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Adoption Of Blockchain Technology In Academic Environment- Evaluation Of Potential Factors

Author 1 : Dr. Suman Mathur, Senior Lecturer , Regenesys Business School

Author 2 : Ms. Gazal Nashte, Senior Lecturer , Regenesys Business School

Blockchain technology has gained significant attention in recent years due to its potential to disrupt different industries by focusing on transparency, security, and efficiency. As per NIST (NISTIR 8202, 2018), blockchain is a technology that allows secure processes for transactions and recordings using ledger blocks. The technology is built upon a decentralised and distributed framework that incorporates security and immutability. It emphasises the role of consensus algorithms in validating transactions and preserving the integrity of the ledger.

Blockchain technology streamlines business operations and minimises reliance on intermediaries. This technology also automates processes such as contract execution, payment processing, etc. in order to save time and boost productivity. Using this technology, businesses can provide their customers and business partners with a more reliable and safer place to do business. Blockchain technology is now being used in a variety of educational settings, including the creation of transparent and secure decentralised learning platforms. This research paper will analyse the understanding and awareness of academics about blockchain technology applications in academic environments such as administration and learning management systems. According to Sunny et.al. (2022), educational institutions are required to maintain comprehensive records including a distinct set of data, such as demographic profiles of both students and teachers, examination outcomes, certifications etc. The use of blockchain technology is appropriate in this context due to its inherent characteristics of flexibility and reliability. Additionally, it will help in the management of the various issues associated with the process of learning and teaching across the globe on a virtual platform.

Literature Review

There have been limited studies in the area of blockchain on the theme of analysing the awareness of blockchain technology among academics. According to Ocheja et.al. (2022), study, it was highlighted that blockchain practices is taking shape. The study explains that from 2016 onwards, the integration of blockchain technology in educational institutions as well as in other administrative activities has increased. Another study done by Grech and Camilleri (2017), discussed the potential advantages of blockchain in education. The paper confirms that the blockchain technology framework can store and share data safely and can also manage challenges such as lack of transparency, standardisation, and portability.

Blockchain implementation in education necessitates understanding and proper coordination among various stakeholders, including academics, administrative personnel, students, and regulators. It also requires addressing technical challenges such as interoperability, privacy, and data protection. Another conference paper by Zoey Li et.al. (2019) compares blockchain technology solutions for education credentials systems, including their future scope. The paper discusses and argues that this blockchain system helps learners to manage their credentials, and they can identify the cost and time they were spending on verification and authentication. In short, the blockchain platform provides a new system of assessment and recognition.

A few of the researchers have studied the applications of blockchain technology in various domains. A study done by Awaji et.al. (2020), identifies, based on the classification of various forty-nine papers, that adoption of blockchain technology requires collaboration between stakeholders and the blockchain system. Also, the study highlights that existing literature on blockchain technology applications in higher education is still at an exploratory stage and lacks practical implications. The study compares the suggested the performance of the system and its scalability to those of a typical academic management system. The findings reveal that the blockchain-based system has various advantages, including increased data security and transparency, as well as lower administrative costs. Another study presents the challenges associated with blockchain technology implementation and argues that there is a need for standardised protocols and regulations.

Another study done by Kumar et.al. (2020), provides insights about the factors that drive the adoption of blockchain technology in higher education. Many authors have used the TAM model to identify the factors and suggest that perceived ease- of-use and perceived-usefulness are the two key factors responsible for the successful adoption of blockchain technology. In fact, the study focuses more on security and privacy. Palma et.al. (2019), proposed in the study that blockchain technology solutions provide secure and temper-proof record-keeping solutions. They proposed a use-case contract solution to automate and validate the academic credentials system. However, the study mainly emphasises the challenges that are linked to the Brazilian legal system. Many research studies have highlighted various applications of blockchain technology other than privacy and security. Thompson et.al (2018), discussed the potential benefits of blockchain technology, which include payment system solutions, supply chain management, and P2P lending platform solutions.

Hameed et.al. (2019), reviewed blockchain technology projects and stated that the technology has higher potential to benefit educational institutions in terms of flexibility and transparency while sharing learning systems and academic credentials. The study discussed various services offered by blockchain technology, which include content libraries, e-certificates, scoring systems, token systems, cooperative learning, etc. In addition, the study mentioned that the adoption of blockchain technology could significantly lower the cost of managing a large, centralised database across the network and minimise the probability of an entire system halting due to technology glitches. Meanwhile, awareness of the technology and adoption framework is discussed in limited studies. Therefore, the proposed study highlights these points and will help tertiary academic institutions successfully adopt blockchain technology to facilitate academic activities with significant transparency and higher productivity.

The successful adoption of any technology is possible if the associated stakeholders are aware of the technology and its benefits. Lustenburg et.al. (2021) suggest that ecosystem readiness is one of the parameters for successful adoption of any technology. The paper suggests a TOE (Technology-Organization-Environment) framework with five key dimensions that include regulatory, market, technological, organizational, and social readiness of an organization. Based on the existing studies, the authors mentioned that technology, organization, and environment equally contribute to the adoption of technology. Authors argue that there are fourteen different factors that play a critical role in influencing the adoption of technology. Furthermore, the study proposed BAM (Blockchain Adoption Model), where they mentioned that ecosystem readiness highly contributes to the adoption of blockchain technology. Blockchain technology is a distributed peer-to-peer network that provides secure distribution through cryptography.

Adoption Model and Conceptual Framework

Many organizations are interested in blockchain technology because of its potential to transform business processes, enhance security, and promote transparency. To effectively adopt and execute blockchain technology, however, human acceptance and willingness to use it are essential. The Technology Acceptance Model (TAM, 1989), developed by Davis, includes different constructs. Primarily, these constructs focus on users' perceptions and attitudes towards the adoption of new technology. Moreover, a study done by Sciarelli et.al. (2021), stated that TAM constructs (Technology Acceptance Model) assist in finding the factors responsible for blockchain technology. Author also evaluated TAM constructs and concluded that perceived ease of use (PU), efficiency and security (ES), and reduced cost (RC) are the factors that significantly contribute to the adoption of blockchain technology. This study analysed the business environment, whereas the proposed study focuses on academic tertiary institutions and proposes the model framework referred to as Extended-TAM (EX-TAM).

EX-TAM framework is influenced by existed TAM (Technology Acceptance Model). As blockchain technology is at a nascent stage, its unique features such as decentralisation, immutability, smart contracts, currency, consensus mechanisms, and traceability provide an opportunity to explore the framework for successful adoption of blockchain technology. The key constructs of the model are explained in Table 1.

TAM Model (Theoretical)	Extended-TAM (EX-TAM Proposed)
Perceived usefulness, perceived ease of use, Attitude towards use, behaviour intentions, actual system use	Perceived usefulness, perceived ease of use, Attitude towards use, behaviour intentions, Availability of technology, insecurity, optimism towards technology, complexity in implementation

Table1

Behaviour intentions (BI): the degree to which a user adopts and encourages peers to adopt blockchain technology.

Technology Availability (TA): the degree to which a user can use blockchain technology independently.

Perceived usefulness (PU): the degree to which a user believes that using blockchain technology will improve their performance and productivity in academic domains.

Perceived ease of use (PEU): the degree to which an individual believes that navigating with blockchain technology will be simple and straightforward.

Attitude towards use (ATU): the degree to which a user understands the importance of blockchain technology in different academic domains.

Insecurity (INSEC): the degree to which a user analyses privacy concerns while using blockchain technology.

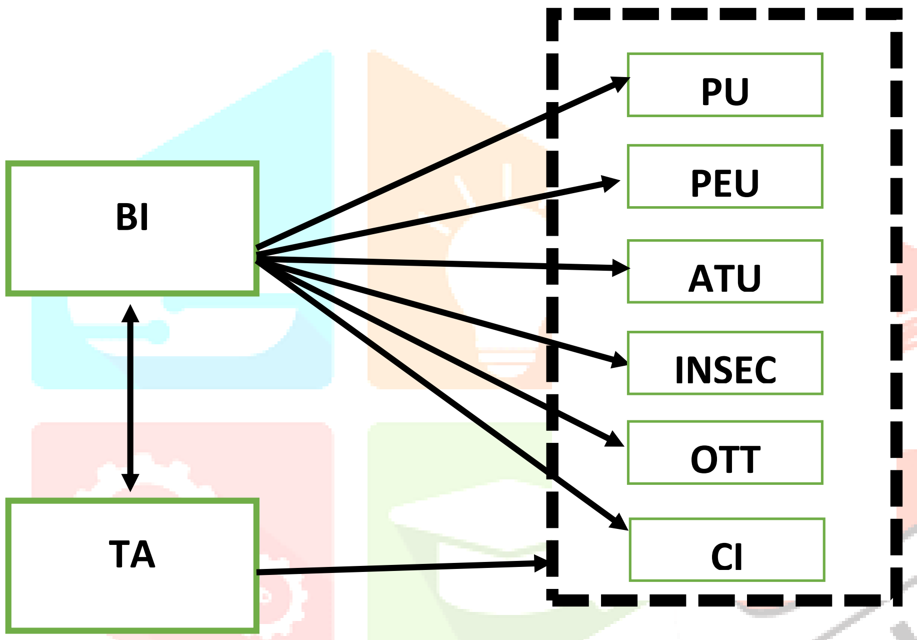
Optimism towards technology (OTT): the degree to which a user measures the probability of risks while using blockchain technology.

Complexity in implementation (CI): the degree to which a user analyses the importance of blockchain technology implementation, including cost.

Study Framework

There are multiple dimensions of the blockchain models that have been proposed by researchers. Sura et.al. (2021) highlighted and compared three models that can be used in different industries based on the size of the organization. The authors found that there are no credits for mining in academics; hence, trusted stakeholders can create the ledger and make use of it for program registration and document verification. However, nothing is highlighted about the user's readiness. The scope of the proposed model is to determine whether BI is highly influenced by the listed components. In addition, the model also explores the impact of TA on blockchain technology adoption. This study analyses the following hypothesis using the regression statistical method:

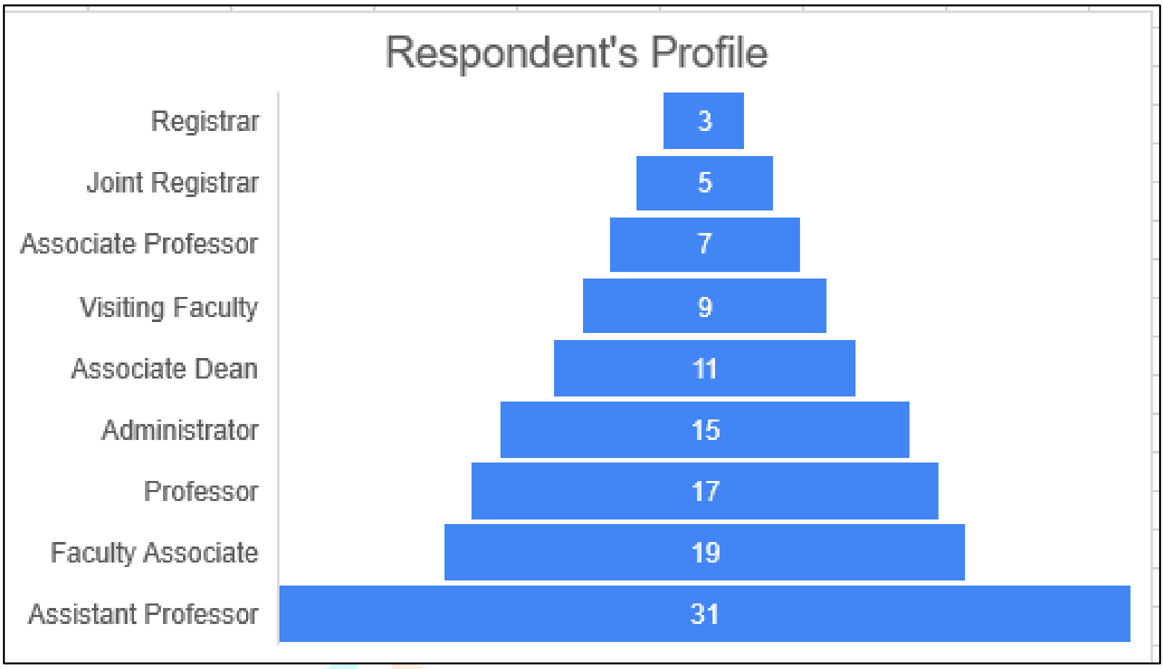
- Hypothesis1: BI is significantly influenced by the constructs PU, PEU, ATU, TA, INSEC, OTT and CI.
- Hypothesis2: There is a significant relationship between BI and AT.



EX-TAM Model (BI-Behaviour Intention, TA-Technology Availability, Pu-Perceived usefulness, PEU-Perceived ease-of-use, ATU-Attitude towards use, INSEC-Insecurity, OTT- Optimism towards technology, CI-Complexity in implementation)

Methodology and Explanation

The data is collected through a 'Google form'. A close-ended questionnaire was developed considering the above components and floated among the academic stakeholders associated with Indian universities. Although the questionnaire was shared among more than 150 academic stakeholders, only 117 responses have been received and used for this study. The demographic profile of the respondents is shown in Table



2. Table 2

Further, evaluated the awareness of the respondents about blockchain technology by asking two questions, as shown in Table 3 below. It has been observed from the table that 89% of respondents are aware of blockchain technology, but only 12% of them are using blockchain services or products. There exists a substantial disparity between the levels of awareness and utilisation. This observation indicates additional initiatives in education and outreach are necessary to enhance the adoption of blockchain technology.

	Aware about blockchain technology		Used/using blockchain technology	
	Frequency	Percent	Frequency	Percent
Yes	89	76.1	14	12.0
No	28	23.9	103	88.0
Total	117	100.0	117	100.0

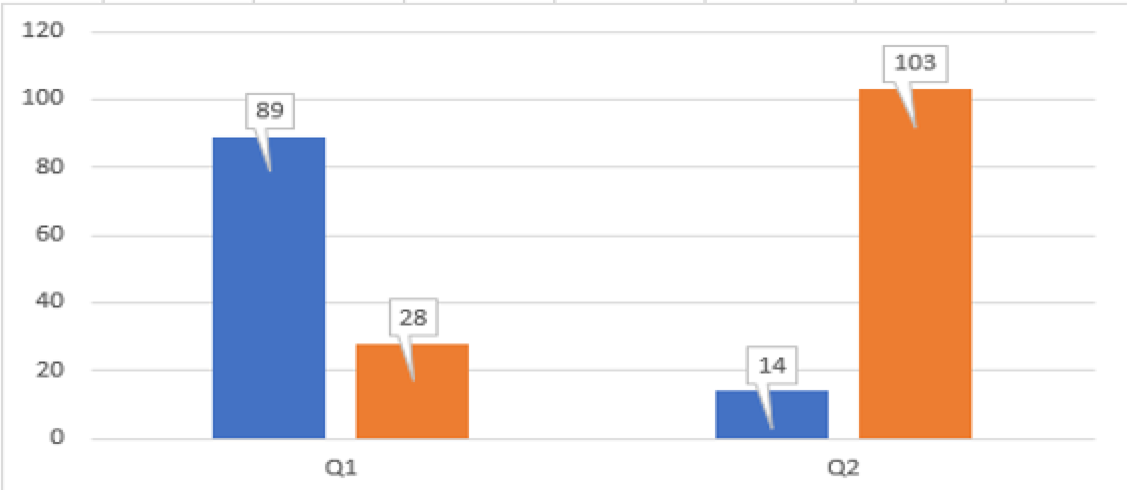


Table 3

Statistical Tool

SPSS is used to analyse the data. Firstly, the internal consistency was evaluated, as shown in Table 4, and further multiple regression analysis was used to determine the overall impact of independent variables on dependent variable variances. Cronbach alpha is applied to identify the internal consistency among the components. As per Table 4, Cronbach's Alpha is 0.705, which is an acceptable level of internal consistency considering the given components. This suggests that items are moderately related to one another and measure a coherent underlying component. Keith (2017) highlights the use of Cronbach's alpha as a measure of internal consistency for research instruments in scientific education after reviewing different studies. Another study done by Barbera et.al. (2021) indicates Cronbach's alpha can be a helpful indicator of reliability conceptualised as item consistency. Alpha value 0.7 is an "acceptable" threshold for research decisions.

Reliability Statistics	
Cronbach's Alpha	N of Items
.705	22

Table 4

Regression Model

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.732[a]	.536	.506	.547
a. Predictors: (Constant), TA ATU, PU, PEU, OTT, INSEC, CI				
b. Dependent Variable: BI				

Table 5

Table 5 presents the regression model summary. The correlation coefficient (R) denotes the degree and direction of the linear relationship that exists between the predictors (TA, ATU, PU, PEU, OTT, INSEC, and CI) and the dependent variable (BI). The model calculated R = 0.732, which shows that the predictors and the dependent variable have a moderately positive association. R^2=0.536, indicates the combination of predictors that explains approximately 53.6% of the variance in the dependent variable. Adjusted R^2=0.506 shows the variability in the dependent variable. The R^2 value demonstrates a little lower value, which indicates the possibility of diminishing returns when incorporating new predictors. Therefore, it is important to carefully evaluate the complexity of the model. Std. Error= 0.547 shows the mean discrepancy between the expected and observed values of the dependent variable. Based on the predictors, the model provides a moderate level of explanation for the dependent variable (BI).

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.688	7	5.384	17.991	<.001[b]
	Residual	32.620	109	.299		
	Total	70.308	116			
a. Dependent Variable: BI						
b. Predictors: (Constant), TA, ATU, PU, PEU, OTT, INSEC, CI						

Table 6

ANOVA Table 6 tests the predictors (TA, ATU, PU, PEU, OTT, INSEC, and CI) collectively explains the variability in the dependent variable (BI). The findings indicate that the combination of predictors (TA, ATU, PU, PEU, OTT, INSEC, CI) jointly exerts a statistically significant influence on the dependent variable BI. F-statistic=17.991 and the p-value is <.001 indicate that the regression model is statistically significant. The ANOVA outcome provides evidence in favour of the validity and reliability of the regression model.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.399	.455		-5.269	<.001
	PU	.427	.083	.398	5.175	<.001
	PEU	.497	.090	.495	5.524	<.001
	ATU	.293	.119	.209	2.458	.016
	INSEC	.201	.058	.341	3.499	<.001
	OTT	-.175	.057	-.273	-3.074	.003
	CI	1.164	.209	.777	5.580	<.001
	TA	-.344	.145	-.351	-2.366	.020

a. Dependent Variable: BI

Table 7

Considering Table 7, the degree of the dependent variable's (BI) sensitivity has been determined and quantified using the below equation:

BI=-2.399 +0.427*PU +0.497*PEU +0.293*ATU + 0.201*INSEC -0.175*OTT +1.164*CI -0.344*TA

PU, PEU, ATU, INSEC, and CI represent that for every one-unit increase, the BI value increases by 0.427, 0.497, 0.293, 0.201, and 1.164 units, respectively, assuming other predictors remain unchanged. The other two predictors, OTT and TA, indicate that if there is a one-unit increase, the BI value decreases by 0.175 and 0.344, respectively. Considering the equation, each coefficient in the equation corresponds to the impact of an independent variable on the dependent variable BI, with the constant term (-2.399) representing the intercept.

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.48	3.00	1.74	.570	117
Residual	-1.079	1.764	.000	.530	117
Std. Predicted Value	-2.214	2.205	.000	1.000	117
Std. Residual	-1.972	3.225	.000	.969	117

a. Dependent Variable: BI

Table 8

Considering Table 8, which indicates the differences between the actual observed values and the model predictions, they range from -1.079 to 1.764, with a mean residual near zero (0.000) and a standard deviation of 0.530. The modest mean residual value indicates that our model's predictions fit the actual observations closely, and the standard deviation of 0.530 indicates that the average gap between forecasts and actual data is approximate 0.530. This shows that the level of prediction accuracy is consistent across the dataset. Hence, the statistics indicate that the model is performing reasonably well in terms of prediction.

Discussion and Conclusion

Considering the proposed hypothesis, the study indicates that behaviour intention (BI) is influenced by the given constructs, but PU and PEU are highly contributing to influencing BI. The outcome is in line with the existing studies (Isaac et.al.,2016, Lee et.al,2015). University stakeholders are more likely to use blockchain technology if they understand that the technology will make changes in their specific functions, and it is easy to apply. On the other hand, the model output also supports the second hypothesis. It indicates that behaviour intention and technology availability have a moderate relationship. Additionally, the study done by Al-Emran (2018), also highlights that there are few variations in the correlation between behavioural intention and technology availability. It shows that making a technology available is not sufficient to ensure that people will use it. Top management or authorities need to improve the infrastructure to increase the possibility of making use of blockchain technology, including assistance. The academic environment must concentrate on enhancing perceived usability, perceived utility, and relevance to users' requirements. Academic institutions should put in efforts to enhance the accessibility, utility, and use of blockchain technology for their stakeholders. By implementing this approach, individuals can establish a conducive environment wherein blockchain emerges as a useful tool for academic activities and educational endeavours. Consequently, this will lead to a higher rate of acceptance and influence of blockchain technology in academic contexts.

In conclusion, the study indicates that universities should focus on constructs such as perceived usefulness, perceived ease of use, and security to increase the potential of blockchain technology adoption. User-friendly interfaces, clear instructions, and adequate support resources can increase the potential of blockchain technology adoption. Academic universities are expected to implement the EX-TAM methodology to gain insights into the most significant factors that should be prioritised to maximise the probability of effective adoption of blockchain technology.

Future Scope

It would be interesting to conduct longitudinal studies that monitor the changes of these constructs. This would provide deeper insights into the evolution of blockchain technology in the university environment. Researchers can contribute to improving knowledge of the adoption of blockchain technology in universities and devise strategies to promote its use to enhance education and learning. It is possible that if we work with a large sample size, the outcome of the study may result in a more significant output.

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References

Al-Emran, M., Mezhuyev, V., & Kamaludin, A. (2018). Technology Acceptance Model in M-Learning Context: A Systematic Review Computers & Education, 125, 389–412. https://doi.org/10.1016/j.compedu.2018.06.008

Bakri A.,Solaiman E., Albshri A. (2020). Blockchain-Based Applications in Higher Education: A systematic Mapping Study. Conference: ICIEI 2020:2020 The 5th International Conference on Information and Education Innovations, doi:10.1145/3411681.3411688

Barbera, J., Naibert, N., Komperda, R., & Pentecost, T. C. (2020). Clarity on Cronbach's Alpha use. Journal of Chemical Education. 98(2), 257–258. https://doi.org/10.1021/acs.jchemed.0c00183

Fedorova E. P. , Skobleva E. I. (2020). Application of Blockchain Technology in Higher Education. European Journal of Contemporary Education, E-ISSN 2305-6746 2020, 9(3): 552-571 DOI: 10.13187/ejced.2020.3.552

Grech, A., Camilleri, A. F. (2017). Blockchain in Education. Inamorato dos Santos, A. (ed.) EUR 28778 EN; doi:10.2760/60649

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). Multivariate data analysis (5th ed.). Upper Saddle River, NJ: Prentice Hall

Hair J. F., Black W. C., Babin B. J., Anderson R. E. (2010). Multivariate data analysis (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall

Hameed, B., et al. (2019). A review of blockchain-based educational projects. International Journal of Advanced Computer Science and Applications, 10(10), f9f2c8ef1368eaa525ac2d0db6017d4aafe7.pdf.

Isaac, O., Abdullah, Z., & Ramayah, T. (2016). Perceived usefulness, perceived ease of use, perceived compatibility, and net benefits: An empirical study of internet usage among employees in Yemen. In 7th International Conference on Postgraduate Education, Universiti Teknologi MARA (UiTM), Malaysia (pp. 899-919)

Khan, T., Nag, K. K., Joshi, B., Acharya, R., & Thomas, S. (2023). Influencing factors of behavior intention and actual use of technology: An application of UTAUT model on science undergraduates. Journal of Higher Education Theory and Practice, 21(13), 89-103. https://doi.org/10.33423/jhetp.v21i13

Taber, K. S. (2017). The use of Cronbach's alpha when developing and reporting research instruments in science education. Research in Science Education, 48(5), 1273-1296. https://doi.org/10.1007/s11165-016-9602-2

Kumar, N., Singh, M., Upreti, K., Mohan, D. (2022). Correction to: Blockchain Adoption Intention in Higher Education: Role of Trust, Perceived Security and Privacy in Technology Adoption Model. In: Al-Emran, M., Al-Sharafi, M.A., Al-Kabi, M.N., Shaalan, K. (eds) Proceedings of International Conference on Emerging Technologies and Intelligent Systems. ICETIS 2021. Lecture Notes in Networks and Systems, vol 299. Springer, Cham. https://doi.org/10.1007/978-3-030-82616-1_58

O'Connor, B. P. (2010). SPSS and SAS for factor analysis: A step-by-step guide. New York, NY: Routledge

Palma, M. L., Vigil, G. A. M., Pereira, L. F., & Martina, E. J. (2019). Blockchain and smart contracts for higher education registry in Brazil. International Journal of Network Management, 29(3). https://doi.org/10.1002/nem.2061

Reddy, S. L., & Kulshrestha, P. (2019). Performing the KMO and Bartlett's test for factors estimating the warehouse efficiency, inventory, and customer contentment for E-retail supply chain. International Journal for Research in Engineering Application & Management (IJREAM), 5(9). ISSN: 2454-9150

Saari, A., Vimpari, J., & Junnila, S. (2022). Blockchain in real estate: Recent developments and empirical applications. Land Use Policy, 121, ISSN 0264-8377. https://doi.org/10.1016/j.landusepol.2022.106334

Sciarelli, M., Prisco, A., Gheith, M. H., & Muto, V. (2022). Factors affecting the adoption of blockchain technology in innovative Italian companies: An extended TAM approach. Journal of Strategy and Management, 15(3), 495-507. https://doi.org/10.1108/JSMA-02-2021-0054

Sunny, F. A., et al. (2022). A systematic review of blockchain applications. IEEE Access, 10, 59155-59177. https://doi.org/10.1109/ACCESS.2022.3179690.

Mohammed Ali, S. I., Farouk, H., & Sharaf, H. (2021). Blockchain models for student information systems. Egyptian Informatics Journal, 23(2), 187-196.

Tabachnick, B. G., & Fidell, L. S. (2007). Using multivariate statistics (5th ed.). Boston, MA: Pearson Education.

Tabachnick, B. G., & Fidell, L. S. (2013). Using multivariate statistics (6th ed.). Pearson Education.

Thomson, J., et al. (2018). Blockchain-Powering and Empowering the Poor in Developing Countries. In Transforming Climate Finance and Green Investment with Blockchains (pp. 137-152). Academic Press

Li, Z., Liu, J. K., Yu, J., & Dragan. (2022). Blockchain-based solution for education credentialing system: Comparison and implications for future development. In 5th IEEE International Conference on Blockchain. https://doi.org/10.1109/Blockchain55522.2022.00021

Author's Credentials - Dr Suman Mathur – Senior Lecturer, Regenesys Business School, South Africa. Email: suman.m@regenesys.net

Ms. Gazal Nashte – Senior Lecturer, Regenesys Business School, South Africa. Email : gazaln@regenesys.net