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Integrating Cognitive Antecedents to UTAUT Model to Explain Adoption of Blockchain Technology Among Malaysian SMEs

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***Abstract*— Blockchain technology is gaining consideration more and more and will potentially revolutionize most of the industries. Bitcoin cryptocurrency which uses Blockchain platform, has even promoted this technology more. Blockchain is a decentralized source and encrypted database for storing transaction information. Instead of being dependent on a centralised mediator like bank, by using blockchain, parties can transfer fund promptly trough connected ledgers called blocks. Using this method transactions will significantly be more transparent for both parties. Consequently, transactions are performed based on the distributed trust among other blockchain users in the network. Blockchain will promote transparency in every industry, yet implementation of blockchain technology is still limited. This study focuses to study the possible factors affecting adoption of blockchain technology by focusing on literature review and using Unified Theory of Acceptance and Use of Technology as a theoretical basis.**

***Keywords*— Blockchain, Technology Awareness, UTAUT, Personal Innovativeness, Perceived Security, Perceived Trust.**

I. INTRODUCTION

We are witnessing incredible growth in the realm of e commerce in last decade. The benefits of the internet have led to a worldwide spread of smart tools. This scientific revolution driven the growth of the variety of innovative services that modified the long-established structures in businesses and trade. Specifically, blockchain technology has proved its ability to establish a trustworthy and transparent record of transaction history. A blockchain has been described as a series of blocks that record information in hash functions with timestamp and a link to the previous block. The data is stored at different nodes in a so-named distributed ledger [1]. This reduces centralized points of weakness, which cybercriminals can manipulate. Blockchain protocols enable the data to be stored in a platform which is not easy to change. This technology introduces tokenization where tokens can be transferred from one party to another, without the necessity for requiring a trusted intermediary or mediator or for the automated execution of "smart contracts" when specific conditions are met. By offering a transparent and immutable lodger, blockchain technology changed the transaction processes, significantly. Most of the blockchain functions are currently being applied in the funding sectors. Blockchain technology certainly provides transparency, but more notably creates an immutable and disseminated set of records by nature of the protocols which is crucial to many aspects of business in terms of traceability of processes. A significant difference between blockchain and FinTech is that blockchain can be used in many different fields and not just financial industry. By emerging the popularity and advantages of this technology, now business owners are considering using this platform in variety of business aspects such as supply chain, to gain competitive advantage. Figure 1 demonstrates global invested amount in blockchain enterprises among the main world players from 2009 to 2018

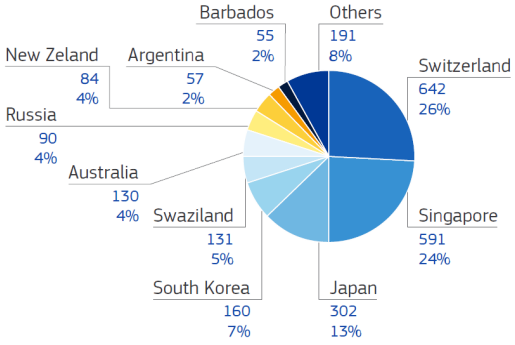

Fig. 1 Shares and amounts (EUR million) of funds dedicated to blockchain start-ups between 2009–2018 [1].

II. BACKGROUND OF STUDY

The blockchain technology has been publicized as revolutionary tool that will convert the structure of businesses and the way that transactions are organized [2]. Figure 2 shows the anticipated size of the global blockchain

technology market in next few years. Marketing specialists expect that the global blockchain marketplace to be worth over US$ 25 billion by 2024 [3]. The usage and implementation of blockchain technology is growing at a swift pace, globally. The Republic of Georgia for instance has confirmed employing blockchain technology to validate property related governmental transactions [4]. Other countries like Honduras and Sweden, are also utilizing such similar blockchain based procedures, to enable secured e governance systems [3].

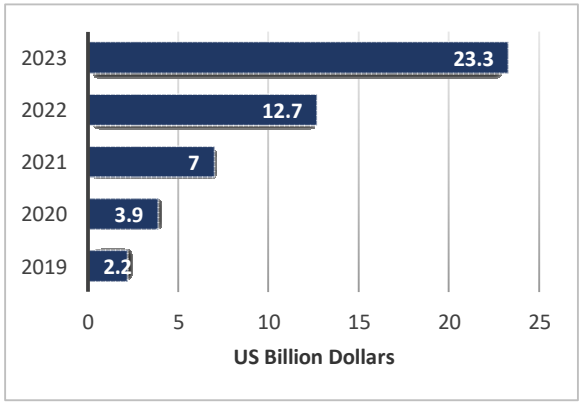

Fig. 2 Size of The Blockchain Technology Market Worldwide (Projected) [3]

The twelve Malaysia has highlighted the significance of developing blockchain technology for safer and consistent retail market services. Disruptive technologies like Blockchain interrupt and transform the industries. Malaysian marketplace demands to convene a rapid change and more technically demanding SMEs which require more efficient financial policies for trading. Although there are expectations for increasing blockchain investments in future, but like any other disruptive technologies and innovations, early adopters may encounter several difficulties. Though, by understanding the total transparency caused by blockchain utilization, mangers and stakeholders 'are still reluctant and cautious about adopting this new technology. An entirely apparent supply chain system for instance in which visible tracking system will be feasible by competitors. With the aim of encourage Malaysian SMEs to explore high-tech inventions and increase efficiency and ability to respond faster to today's competitive world. This will prompt professionals and researchers to discuss about the challenges of blockchain adoption in early stage. Because of the initial lunch of blockchain, its awareness is poor, and public have difficulty understanding this phenomenon, effortlessly. Therefore, the intention to accept this technology is still uncertain. Moreover, regardless of the possibilities of market growth, even the most pioneering, technically superior enterprises are still hesitating to adopt this technology. Consequently, discovering and reviewing the concerns of blockchain adoption is essential.

This study is aimed to examine a proposed conceptual framework for adoption of blockchain technology among SMEs in Malaysia using Unified Theory of Acceptance and Use of Technology as theoretical framework. The context underlines (Technical, Personal and Norm) factors that are presented in the framework. The suggested framework can be used by businesses as a reference to have better understanding of implementing blockchain in early stages and by researchers to develop, enhance and assess this framework in blockchain technology adoption.

III. Conceptual Framework And Hypothesys Development

The purpose of this research was to investigate the acceptance of blockchain technologies among SMEs in Malaysia. This research extends UTAUT theory (underpinning theory) by adding some constructs suggested by other scholars in information technology adoption, a conceptual model is established. The study concludes with adoption of blockchain instigated by UTAUT theory and literature review. Figure 3. Illustrates the UTAUT model suggested by Venkatesh et al [5].

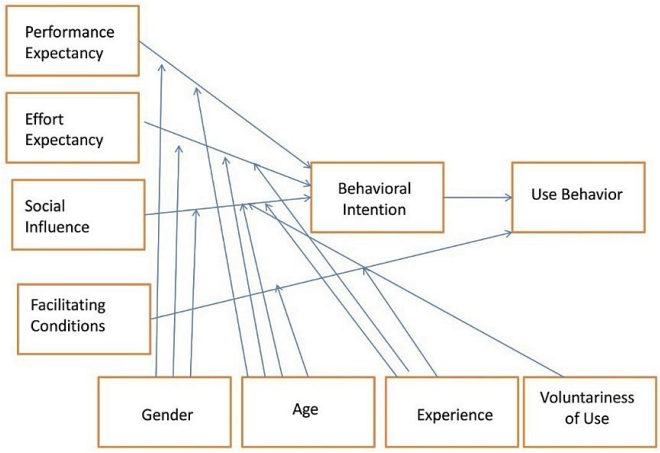

Fig. 3 Figure 3. UTAUT model [4]

Based on the UTAUT model, and inspired by acceptance of technology literature review, this paper is considering the following constructs to develop a framework to predict acceptance behaviour towards blockchain application.

I. *Behavioural Intention to Adopt Blockchain*
Social scientists have largely investigated behavioural and user's intention to perform a potential behaviour. Behavioural intention to adopt a technology describes the individual's subjective likelihood that he or she will use or purchase that specific technology in future [5]. Numerous of technology adoption models incorporated in UTAUT theory which support the relationship between behavioural intention and usage of technology [5].

II. *Personal Innovativeness*
Personal Innovativeness (PI) is described as the eagerness of individuals to evaluate, test, or use any new technology or idea [6]. It is expected that those individuals with high personal Innovativeness are commonly more determined to adopt innovative technologies [7]. This indicates that individuals who have a higher PI are most expected to develop a positive attitude, and this increases the chance of trying

a new technology [7]. Researchers in the disruptive technology domain have viewed Personal Innovativeness to be significantly correlated to intention to buy a certain new technology [6]. Based on above discussion the following hypothesis is generated:

H1: Individuals Personal Innovativeness has significant influence on adoption of blockchain application.

III. Perceived Trust

Mayer et al. [8] defined trust as the eagerness or readiness to expose to new risky ideas. Perceived Trust (PT) is suggested to be an important determinant of behavioural intention, specifically in information technology and e commerce [9]. Perceived Trust has been defined as "correct expectations of the actions of others when one has to make one's own choice before monitoring the actions of the other" [8]. In the field of blockchain adoption, it can be defined as the trust of consumers to accept a disruptive technology. The aspect of perceived trust has been proved in the study on viewpoints of online services and payments using handphones, which can be considered close to concept of blockchain as a form of exchange in cryptocurrencies. PT has been suggested as one of the most important factors affecting technologies implementation [9]. Therefore:

H2: Perceived Trust has significant impact on adoption of blockchain application.

IV. Perceived Security

Salisbury et al. [10] defined perceived security (PS) as the grade to which individuals believe that the technology, service, or product they use is secure for exposing vital data such as transaction information or credit card details. PS may also be described as the users' assessment of safeguarding against security threats and controlling the personal data in an online platform [10]. Therefore, the user's perception or trust of being protected using a technology can cause them to feel safer against any threat that intimidate their private or financial information, when using that technology. PS found to be an essential factor that influences intention to use new technologies or to have confidence in third party [11]. Therefore, customers should be certain the third party which keeps confidential financial data is working legally and honestly [11]. Based on above discussion the following Hypothesis is generated:

H3: Perceived security has significant influence on adoption of blockchain application.

V. Performance Expectancy

Performance expectancy (PE) is the perceive advantages of using new technologies for doing a task [5]. It stands for how using a technology enhances users' performances. Performance expectancy is one of the most significant predictors for using a technology [12]. Blockchain technology is a key for a trusted transaction using decentralized data with improved data precision and proficiencies that will help asset managers more chance to monitor, trace and implement resources. Following above discussion, the subsequent Hypothesis is created:

H4: Performance expectancy has significant influence on adoption of blockchain application.

VI. Effort Expectancy

Effort expectancy (EE) is consumers perception about the amount of effort needed to perform a behaviour. The easier the use of technology is, the more intention is to adopt that technology. Effort expectancy is associated with efficiency of technology [5]. Using blockchains effects an establishment's efficiency derived by several factors. Data sharing procedures can create effective data recording models without the need for conventional tracking systems. Moreover, blockchain facilitates the usage of "smart contracts" which are established on user specified regulations involving little to no human interventions. According to above discussion, the subsequent hypothesis is generated:

H5: Effort expectancy has significant influence on adoption of blockchain application.

VII. Social Influence

Social influence (SI) has been described as the magnitude of individual's perception about importance of others opinion about using specific product or technology [5]. Social influence is shown an important predictor of intention to use a specific innovation [13]. Blockchain is a communal technology. Social influence can be derived by family, peers, and colleagues. In blockchain context, there are numerous observations between the colleagues and the society. Incidentally, it can be argued that the positive view of innovators and early adopters on blockchain, will increase diffusion of this technology among society. Therefore:

H6: Social influence has significant influence on adoption of blockchain application.

VIII. Technology Awareness

When there is insufficient awareness about a technology, there is hindrance to shift away from the current systems [14]. Blockchain projects, it is crucial that the target operators or consumers to have the essential technical awareness and competence [14]. Like any pioneering technology blockchain needs to pass five stages of adoption process which are Awareness, Attention, Evaluation, Trial and ultimately, acceptance [15]. Earlier researchers found that awareness significantly influence the adoption of e payment systems. Furthermore, Ghazali & Yasuoka, [16] suggest that little understanding and technology awareness will have negative effect on expansion of Fintech [16]. Studies also suggest that experience will increase awareness about the usage and benefits of

technology [17]. *Based* on above discussion the following propositions are generated:

H7: There is a significant correlation among technology awareness and behavioural intention to use blockchain technology.

IV. Instrument, Data Collection and Sample

This research utilised seven-point Likert Scale survey items to measure variables of study. The instruments items were adapted from Mekovec, R., & Hutinski, Ž. [18], Chiu et al. [19], Stone, [17], Khazaei [7], and Venkatesh et al. [5]. All the measures were subject to reliability and validity analysis before further data analysis. Both printed and online surveys were conducted from March to October 2019 by randomly selecting and conducting members of 384 SMEs in different states of Malaysia. This study collected a total of 262 finished questionnaires. After preliminary data screening, 246 datasets entered to SPSS version 22 for analysis. The sample of respondents was composed of more males (63.4%) than females (36.6%). A total of 16.3% of respondents were amongst 26 and 35 years old, 37% were among 36 and 45 years old, and 32% were among 36 to 55 years old and 15% of them were over 55. Tables 1 shows the demographic features of respondents of this study.

TABLE I
Demographic Features Of Respondents

		Frequency	Percent
Gender	Male	156	63.4
	Female	90	36.6
	Total	246	100.0
Age	under 25	1	0.4
	26-35	40	16.3
	36-45	91	37.0
	46-55	79	32.1
	over 55	35	14.2
	Total	246	100.0
Education	Secondary school certificate	21	8.5
	Diploma/technical school certificate	28	11.4
	Bachelor's degree or equivalent	92	37.4
	Master	91	37.0
	PhD	14	5.7
	Total	246	100.0
Ethnicity	Chinese	167	67.9
	Malay	51	20.7
	Indian	21	8.5
	Other	7	2.8
	Total	246	100.0
Profession	Administrative and Managerial	28	11.4
	Technical	49	19.9
	Sales and Service	70	28.5
	Production	70	28.5
	Entrepreneur	24	9.8
	Others	5	2.0
	Total	246	100.0

V. Results and Discussion

To test the suggested model, this research used Confirmatory factor analysis (CFA). The consistency and reliability of measures were examined by tests of Cronbach alpha, convergent validity, composite Reliability (CR), discriminant validity and Average Variance Extracted (AVE). Fornell and Larcker, suggested the composite Reliability larger than 0.7, and Cronbach's alpha, greater than 0.8 [19]. The validity and reliability statistics are shown in table 2. After elimination of all factor loadings below 0.40 according to Hair et al., all the values are greater than the critical values, indicating an acceptable internal consistency in the model. Figure 4 illustrates the structural model of the research.

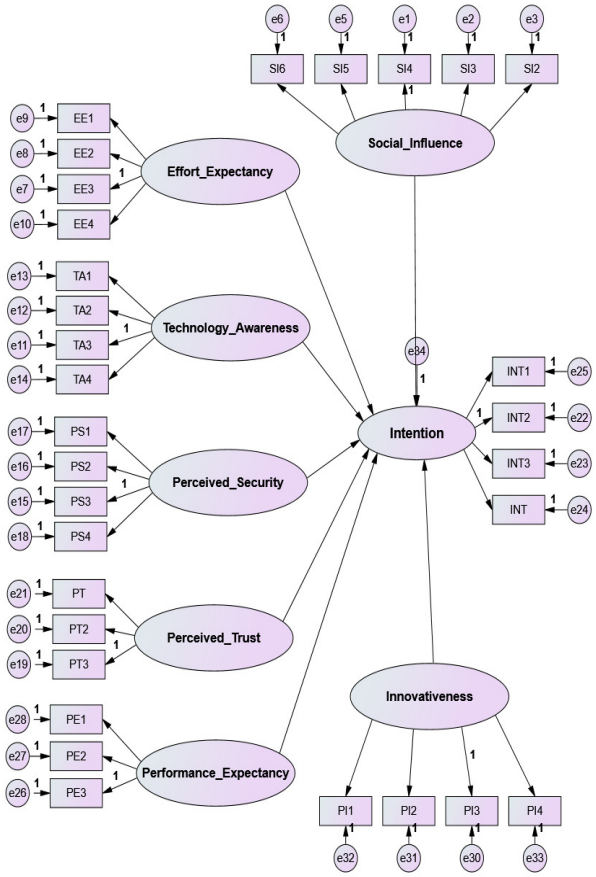

Fig. 4 The structural model of the study

Table 3 shows the correlations between different variables in the model are not surpassed 0.85 as recommended by Kline [20]. That the absolute correlation for each variable is lesser than the squared root of the average variance, demonstrating an acceptable discriminant validity among these constructs [20].

TABLE III
RELIABILITY AND VALIDITY MEASUREMENT

Factor	Items	Cronbach's Alpha	Factor Loading	Convergent validity	
				Average Variance Extracted (AVE)	Composite Reliability (CR)
Intention to Adopt Blockchain	4	0.7235	0.681 0.423 0.487 0.814	0.570	0.751
Personal Innovativeness	4	0.832	0.953 0.923 0.777 0.883	0.811	0.933
Social Influence	5	0.751	0.534 0.886 **0.198** **0.168** 0.971	0.671	0.804
Effort Expectancy	4	0.698	0.963 **0.292** 0.552 0.782	0.615	0.746
Technology Awareness	4	0.881	0.861 0.885 0.798 0.756	0.683	0.855
Perceived Security	4	0.833	0.756 0.841 **0.245** 0.814	0.647	0.781
Perceived Trust	3	0.7235	0.922 0.875 0.978	0.857	0.939
Performance Expectancy	3	0.884	0.793 0.880 0.940	0.762	0.880

TABLE III
DISCRIMINANT VALIDITY INFORMATION

		1	2	3	4	5	6	7	8
1	**SI**	**0.738**							
2	**EE**	0.53	**0.784**						
3	**TA**	-0.47	0.13	**0.827**					
4	**PS**	0.02	0.14	0.26	**0.805**				
5	**PT**	0.35	0.21	0.19	0.21	**0.926**			
6	**PE**	0.17	0.21	0.22	0.28	0.19	**0.874**		
7	**PI**	0.45	0.34	0.12	0.11	0.25	0.11	**0.900**	
8	**INT**	0.32	0.10	-0.43	0.22	0.33	.025	0.21	**0.755**

This study used a Confirmatory Factor Analysis (CFA) in AMOS 24. Using Confirmatory Factor Analysis to test the goodness of model, needs consideration of several standards and different measures. According to Hair et al. [21], an appropriate model must follow these standards: The comparative fit index (CFI) and Tucker–Lewis index (TLI) have to be larger than 0.9, the root mean square error of approximation (RMSEA) must be less than 0.1 the X2 relative value of the degree of freedom (X2/df) must not be more than 5, and the root mean square error of approximation (RMSEA) have to be smaller than 0.1 [21]. Table 4 shows that all the model fit statistics are acceptable according the above discussion.

TABLE IV
MODEL FIT STATISTICS

X2	df	X2/df	RFI	IFI	TLI	CFI	RMSEA
865.701	321	2.697	0.856	0.92	0.904	0.919	0.083

Path analysis in SPSS AMOS 24 has been utilized to evaluate the hypotheses of the proposed model. The results of the path analysis are reported in Table 5. The findings show significant relationship among personal innovativeness (PI) on blockchain adoption (β = 0.184, p = 0.000), PI has been found to be significant predictor of accepting new technologies [5;22]. This indicates that mangers or who have a higher-level Personal Innovativeness are most likely to develop a positive attitude, and this increases the chance of trying blockchain technology.

TABLE V
STANDARNADISED ESTIMATES

				Estimate	S.E.	C.R.	P
H1	INT	←	PI	0.191	0.026	7.490	***
H2	INT	←	PT	0.271	0.029	9.333	***
H3	INT	←	PS	0.191	0.024	7.902	***
H4	INT	←	PE	0.333	0.030	11.183	***
H5	INT	←	EE	0.044	0.019	2.261	0.024
H6	INT	←	SI	0.296	0.081	3.645	***
H7	INT	←	TI	-0.038	0.023	-1.679	0.142

Perceived Trust (β = 0.275, p = 0.000) and Perceived Security (β = 0.187, p = 0.000) also showed to have significant influence in intention to adopt blockchain. Hence H2, and H3 are also supported. Perceived Security and Trust in Blockchain technology and a clearer knowledge of its capability needs to be formed before contemplating implementation of this technology. These finding are consistent with Mattevi and Jones [23] and [24] show that many mangers and stakeholders have security concerns adopting blockchain.

H4 (β = 0.187, p = 0.000), H5 (β = 0.324, p = 0.024) and H6 (β = 0.321, p = 0.024) were supported, suggesting the positive impact of Performance Expectancy, Effort

Expectancy and Social Influence, respectively, on blockchain acceptance. These findings are all suggested by Venkatesh et al. [5] and therefore is in line with their UTAUT theory. However, the influence of Technology Awareness on intention to adopt blockchain is not supported (β = -0.033, p = 0.142). Therefore, H7 is rejected.

VI. Conclusion

The aim of this paper was to extend UTAUT model and examine the developed conceptual framework for adoption of blockchain technology among Malaysian MSEs. The results of CFA and SEM analysis showed that the proposed model has a good fit for constructs used in this study. The outcome of path analysis showed a significant influence of personal innovativeness, Trust, Security, Effort Expectancy, Performance Expectancy, and social influence on intention to use blockchain among Malaysian SMEs. Moreover, the influence of technology awareness intention to accept blockchain was not supported. The recommended model in this study, can be used by entrepreneurs, start-ups, and governmental organizations as a reference to have better understanding of implementing blockchain in early stages and by researchers to develop, enhance and assess this factor in blockchain technology adoption

References

[1] Blockchain Now and Tomorrow (2019). European Union Publication.

[2] Behnke, K., & Janssen, M. F. W. H. A. (2019). Boundary conditions for traceability in food supply chains using blockchain technology. International Journal of Information Management, 101969.

[3] Liu, S. (2019). Size of blockchain technology market worldwide from 2018 to 2023 (in billion US dollars).

[4] Hyvärinen, H., Risius, M., & Friis, G. (2017). A blockchain-based approach towards overcoming financial fraud in public sector services. Business & Information Systems Engineering, 59(6), 441-456.

[5] Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D., 2003. User acceptance of information technology: toward a unified view. MIS Quarterly, 27 (3), 425–478.

[6] Agarwal, R., & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. Information systems research, 9(2), 204-215.

[7] Khazaei, H. (2019). The Influence of Personal Innovativeness and Price Value on Intention to Use of Electric Vehicles in Malaysia. European Online Journal of Natural and Social Sciences, 8(3), pp-483.

[8] Mayer, R. C., & Davis, J. H. (1999). The effect of the performance appraisal system on trust for management: A field quasi-experiment. Journal of applied psychology, 84(1), 123.

[9] Mondego, D. Understanding the influence of trust on mobile payment systems adoption: A literature review.

[10] Salisbury, W. D., Pearson, R. A., Pearson, A. W., & Miller, D. W. (2001). Perceived security and World Wide Web purchase intention. Industrial Management & Data Systems.

[11] Lim, S. H., Kim, D. J., Hur, Y., & Park, K. (2019). An empirical study of the impacts of perceived security and knowledge on continuous intention to use mobile fintech payment services. International Journal of Human–Computer Interaction, 35(10), 886-898.

[12] Khazaei, H. (2016). Predictors of Acceptance of Electric Cars in Malaysia: Moderating Effects of Driving Experience and Voluntariness of Use. INNOVATION AND MANAGEMENT, 1893.

[13] Khazaei, H. and Khazaei, A. (2016). Electric vehicles and factors that influencing their adoption moderating effects of driving experience and voluntariness of use (conceptual framework). Journal of Business and Management, 18(12), 60-65.

[14] Lambrecht, I., Vanlauwe, B., Merckx, R., & Maertens, M. (2014). Understanding the process of agricultural technology adoption: mineral fertilizer in eastern DR Congo. World Development, 59, 132-146.

[15] Rogers, E. M. (2010). Diffusion of innovations. Simon and Schuster.

[16] Ghazali, N. H., & Yasuoka, T. (2018). Awareness and perception analysis of small medium enterprise and start-up towards FinTech instruments: Crowdfunding and peer-to-peer lending in Malaysia. International Journal of Finance and Banking Research, 4(1), 13.

[17] Stone, V. (2013) The LOKUS instrument, University at Buffalo - Center on Knowledge Translation for Technology Transfer

[18] Chiu, C.M., Chang, C.C., Cheng, H.L. and Fang, Y.H. (2009) 'Determinants of customer repurchase intention in online shopping', Online Information Review, Vol. 33, No. 4, pp.761–784.

[19] Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of marketing research, 18(1), 39-50.

[20] Kline, Rex B. Convergence of structural equation modeling and multilevel modeling. na, 2011.

[21] Hair Jr, F., Black, W. C., Babin, B. J., & Anderson Rolph, E. (2010). Multivariate data analysis. Pearson Education.

[22] Nuryyev, Guych, Yu-Ping Wang, Jennet Achyldurdyyeva, Bih-Shiaw Jaw, Yi-Shien Yeh, Hsien-Tang Lin, and Li-Fan Wu. "Blockchain Technology Adoption Behaviour and Sustainability of the Business in Tourism and Hospitality SMEs: An Empirical Study." Sustainability 12, no. 3 (2020): 1256.

[23] Mattevi, M. and Jones, J.A. (2016), "Food supply chain – are UK SMEs aware of concept, drivers, benefits and barriers, and frameworks of traceability?", British Food Journal, Vol. 118 No. 5, pp. 1107-1128.

[24] Sander, F., Semeijn, J., & Mahr, D. (2018). The acceptance of blockchain technology in meat traceability and transparency. British Food Journal.