not fully back to normal after the Sudanese Revolution of December 2018. However, the data collection took place between November 2019 and January 2020. Consequently, the sample size was limited to 97.

The instrument used for collecting data for this study was a questionnaire administered in Arabic that went through several rounds of pre-tests and refinement taken by a panel of academics and

practitioners to check for ease of use and ensure accurate interpretation of the measurement items.

The data were analyzed using the Partial Least Squares (PLS) approach to Structural Equation Modeling (SEM), appropriate to small samples.

4. RESULTS

The study implemented the Confirmatory Tetrad Analysis (CTA) via computing all vanishing tetrads and examining the upper and lower Bonferroni-adjusted confident intervals "CI Low adj." and "CI Up adj." The study hypothesized that if any of the intervals do not include zero value, then the construct is formative (i.e., it has a value that ranges between + + or – – compared to reflective constructs that range between + and +) (Gudergan, Ringle, Wende, & Will, 2008). The CTA results indicated that subjective norms (SN) was the only formative construct for this study, as presented in Table A1.

The reflective measurement model's evaluation procedures applied to EA, CR, PU, SELF, BE, ET, ENV, PC, and EI and were presented in Table A2.

All the reflective construct loadings exceeded the 0.700 reference values, except 12 items, which were excluded from further analysis (see Table A4 for the final list). These were 5 PC items, 4 CR, two items of ENV, and one of ET.

The Cronbach's alpha, which reflects the reliability of the indicators for each construct, ranged between 0.707 (the minimum acceptable level) and 0.872 as indicative of excellent reliability among the indicators (except CR, which converged to a single construct as its items did not satisfy the reliability and validity conditions with Cronbach's alpha equal to 1). The composite reliability, which tells the internal consistency, exceeded the 0.7 reference value and even the stricter 0.9 value. The average variance extracted (AVE) values were higher than 0.5, thus ensuring the model's convergent validity (Hair, Hult, Ringle, & Sarstedt, 2016). The formative constructs' measurement model assessment included three testes: convergent validity, collinearity among indicators and significance, and relevance of the outer weights.

The evaluation of formative constructs differs from procedures applied to the reflective models. According to Edwards and Bagozzi (2000), the internal consistency reliability concept is inappropriate to formative constructs as they are assumed to have lower internal correlation compared to the reflective ones.

The study assessed the convergent validity of the formative constructs (EA and SN) through the path coefficient magnitude linking each of the two constructs with a global item obtained by averaging each construct's constituting indicators. This test is termed redundancy analysis as per Chin (1998). High path coefficients between the construct and the global item indicate the existence of convergent validity. The path coefficient of the SN construct and its global items was equal to 0.999. i.e., comfortably above the minimum 0.700 acceptable level for convergent validity indicated by Hair et al. (2016).

The study assessed the collinearity among the formative constructs' indicators through the variance inflation factor (VIF). According to Hair et al. (2016), VIF is the reciprocal of tolerance. It represents the amount of variance of one formative indicator not explained by the other indicators in the same block, i.e., $VIFx1 = 1/TOLx1$. The maximum acceptable VIF level is 5, according to Table A2, i.e., the SN construct was free from the collinearity problem as the maximum VIF was 1.75.

The last step of the formative model assessment tested the significance and relevance of formative items' outer weights to verify how they contribute to the SN construct via bootstrapping procedure (Hair et al., 2016). Two SN items were dropped as their outer weights proved insignificant.

The structural model assessment included the predictive relevance (Q^2) test, which tells how the predicted value of a reflective endogenous construct deviates from their original values (Hair et al., 2016). Hair, Ringle, and Sarstedt (2013) also stated that the path model's predictive relevance for a reflective endogenous construct would be assured if its Q^2 values were larger than zero.

Table A3 reveals that all the endogenous constructs considered predictive, as their magni-
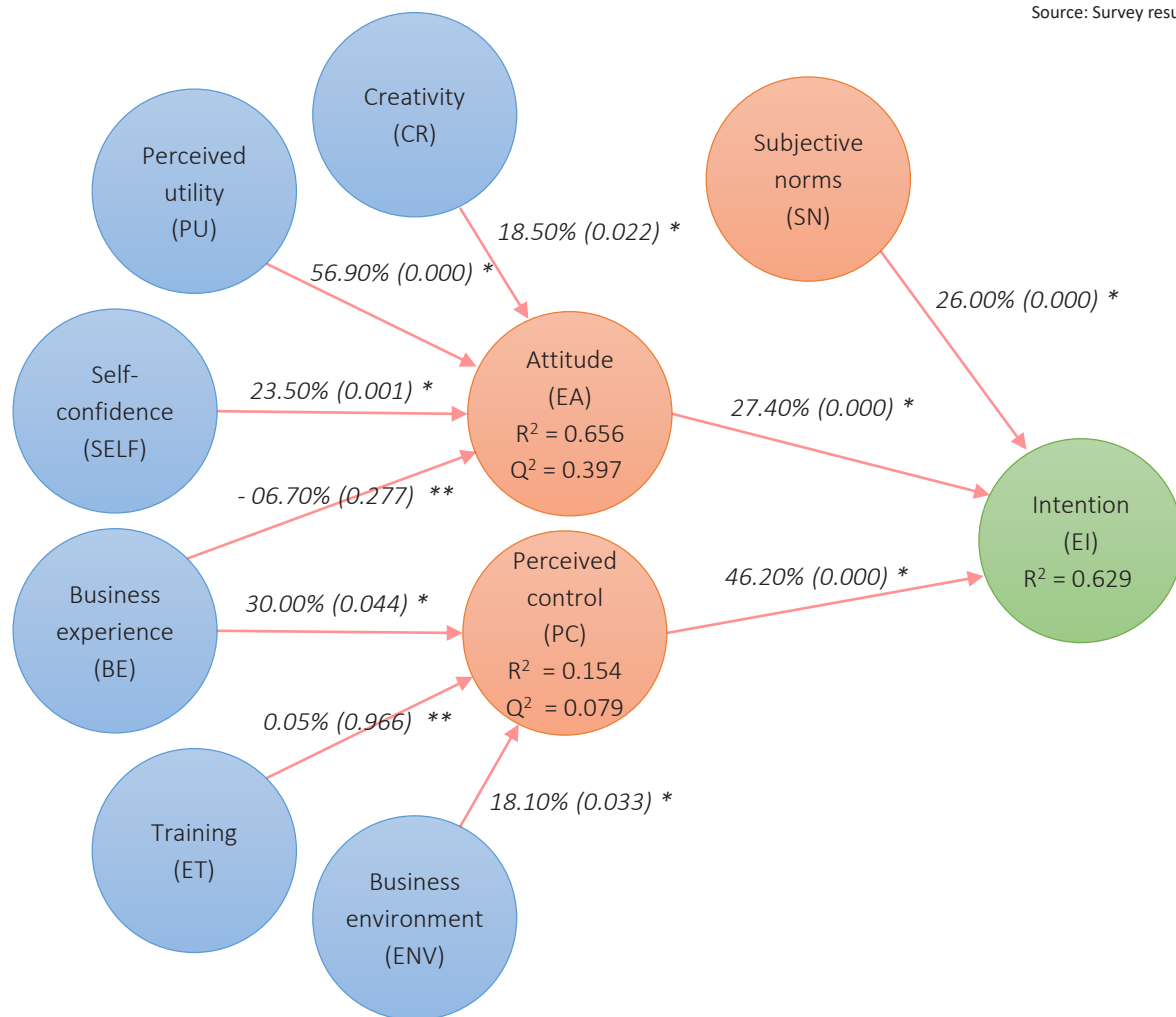
Note: * Significant at 95%, ** non-significant.

Figure 2. Structural model estimation

tude of Q^2 was greater than zero; thus, the model's predictive relevance was satisfactory. The model's predictive power (R^2) was acceptable (Table A4) as it contributes to explaining 61.70% of the variance of EI, 64.10% of EA, and 12.70% of the PC.

Table A5 and Figure 2 present the results of the evaluation made with our structural model. The arrows indicate causal relationships, the number beside each is the respective standardized coefficient, and in parentheses is the product of the standardized coefficient and the correlation coefficient between the two constructs expressed as a percentage (Dijkstra & Henseler, 2015). The bootstrap resampling procedure determined the t-values and significance of the causal relationships with 500 sub-samples.

Perceived control (PC) was the construct that contributed most (46.20%) towards explaining entrepreneurial intent. The EA and SN were significant and contributed by 27.40% and 26.00% in explaining this intention. In turn, the EA is explained by PU (56.90%), SELF (23.50%), and CR (18.50%), while PC is explained mainly by BE (30.00%) and ENV (18.10%).

5. DISCUSSION

The intention models offer us a significant opportunity to increase the ability to understand and predict entrepreneurial activity (Krueger et al., 2000). The study endeavored to analyze the determinants of the Sudanese academicians EI by using the intention-based model built based on the

Theory of Planned Behavior. This study's empirical results confirmed that EA, PC, and SN, as the predictors described in the TPB, significantly impacted the entrepreneurial intention. The model has proven its capacity as a conceptual framework because it explained 61.70% of EI variance.

This result was consistent with that yielded by Miranda et al. (2017), where attitude, subjective norms, and perceived control derived 56.8 % of EI variance. It was also consistent with that of Liñán and Chen (2009) and Goethner et al. (2012). The study findings were highly satisfactory since most previous research (Goethner, Obschonka, Silbereisen, & Cantner, 2009; Krueger et al., 2000) using linear models typically explained less than 40% of EI. From the Sudanese perspective, Mansour and Omer (2020) found that the TPB model predicted 42% of entrepreneurial intention variance.

Despite having intention models that typically explain from 40% to 60% of the variance in entrepreneurial intentions (Urban & Chantson, 2019), there is no agreement about which of the three antecedents has more predictive power. In this study, perceived control was more influential in predicting entrepreneurial intention (42.20%) than the entrepreneurial attitude (EA) and subjective norms (SN), which significantly contributed by 27.40% and 26.00%, respectively. Nevertheless, the result was compatible with Goethner et al. (2012), Darmanto and Yuliari (2018), Mansour and Omer (2020) who found that perceived behavioral control has a strong, highly significant effect on entrepreneurial intention.

In contrast, Miranda et al. (2017) indicated that EI was solely explained by EA. However, the subjective norms showed a weaker impact than the perceived behavioral control and entrepreneurial attitude, matching that achieved by Liñán and Chen (2009), Goethner et al. (2011).

The model's predictive power contributes to explaining 64.10% of the variance of EA. In turn, PU, SELF, and CR explained 56.90%, 23.50%, and 18.50% of the EA, respectively. This result conveys the real situation in Sudan: the economic crises manifested in high inflation rates and the persistent devaluation of national currency. Such situa-

tions motivate the academicians to take a venture and have their own business to counter this situation and get an advantage (Welsh, Memili, Kaciak, & Ahmed, 2013) indicated that entrepreneurial activity is highly financially rewarding in Sudan.

Two reasons might lie behind having business experience not significantly contributed to the prediction of the entrepreneurial attitude. The first reason is that entrepreneurship is a newly emerging phenomenon in Sudan, which is lagging while most business activities are within the consumer-oriented service sector (A/Rahman et al., 2018). The second justification is that entrepreneurship education is inadequate and insufficient across all levels and types as there is low awareness at the individual level and deficiency in governmental policies that encourage entrepreneurship.

The business environment (BE) was the highest predictor in explaining the perceived behavioral control variance, with 30%, followed by ENV with 18%. The training effect on PC proved to be insignificant, with just 0.50%. The weak impact of training on PC likely reflects Sudan's inappropriate entrepreneurial education and training conditions. In this regard, Timan and Gangi (2015) stated that just a few Sudanese universities' entrepreneurial courses or programs do not reflect the importance of the issue to the Sudanese economy or the pressing need for it. Offering such courses and launching related programs would raise the Sudanese academicians' skills in the field and raise their intention towards it.

Despite the strong support for this research's entrepreneurial intention model, the findings should be deliberately treated because of the lack of previous work using the Sudanese academicians' sample. The small sample was another limiting factor confined to the uncalm security situations that prevailed recently in Sudan. Nevertheless, the model and findings seem quite robust because they explained a very high percentage of entrepreneurial intention and EA and PC variance. According to the study findings, the study suggests the following implications.

The findings indicated the relative effects of PC on entrepreneurial academic intention (*H2*), which is necessary for policymakers in higher educa-

tion and universities to formulate concrete policies to encourage entrepreneurship in universities. Academic scientists' entrepreneurial intentions come about when individuals with suitable psychological characteristics live in environments favoring such activities (Foo, Knockaert, Chan, & Erikson, 2016). Also, the universities must transform into entrepreneurial institutions supported by adequate policies and atmosphere. Entrepreneurial university community (academics, students) can explore, evaluate, and exploit the knowledge transferable into new ventures that eventually pours into the country's economic development via knowledge production and commercialization (Guerrero & Urbano, 2014), which is considered a vital ingredient in Sudan. Unfortunately, academic research at universities in Sudan is mostly basic and does not generate immediate economic value and commercialization opportunities. Another implication regarding training and education are their essentiality in building the academic staff's abilities and skill in establishing and managing their businesses. Thus, the Sudanese government and universities must adopt suitable policies and regulations that facilitate and support entrepreneurship. The applied model is to be elaborated by integrating demographic factors in future researches.

CONCLUSION

This study was based on the Theory of Planned Behavior (TPB) to explain the influence of perceived control, subjective norms, and attitude on the academic staff's entrepreneurial intention in Sudanese universities. The findings proved the theoretical model's ability to explain the entrepreneurial intention in Sudan as one of the underdeveloped countries. The study results indicated a significant impact of perceived control on entrepreneurial intention. The findings also manifested that both the business environment and experience positively influence the perceived control. This result may be attributed to encouraging business environment resulting from the support provided by microfinance institutions to the small enterprises and the in-depth technical knowledge possessed by the academicians. However, the result indicated that training had no significant influence on perceived control. This can also be attributed to the general lack of capacity building programs in the business management area rendered by the universities to its academic staff.

AUTHOR CONTRIBUTIONS

Conceptualization: Selma Abedelrahim.
Data curation: Selma Abedelrahim.
Formal analysis: Selma Abedelrahim.
Investigation: Selma Abedelrahim.
Methodology: Selma Abedelrahim.
Resources: Selma Abedelrahim.
Writing – original draft: Selma Abedelrahim.
Writing – review & editing: Selma Abedelrahim.

REFERENCES

1. A/Rahman, W. A., Mahgoub, Lena ELshiekh Omer, Eltayib, Nuha Hassan Elmubasher, Alsaeed, Mohammed, & Yassien, Moneera. (2018). Global Entrepreneurship Monitor SUDAN National Report 2018.

2. Abreu, M., & Grinevich, V. (2013). The nature of academic entrepreneurship in the UK: Widening the focus on entrepreneurial activities. *Research Policy, 42*(2), 408-422. https://doi.org/10.1016/j.respol.2012.10.005

3. Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. In *Action Control From Cognition to Behavior* (pp. 11-39). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-69746-3_2

4. Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211. Retrieved from https://sphweb.bumc.bu.edu/otlt/MPH-Modules/

SB/BehavioralChangeTheories/BehavioralChangeTheories3.html

5. Ajzen, I. (2012). The theory of planned behaviour. In *Handbook of Theories of Social Psychology* (pp. 438-459). https://doi.org/10.4135/9781446249215.n22

6. Atiya, T. M. S., Bilal, Z. O., Abulhamid, M., & Shoaib, S. A. (2019). The Impact of Entrepreneurial Characteristics on Entrepreneurial Intention of Sudanese and Omani University Students. *European Scientific Journal, 15*(4), 66-86. https://doi.org/10.19044/esj.2019.v15n4p66

7. Chin, W. W. (1998). The Partial Least Squares Approach to Structural Equation Modeling. *Modern Methods for Business Research, 295*(2), 295-336.

8. Darmanto, S., & Yuliari, G. (2018). Mediating Role of Entrepreneurial Self Efficacy in Developing Entrepreneurial Behavior of Entrepreneur Students. *Academy of Entrepreneurship Journal, 24*(1), 1-14. Retrieved from https://www.abacademies.org/articles/mediating-role-of-entrepreneurial-self-efficacy-in-developing-entrepreneurial-behavior-of-entrepreneur-students-7055.html

9. Dijkstra, T. K., & Henseler, J. (2015). Consistent Partial Least Squares Path Modeling. *MIS Quarterly*. https://doi.org/10.25300/MISQ/2015/39.2.02

10. Edwards, J. R., & Bagozzi, R. P. (2000). On the Nature and Direction of Relationships Between Constructs and Measures. *Bulletin of the Menninger Clinic, 64*(2), 257-280. https://doi.org/10.1037//1082-989X.5.2

11. Esfandiar, K., Sharifi-Tehrani, M., Pratt, S., & Altinay, L. (2019). Understanding entrepreneurial intentions: A developed, integrated structural model approach. *Journal of Business Research, 94,* 172-182. https://doi.org/10.1016/j.jbusres.2017.10.045

12. Foo, M., Knockaert, M., Chan, E. T., & Erikson, T. (2016). The Individual Environment Nexus : Impact of Promotion Focus and the Environment on Academic Scientists' Entrepreneurial Intentions. *IEEE Transactions on Engineering Management, 63*(2), 213-222. Retrieved from https://ieeexplore.ieee.org/document/7437428

13. Gangi, Y. A., & Mohammed, H. E. (2017). The Development of Entrepreneurship in Sudan. In *Entrepreneurship in Africa* (pp. 209-231). Brill. https://doi.org/10.1163/9789004351615

14. Gangi, Y. A., & Timan, E. (2013). An empirical investigation of the entrepreneurial environment in Sudan. *World Journal of Entrepreneurship, Management, and Sustainable Development, 9*(2/3), 168-177. https://doi.org/10.1108/WJEMSD-03-2013-0021

15. Goethner, M., Obschonka, M., Silbereisen, R. K., & Cantner, U. (2012). Scientists' transition to academic entrepreneurship: Economic and psychological determinants. *Journal of Economic Psychology, 33*(3), 628-641. https://doi.org/10.1016/j.joep.2011.12.002

16. Goethner, M., Obschonka, M., Silbereisen, R. K., & Cantner, U. (2011). Foundations of academic entrepreneurship: A path model for the prediction of scientists' academic entrepreneurial intentions. *DIME Final Conference, 6,* 8. Retrieved from https://www.researchgate.net/publication/266880475_Foundations_of_academic_entrepreneurship_A_path_model_for_the_prediction_of_scientists'_academic_entrepreneurial_intentions

17. Goethner, M., Obschonka, M., Silbereisen, R. K., & Cantner, U. (2009). *Approaching the Agora – Determinants of Scientists' Intentions to Purse Academic Entrepreneurship* (Jena Economic Research Papers). Retrieved from https://www.researchgate.net/publication/46463452_Approaching_the_Agora_-_Determinants_of_scientists'_intentions_to_pursue_academic_entrepreneurship

18. Gudergan, S. P., Ringle, C. M., Wende, S., & Will, A. (2008). Confirmatory tetrad analysis in PLS path modelling. *Journal of Business Research, 61*(12), 1238-1249. https://doi.org/10.1016/j.jbusres.2008.01.012

19. Guerrero, M., & Urbano, D. (2014). Academics' start-up intentions and knowledge filters : an individual perspective of the knowledge spillover theory of entrepreneurship. *Small Business Economics, 43*(1), 57-74. https://doi.org/10.1007/s11187-013-9526-4

20. Guo, F., Zou, B., Guo, J., Shi, Y., Bo, Q., & Shi, L. (2019). What determines academic entrepreneurship success ? A social identity perspective. *International Entrepreneurship and Management Journal, 15*(3), 929-952. Retrieved from https://link.springer.com/article/10.1007/s11365-019-00569-6

21. Hair, J. F. J., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM).*

22. Hair, J. F. J., Ringle, C. M., & Sarstedt, M. (2013). Editorial Partial Least Squares Structural Equation Modeling : Rigorous Applications, Better Results, and Higher Acceptance. *Long Range Planning, 46,* 1-12. https://doi.org/10.1016/j.lrp.2013.01.001

23. Ibrahim, S. B., EssaEshag, E., & Afifi, O. (2018). Determinants of entrepreneurial intentions using Theory of Planned Behavior. *Journal of Economic Sciences, 19*(2), 179-206. Retrieved from https://www.researchgate.net/publication/323616845_Determinants_of_entrepreneurial_intentions_using_Theory_of_Planned_Behavior

24. Khattab, I., Sid Ahmed, S., & Mohamed, A. (2017). Determinants of Business Entrepreneurship Success in Sudan. *Business and Management Research Journal, 7*(7), 66-75. Retrieved from https://www.hilarispublisher.com/open-access/determinants-of-business-entrepreneurship-success-in-sudan-2169-026X-1000218.pdf

25. Krueger, Jr. N. F., Reilly, M. D., & Carsrud, A. L. (2000). Competing models of entrepreneurial

intentions. *Journal of Business Venturing, 15*(5-6), 411-432. https://doi.org/10.1016/S0883-9026(98)00033-0

26. Krueger, N., & Carsrud, A. (1993). Entrepreneurial intentions: Applying the theory of planned behaviour. *Entrepreneurship & Regional Development, 5*(4), 315-330. Retrieved from https://www.researchgate.net/publication/232926814_Entrepreneurial_intentions_Applying_the_theory_of_planned_behaviour

27. Liñán, F. (2008). Skill and value perceptions: how do they affect entrepreneurial intentions? *International Entrepreneurship and Management Journal, 4*(3), 257-272. https://doi.org/10.1017/CBO9781107415324.004

28. Liñán, F., & Chen, Y.-W. (2009). Development and Cross-Cultural Application of a Specific Instrument to Measure Entrepreneurial Intentions. *Entrepreneurship Theory and Practice, 33*(3), 593-617. https://doi.org/10.1111%2Fj.1540-6520.2009.00318.x

29. Liñán, F., & Fayolle, A. (2015). A systematic literature review on entrepreneurial intentions: citation, thematic analyses, and research agenda. *International Entrepreneurship and Management Journal, 11*(4), 907-933. https://doi.org/10.1017/CBO9781107415324.004

30. Lucas, W. A., & Cooper, S. Y. (2012). Theories of Entrepreneurial Intention and the Role of Necessity. In *Proceedings of the 35th Institute of Small Business and Entrepreneurship Conference 2012* (pp. 7-8). Retrieved from https://www.academia.edu/9192571/Theories_of_Entrepreneurial_Intention_and_the_Role_of_Necessity

31. Mansour, I. H., & Gangi, Y. A. (2020). Women Entrepreneur Motivations, Challenges, and Growth Aspiration: A Gender lens analysis in Sudan. *ASRIC Journal on Social Sciences & Humanities, 1*(1), 9-19. Retrieved from https://www.researchgate.net/publication/341763848_

Women_Entrepreneur_Motivations_Challenges_and_Growth_Aspiration_A_Gender_lens_analysis_in_Sudan_Introduction

32. Mansour, I. H. F., & Omer, A. (2020). The antecedents of entrepreneurial intention among Sudanese University Students. *ASRIC Journal on Social Sciences & Humanities, 1*(1), 1-8. Retrieved from https://www.researchgate.net/publication/340335089_The_antecedents_of_entrepreneurial_intention_among_Sudanese_University_Students

33. Miranda, F. J., Chamorro-Meraa, A., & Rubiob, S. (2017). Academic entrepreneurship in Spanish universities: An analysis of the determinants of entrepreneurial intention. *European Research on Management and Business Economics, 23*(2), 113-122. https://doi.org/10.1016/j.iedeen.2017.01.001

34. Musa, E. A. (2012). *Emerging Women Entrepreneurs in Sudan : Individual Characteristics, Obstacles, and Empowerment.* Retrieved from https://media.africaportal.org/documents/Emerging_Women_Entrepreneurs_in_Sudan_1.pdf

35. Mwange, A. (2018). An Evaluation of Entrepreneurship Intention Theories. *IJRDO – Journal of Social Science and Humanities Research, 3*(9), 127-160. https://doi.org/10.1016/j.iedeen.2017.01.001

36. Omoruyi, E. M. M., Olamide, K. S., Gomolemo, G., & Donath, O. A. (2017). Entrepreneurship and Economic Growth: Does Entrepreneurship Bolster Economic Expansion in Africa? *Journal of Socialomics, 6*(4), 1-11. https://doi.org/10.4172/2167-0358.1000219

37. The GlobalEconomy.com. (2019). *Sudan: Employment in agriculture.* Retrieved from https://www.theglobaleconomy.com/Sudan/Employment_in_agriculture/

38. The World Bank. (2017). The World Bank Group and Sudan̓s Ministry of Agriculture Launch 2016 Enabling the Business of Agriculture Report.

39. Timan, E., & Gangi, Y. A. (2015). Entrepreneurship education in Sudan Entrepreneurship education in Sudan. *J. for International Business and Entrepreneurship Development, 8*(3), 231-247. https://doi.org/10.1504/JIBED.2015.070798

40. Urban, B., & Chantson, J. (2019). Academic entrepreneurship in South Africa: testing for entrepreneurial intentions. *The Journal of Technology Transfer, 44*(3), 948-980. https://doi.org/10.1007/s10961-017-9639-z

41. Vamvaka, V., Stoforos, C., Palaskas, T., & Botsaris, C. (2020). Attitude toward entrepreneurship perceived behavioral control, and entrepreneurial intention: dimensionality, structural relationships, and gender differences. *Journal of Innovation and Entrepreneurship, 9*(1). https://doi.org/10.1186/s13731-020-0112-0

42. Welsh, D. H., Memili, E., Kaciak, E., & Ahmed, S. (2013). Sudanese women entrepreneurs. *Journal of Developmental Entrepreneurship, 18*(2). https://doi.org/10.1142/S1084946713500131

43. Zampetakis, L. A., & Moustakis, V. (2006). Linking Creativity with Entrepreneurial Intentions : A Structural Approach Linking creativity with entrepreneurial intentions : A structural approach. *The International Entrepreneurship and Management Journal, 2*(3), 413-428. https://doi.org/10.1007/s11365-006-0006-z

APPENDIX A

Table A1. Confirmatory Tetrad Analysis – subjective norms (SN) items

Subjective norms (SN)	Original sample (O)	t-statistics (|O/ STDEV|)	p-values	Bias	CI Low	CI Up	Alpha adj.	z(1-alpha)	CI Low adj.	CI Up adj.
1: SN1, SN2, SN3, SN4	0.64787	3.03618	0.00252	−0.01200	0.24063	1.07910	0.02500	2.24817	+0.18015	+1.13958
2: SN1, SN2, SN4, SN3	0.60588	2.80152	0.00528	−0.01444	0.19541	1.04523	0.02500	2.24817	+0.13411	+1.10653

Table A2. Reflective and formative measurement models assessment

Construct reliability and validity	Construct type		Cronbach's Alpha	rho_A / Significance of outer weights***	Composite reliability VIF*	Average Variance Extracted (AVE) /t-values**
	Outer loadings / Outer weights					
Attitudes (EA)	Reflective		0.81431	0.82024	0.87831	0.64447
EA1	Outer loadings	0.79676				
EA2		0.88511				
EA3		0.73360				
EA4		0.78834				
Business environment (ENV)	Reflective		0.85240	0.90859	0.89544	0.68223
ENV1	Outer loadings	0.85617				
ENV2		0.85864				
ENV3		0.83378				
ENV4		0.75063				
Business experience (BE)	Reflective		0.70013	0.78767	0.86466	0.76231
BE1	Outer loadings	0.92615				
BE2		0.81662				
Creativity (CR)	Reflective		1.000	1.000	1.000	1.000
CR4	Outer loadings	1				
Intention (EI)	Reflective		0.87213	0.88991	0.91326	0.72625
EI1	Outer loadings	0.89114				
EI2		0.87792				
EI3		0.90729				
EI4		0.71900				
Perceived control (PC)	Reflective		0.82584	0.83429	0.87785	0.59062
PC2	Outer loadings	0.75261				
PC4		0.78062				
PC6		0.84944				
PC7		0.74051				
PC9		0.71232				
Perceived utility (PU)	Reflective		0.81814	0.83925	0.91596	0.84498
PU3		0.90318				
PU4		0.93500				
Self-confidence (SELF)	Reflective		0.77573	0.81710	0.85352	0.59396
SEL1	Outer loadings	0.71018				
SEL3		0.84761				
SEL4		0.76566				
SEL5		0.75287				
Training (ET)	Reflective		0.87113	0.97724	0.91376	0.78020
ET1	Outer loadings	0.92150				
ET2		0.92922				
ET3		0.79246				
Subjective norms (SN)	Formative			1.000		
SN2	Outer weights	0.53861		0.00370	1.75674	2.90416
SN4		0.41429		0.00443	1.09341	2.84705

Note: * Collinearity statistics (VIF) is for the formative items, ** t-values are for the formative items, *** significance of outer weights is for the formative items.

Table A3. Construct cross-validated redundancy (Q²)

Constructs	SSO	SSE	Q² = 1-SSE/SSO
Attitude (EA)	388.000	234.036	0.397
Business environment (ENV)	388.000	388.000	
Business experience (BE)	194.000	194.000	
Creativity (CR)	97.000	97.000	
Intention (EI)	388.000	221.615	0.429
Perceived control (PC)	485.000	446.630	0.079
Perceived utility (PU)	194.000	194.000	
Self-confidence (SELF)	388.000	388.000	
Subjective norms (SN)	291.000	291.000	
Training (ET)	291.000	291.000	

Table A4. Coefficient of determination (R-squared)

Constructs	R-squared	Adjusted R-squared
Attitude (EA)	0.65614	0.64119
Intention (EI)	0.62904	0.61707
Perceived control (PC)	0.15481	0.12754

Table A5. Path coefficients and hypotheses testing

Hypotheses	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T-statistics (|O/ STDEV|)	p-values	Status
Entrepreneurial attitude (EA)						
H1: Attitude (EA) → Intention (EI)	0.274	0.276	0.077	3.559	0.000	Accepted
Antecedents of entrepreneurial attitude (EA)						
H1a: Creativity (CR) → Attitude (EA)	0.185	0.186	0.081	2.289	0.022	Accepted
H1b: Perceived utility (PU) → Attitude (EA)	0.569	0.569	0.080	7.078	0.000	Accepted
H1c: Self-confidence (SELF) → Attitude (EA)	0.235	0.236	0.070	3.369	0.001	Accepted
H1d: Business experience (BE) → Attitude (EA)	−0.067	−0.067	0.062	1.086	0.277	Rejected
Perceived control (PC)						
H2: Perceived control (PC) → Intention (EI)	0.462	0.458	0.067	6.926	0.000	Accepted
Antecedents of perceived control (PC)						
H2a: Business experience (BE) -> Perceived control (PC)	0.300	0.272	0.149	2.016	0.044	Accepted
H2b: Training (ET) → Perceived control (PC)	0.005	0.040	0.126	0.043	0.966	Rejected
H2c: Business environment (ENV) → Perceived control (PC)	0.181	0.202	0.085	2.132	0.033	Accepted
Subjective norms (SN)						
H3: Subjective norms (SN) → Intention (EI)	0.260	0.263	0.072	3.593	0.000	Accepted

Table A6. Fornell-Larcker criterion

Constructs	EA	ENV	BE	CR	EI	PC	PU	SELF	ET
Attitude (EA)	0.80279								
Business environment (ENV)	−0.08646	0.82597							
Business experience (BE)	−0.08752	0.27337	0.87310						
Creativity (CR)	0.52533	−0.12441	0.01796	1.00000					
Intention (EI)	0.57267	0.12149	0.20633	0.48171	0.85220				
Perceived control (PC)	0.44061	0.26487	0.35224	0.38448	0.69603	0.76852			
Perceived utility (PU)	0.71635	−0.00160	0.02998	0.44959	0.56538	0.48799	0.91923		
Self-confidence (SELF)	0.64443	−0.02298	−0.10943	0.32192	0.43356	0.35585	0.51936	0.77069	
Training (ET)	−0.22679	0.32513	0.51043	−0.03015	0.11239	0.21739	0.00871	−0.22367	0.88329

Table A7. Heterotrait-Monotrait Ratio (HTMT)

Constructs	EA	ENV	BE	CR	EI	PC	PU	SELF
Business environment (ENV)	0.18115							
Business experience (BE)	0.19388	0.36004						
Creativity (CR)	0.57705	0.16410	0.06221					
Intention (EI)	0.66498	0.14971	0.26282	0.52112				
Perceived control (PC)	0.53997	0.28877	0.42568	0.41204	0.81966			
Perceived utility (PU)	0.86726	0.16721	0.14399	0.49597	0.66200	0.59660		
Self-confidence (SELF)	0.78310	0.18078	0.20697	0.34499	0.48660	0.42524	0.61950	
Training (ET)	0.31408	0.34185	0.66875	0.06961	0.18245	0.24988	0.14487	0.33698