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THE IMPACT OF IR 4.0 TECHNOLOGY ACCEPTANCE ON SMALL MEDIUM ENTERPRISES BEHAVIOR INTENTION IN THE HALAL FOOD AND BEVERAGE INDUSTRY IN MALAYSIA: A PILOT STUDY

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ABSTRACT

This pilot study implemented Venkatesh, Morris, Davis and Davis (2003)'s model of Unified Theory of Acceptance and Use of Technology (UTAUT) in the field of halal food and beverage enterprises in Malaysia. 30 sets of questionnaires have been sent to participants which are from the management level in food and beverage establishment. The questionnaire is organized in eight parts and used 5 point Likert scale. The research variables are effort expectancy, performance expectancy, facilitating condition, social influence, price value and muamalat e-commerce. The dependent variable is Small Medium Enterprise (SME) behavior intention in halal food and beverage establishment. The findings highlighted the question items that performed and thus should be kept, as well as the question items that performed badly and should be discarded or studied further. Statistical Program for Social Science (SPSS) version 26 was also used to do a reliability analysis and factor analysis. The findings revealed that the data is trustworthy and has a fair level of normality. In the future, this pilot study will be followed by a full study.

Keywords: Halal; Small Medium Enterprises; Facilitating conditions; Price value; Muamalat e-commerce

INTRODUCTION

Halal can be categorized into two categories as suggested by Department of Islamic Development of Malaysia (JAKIM) which are goods or food, and food-

based services or products. Halal food does not include or consist of any part or component of animals that are prohibited for Muslims to consume under Sharia law or that have not been executed in accordance with Sharia law and Fatwa (JAKIM, 2014). Due to the global epidemic, halal cuisine has been more popular in recent years. According to Technavio's (2020) report, there is a substantial shift in Halal Food Market Strategy 2020-2024 during pandemics, indicating increased consumer expenditure on Halal Food. Furthermore, according to Elias et al. (2019), a growth in demand of halal product has steered more businesses, particularly small and medium companies, entering the halal sector market. According to the Halal Industry Master Plan 2030 (HIMP) developed by the Halal Development Corporation (HDC), Malaysia's halal market contributed USD 28.4 billion in 2018 and is predicted to contribute USD 113.2 billion by 2030. Moreover, Halal traceability services are incorporated to ensure a seamless deployment. Among the most enablers mentioned in the "Halal Industry Master Plan 2030 (HIMP)" is a significant focus on fostering halal innovation through technology advancements such as IR4.0, Blockchain, IoT, BigData, and Fintech to ensure that halal products pass through a completely verified supply chain. With technology continuously evolving and converging, it is more important than ever for small and medium enterprises (SMEs) to use technology to increase efficiency and profitability in order to enhance performance and expand further.

Furthermore, industry 4.0 technologies provide enormous prospects to increase productivity in the SME sector. Information and communications technology and new Industry revolution 4.0 technology will convert nowadays small and medium-sized firms into smart factories with enormous economic opportunity as suggested by Lee & Lapira 2013 and Gualtieri et al. (2018). Nonetheless, the Huawei (2018) report, a collaboration between Huawei Technologies (M) Sdn. Bhd and SME Corp, examined the current state of digitalization in Malaysian SMEs and discovered that the use of digitalization technology as a growth engine for productivity and business gains has only scratched the surface. According to the Huawei analysis, businesses are still lagging behind in exploiting technology for commercial opportunities, particularly in adapting to Industry 4.0. Furthermore, industry 4.0 poses a unique challenge for companies in general and SMEs in specifically (Matt, Modrák, & Zsifkovits, 2020), and SMEs must adapt to the business difficulty during a pandemic. According to SME Malaysia (2020), the pandemic has impacted the majority of companies, especially small and medium enterprises (SMEs), which represent approximately 98.5 percent of Malaysian companies (Voon,2020). As a result, as Kergroach (2020) points out, SMEs should consider embracing new technologies, digitalization, and integrating e-commerce solutions in order to save money, time, and effort. according to Bouey (2020), SMEs might gain from enterprise platform diversity. Small and medium-sized businesses can use online platforms and virtual service offerings to stay in business during quarantines or travel bans. Furthermore, a company's ambition to expand and grow its market share over time may be a powerful motivator to boost its resilience and renewal initiatives. Alves et al. (2020) also point to a high dependence on technologies throughout the crisis, urging the government to increase its investment in the expansion of information technology (IT) and telecommunications infrastructure, as well as to assist local small and

medium-sized enterprises in adapting to the changing climate. As a result, SMEs must collaborate closely in a continuously changing business environment, and they must adapt to a new technological era. Despite these hurdles, headlines such as "the majority of SME manufacturing enterprises are not yet ready for Industry 4.0" or "Industry 4.0 has not reached SMEs" have been written about the adoption of Industry 4.0 (Olle and Clauß, 2015). Despite the government's encouragement for SMEs in Malaysia to adopt IR4.0 in their operations, most SMEs tend to underutilize the technology's potential benefits by limiting its usage to minor managerial duties (Ramdani et al., 2013). According to Ramli (2019), the technical advancements of 4.0 must be completely leveraged. Furthermore, technology 4.0 has ramifications for halal concerns such as contamination of prohibited substances in the manufacturing process. For example, the fake halal meat cartel incident reported by a Malay daily newspaper in November 2020 has caused worry among Malaysian citizens, particularly Muslims (The Malaysian reserve, 2021). Nonetheless, according to Salama (2021), a combination of serialization technology, machine learning (ML), artificial intelligence (AI), and the Internet of Things (IoT) must be used to solve the halal meat crisis problem. Aside from IR4.0 technology and halal manufacturing, e-commerce issues must also be addressed, since a firm is also concerned with everyday transactions. The halal e-commerce market is growing in strength and size as global Muslim customers spend more money on halal products (Reuters, 2015). Furthermore, Halal e-commerce makes use of technical improvements to offer information about product halal status via the internet. To summarize, the effectiveness and success of the halal e-commerce platform may become the most important concern confronting the halal industry (Jusop, Ismail & Ismail, 2017).

In addition, Cheng's (2020) study proposes that the conceptual UTAUT model may allow researchers to investigate and focus on different Islamic instrument model adoption as variables. According to the findings, there is a potential to research UTAUT extension in an Islamic context in more depth. As a result of this study, future researchers will be able to investigate other areas or concerns connected to expanding understanding about technological acceptability in order to deploy IR4.0 technology. In addition, according to Weber (2012), a theory or framework may bring something new to a field of study if the focal phenomena of a current and well-known theory or framework change in new ways or if it incorporates substantial modifications to an existing theory, such as replacing or introducing connections and constructs, or elaborating on the existing constructs and associations. As an outcome, this study can provide a new framework to the UTAUT theory by including Muamalat e-commerce as one of the new independent variables, based on earlier research. Figure 1 represent the research framework for this study.

Research Framework

Figure 1: Research framework

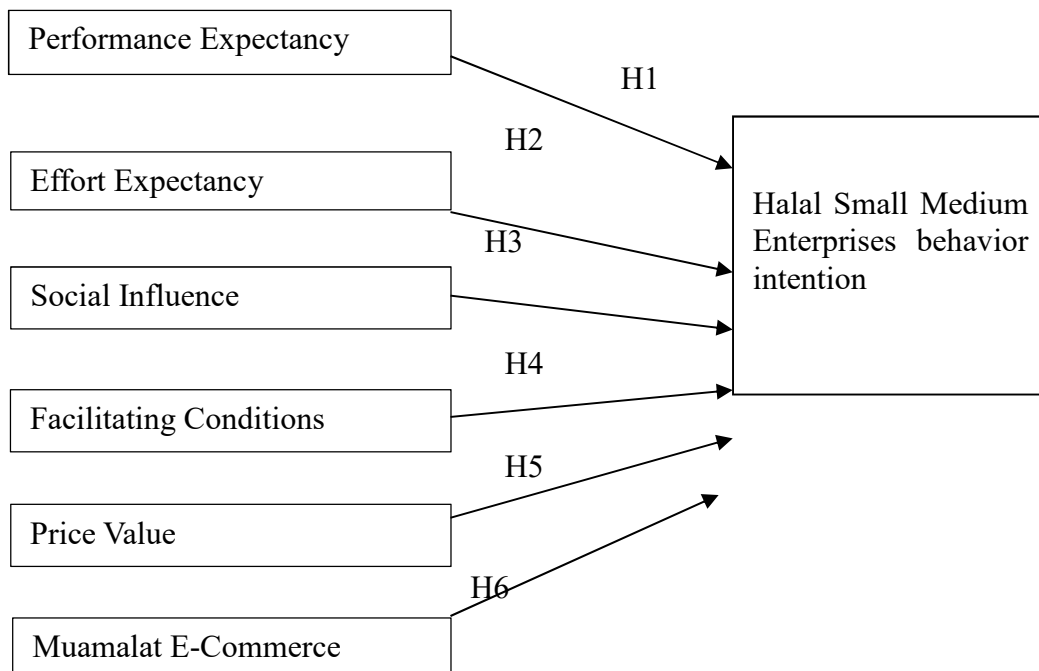


Figure 1 above is the research framework created to provide a better understanding of every variable included in the investigation. As guidelines, the model is developed based on theory model of unified theory of acceptance and use of technology (UTAUT) from Venkatesh, Morris, Davis, and Davis (2003). Based on research review, the independent variables are Halal performance expectancy, effort expectancy, social influence, facilitating condition, price value and Muamalat e-commerce. Meanwhile, the dependent variable is Halal Small and Medium Enterprises behavior intention.

METHODOLOGY

For methodology in this research, the researchers used a structured questionnaire with closed ended multiple choice questions. Questionnaires are used to collect a lot of relevant and correct information from respondents in order to acquire more responses. By using this technique, researchers also can utilize the software of Statistical Package for Social Science (SPSS) version 26.0 to analyze the data in this research. The same questions were utilized for all respondents in each research. For the purpose to achieve the study's aims, this research instrument is constructed in accordance with research questions. Five-point scales are used to measure these dimensions. A Likert-type scale, according to Alreck and Settle (1995), is more suited and more reliable for analyzing questionnaire items. A 5-point Likert-type rating scale ranging from strongly disagree to strongly agree was

utilised, as according Krosnick and Fabrigar in Lyberg et al. (1997). SMEs companies that create halal food and beverage products were the target population for this research.

DATA ANALYSIS

This research is a pilot test relating on the technology acceptance of IR4.0 toward behavior intention of halal Small Medium Enterprises (SMEs) in food and beverage sector, and the main purpose is to test the questionnaire on a minimum sample size of 30. As a result, a total of 30 surveys were distributed individually. Within two months, the questionnaire was completed and correctly returned, and it was examined for analysis. The study instrument was initially sent to specialists for input on its applicability, substance, layout, and sufficiency of the questions that are intended to evaluate the examined components. Similarly, a pilot test can aid in increasing the instrument's dependability and ensuring its suitability for data collecting (Wong and Ko, 2009). Apparently Cronbach's alpha coefficient is the most commonly used test of inter-item consistency dependability, as according Sekaran and Bougie (2010). As a result, the Cronbach alpha coefficient was used in this research to assess the instrument's internal consistency (Litwin, 1995). Factor analysis is another strategy that may be used in a pilot study. Confirmatory factor analysis was used to group all of the elements into one component. Hair et al. (2006) state that six assumptions about factor analysis must be met: (i) the sampling measure of Kaiser-Meyer-Olkin (KMO) adequacy values must be greater than 50, (ii) the Bartlett's Test of Sphericity would have to be at least 0.05, (iii) the anti-image correlation of items must be significantly larger than 0.05, (iv) the communalities of items must be higher than 0.05, (v) the factor loading minimum is 0.30, Cross-loadings, on the other hand, have a cut-off point of 0.35 (Igbaria and Iivari, 1995), (vi) the KMO sample adequacy was classified as magnificent if it was 90 or higher, meritorious if it was 70 or higher, medium if it was 60 or higher, mediocre if it was 50 or higher, and terrible if it was 50 or below as suggested by Hair, Anderson, Tatham and Black (1998).

RESULT AND DISCUSSION

Result for means, standard deviations, skewness and kurtosis are illustrating in table 1 below. Mean values in table 1 displays that for every variable ranges from 3.72 to 4.43 and are considered as medium to high. The standard deviations for these variables are ranged from 0.485 to 0.764. Based on the results, the skewness for all of the tested items ranges from -0.211 to 0.117. The normal curve is bell-shaped and is within +/- 3 standard deviations from its mean as according to Hair, Black, Babin, Anderson and Tatham (2010). Meanwhile, kurtosis values for all of the items in the test ranges from -1.664 to -0.431. Most of the kurtosis values do not exceed the threshold of +/- 10. Based on the values of kurtosis and skewness in both tests, the input of data was described as reasonably normal.

Table 1: Result for means, standard deviations, skewness and kurtosis

	Mean	Std. Error	Std. Deviation	Skewness	Std. Error	Kurtosis	Std. Error
TAPE	4.4333	.09877	.54097	-.211	.427	-1.501	.833
TAAE	4.3333	.11137	.61002	-.142	.427	-1.367	.833
TASI	4.3500	.08857	.48512	.177	.427	-1.613	.833
T AFC	4.4250	.08902	.48756	.005	.427	-1.664	.833
TAPV	3.8667	.13429	.73552	-.112	.427	-.665	.833
TAME	3.7250	.13945	.76381	.086	.427	-.431	.833
BE	4.1400	.12323	.67497	-.039	.427	-1.078	.833

N=30

The test was done to evaluate if the components for putting up the questionnaire were appropriate, as well as to determine the scale's reliability. To test the consistency of a multi-scale evaluation, Cronbach's alpha is being used to find out if all of the items assessed the same thing (DeVellis, 1991). Cronbach's alpha was selected as reasonable criteria in most reliability discussions in the study. The goal of the research field determines the degree of acceptability for reliability. Nunnally (1978), for example, believes that reliabilities of 0.50 to 0.60 are acceptable in the early phases of study, and that "for basic research, it may be claimed that elevating reliability over 0.80 is often pointless." As a result, for this experiment, the target threshold of minimal dependability was set at 0.60 or above. Table 2 reveals that the Cronbach alpha for this study is in the range of 0.7-0.9, which is favorable because it exceeds the minimum required level of 0.6. (Sekaran, 2003). As a result, the results from the pilot research are trustworthy and have an adequate level of internal consistency.

Table 2: Reliability test result

Constructs	for	Items	Correlated item- total correlation	Cronbach alpha if item deleted	Cronbach alpha	Sample size (N)
Performance Expectancy (PE)		TAPE1	.883	.883	.915	30
		TAPE2	.812	.892		
		TAPE3	.776	.902		
		TAPE4	.813	.895		
		TAPE5	.733	.908		
Effort Expectancy (EE)		TAE1	.692	.924	.913	30
		TAE2	.880	.860		
		TAE3	.860	.866		
		TAE4	.810	.890		
Social Influence (SI)		TASI1	.675	.667	.776	
		TASI2	.532	.745		
		TASI3	.626	.697		
		TASI4	.492	.766		
Facilitating Condition (FC)		TAFC1	.692	.924	.841	30
		TAFC2	.880	.860		
		TAFC3	.860	.866		
		TAFC4	.810	.890		
Price Value (PV)		TAPV1	.657	.682	.787	30
		TAPV2	.558	.782		
		TAPV3	.679	.654		
Muamalat commerce	E-	TAME1	.893	.957	.963	30

(ME)					
	TAME2	.922	.949		
	TAME3	.934	.945		
	TAME4	.892	.957		
Behavior Intention (BI)	BI1	.877	.960	.965	30
	BI2	.899	.956		
	BI3	.960	.946		
	BI4	.823	.968		
	BI5	.938	.950		

The construct of performance expectation was investigated using factor analysis, as shown in Table 3 below. All items were pushed into one factor and dropped onto a single component, resulting for 71.61 percent of the total variation in variable performance expectation. Kaiser - meyer – olkin(KMO) sampling measure was 0.873 and is considered marvelous. The Bartlett’s test of Sphericity was significant as Chi-square = 104.767 and $p < 0.001$.

Table 3. Factor Analysis on performance expectancy

Items	Factor Loading Component
I think the use of IR4.0 technologies would be useful in any halal food and beverage production task in my company	.928
I think IR4.0 technologies in halal food and beverage production enable worker to accomplish tasks more quickly	.856
The use of IR 4.0 technologies in halal food and beverage production increase my worker productivity.	.812
IR 4.0 technology can be useful tool for communication purposes	.859
IR4.0 technology has many uses for my business development	.768

Eigen values	3.581
Total Variance Explain	71.618%
KMO	.873
Barthlett's Test of Sphericity	104.767***

N=30, p <0.05*, p < 0.01**, p < 0.001***

Meanwhile, findings of the effort expectancy are shown in Table 4 below, which shows that all items of effort expectation are accepted. Because of this, neither of the effort expectancy items were dropped. Besides that, Kaiser - meyer – olkin (KMO) sampling measure was 0.808 which considered as marvelous. Moreover, with a Chi-square of 85.345 and $p < 0.001$ the Bartlett's test of sphericity was significant.

Table 4. Factor Analysis on effort expectancy

Items	Factor Loading Component
Participating in a IR4.0 technology initiative in producing halal food and beverage, would be clear and understandable.	.727
Participating in IR4.0 technology initiative in producing halal food and beverage, would be easily improve my skills at using the strategy.	.940
Participating in a IR4.0 technology initiative in producing halal food and beverage, would be easy to use.	.907
Participating in a IR4.0 technology initiative in producing halal food and beverage would be easy to integrate.	.851
Eigen values	2.958
Total Variance Explain	73.956%
KMO	.808
Barthlett's Test of Sphericity	85.345***

N=30, p <0.05*, p < 0.01**, p < 0.001***

Furthermore, table 5 below illustrates the results of factor analysis which indicated that all items of social influence were accepted. Hence, none of the items were dropped. The Kaiser - meyer – olkin(KMO) sampling is 0.589 and considered mediocre. Furthermore, with a Chi-square of 45.451 and $p < 0.001$ the Bartlett's test of sphericity was significant.

Table 5. Factor Analysis on social influence

Items	Factor Loading Component
People who influence my behavior think I should use the IR4.0 technology in producing halal food and beverage	.804
People who are important to me think that I should use the IR 4.0 technology in producing halal food and beverage	.753
The senior management of this company has been helpful in the use of IR 4.0 technology in producing halal food and beverage	.695
In general, the organization has supported the use of IR4.0 technology in producing halal food and beverage	.659
Eigen values	2.131
Total Variance Explain	53.276%
KMO	.589
Barthlett's Test of Sphericity	45.451***

N=30, $p < 0.05^*$, $p < 0.01^{**}$, $p < 0.001^{***}$

The construct of Facilitating condition was investigated using confirmatory factor analysis, as shown in Table 6. All items were pushed into one factor and dropped onto a single component, contributing for 58.082 percent of the total variation in variable performance expectation. The Kaiser - meyer – olkin(KMO) sampling is 0 .645 and is considered middling. Besides that, The Bartlett's Test of Sphericity for facilitating condition was significant with a Chi-square = 67.833 and $p < 0.001$.

Table 6. Factor Analysis on Facilitating condition

Items	Factor Loading Component
I would participate in the technology IR 4.0 initiative in producing halal food and beverage because I have access to essential resources.	.746
I would participate in the technology IR 4.0 initiative in producing halal food and beverage because I have the knowledge to use it.	.831
I would participate in the technology IR 4.0 initiative in producing halal food and beverage because my facility and equipment is compatible with the technology IR 4.0	.738
I would participate in the technology 4.0 initiative in producing halal food and beverage because I can get technical support.	.729
Eigen values	2.323
Total Variance Explain	58.082 %
KMO	.645
Barthlett's Test of Sphericity	67.833 ***

N=30, p < 0.05*, p < 0.01**, p < 0.001***

Similarly, table 7 below represents the findings of the analysis which indicated that all items of price value were accepted. Hence, none of the items were discarded. The Kaiser - meyer – olkin(KMO) sampling is 0.687 and considered middling. Furthermore, with a Chi-square of 24.844 and p< 0.001, the Bartlett's test of sphericity was significant.

Table 7. Factor Analysis on price value

Items	Factor Component	Loading
The price to purchase IR4.0 technology for food and beverage production are reasonable berpatutan		.785
The investment for IR4.0 technology is a good value for the profit.		.631
At the current price, IR4.0 technology use in manufacturing halal food and beverage provides a good value		.822
Eigen values		1.690
Total Variance Explain		56.322%
KMO		.687
Barthlett's Test of Sphericity		24.844***

N=30, p <0.05*, p < 0.01**, p < 0.001***

Table 8 below illustrate the findings of the analysis, which showed that all Muamalat e-commerce items were accepted. Thus, none of the items were dropped. The Kaiser - meyer – olkin(KMO) sample measured was 0.873, which is deemed marvelous. Moreover, Chi-square of 132.509 and p < 0.001 in factor analysis of Muamalat e-commerce, The Bartlett's test of Sphericity was also significant.

Table 8. Factor Analysis on Muamalat e-commerce

Items	Factor Component	Loading
I intend to use Muamalat e-commerce as one of the IR4.0 technologies in my organization.		.913
I intend to continue using Muamalat e-commerce in my organization in the future		.946

I will always try to use Muamalat e-commerce in my organization daily	.960
I plan to continue to use Muamalat e-commerce frequently	.912
Eigen values	3.481
Total Variance Explain	87.023%
KMO	.873
Barthlett's Test of Sphericity	132.509***

N=30, p <0.05*, p < 0.01**, p < 0.001***

At last, a similar factor analysis was performed to validate all constructs of the variable of behaviour intention. Table 9 reveals that a single factor solution was produced, representing for 84.760 percent of the total variation in the variable, and no question items were eliminated. The Kaiser-Meyer-Olkin(KMO) sample adequacy value was 0.857, which was deemed marvelous, and also the with a Chi-square of 184.639 and p< 0.001, the Bartlett's test of sphericity was also significant.

Table 9. Factor Analysis on behavior intention

Items	Factor Component	Loading
I intend to use IR 4.0 technology in producing halal food and beverage in the future	.894	
I predict I would use IR 4.0 technology in producing halal food and beverage in the future	.920	
I plan to use IR 4.0 technology in producing halal food and beverage in the future	.985	
I will always try to use IR 4.0 technology in my organization daily.	.837	
I intend to continue using IR 4.0 technology in my organization	.960	
Eigen values	4.238	

Total Variance Explain	84.760%
KMO	.857
Barthlett's Test of Sphericity	184.639***

N=30, p < 0.05*, p < 0.01**, p < 0.001***

CONCLUSION

The extended UTAUT theory was utilized in this study to examine the variables of technology adoption and behavior intention in halal small to medium enterprises in food and beverage sector. It provides crucial information to lean practitioners and companies about the major roadblocks and opportunities for improvement. A technology of IR 4.0 is one of the most crucial prerequisites for every organization's existence in today's global competitive climate. Furthermore, this will act as a platform for conducting an in-depth study on technology acceptability in the Malaysian halal food and beverage business. Moreover, the goal of this pilot research is to determine the relationship between the correlation of IR 4.0 technology adoption and the behavioral intentions of Malaysian SMEs inside the halal food and beverage industry. Furthermore, this research incorporates expanded UTAUT theories as a supplement to the study's goals, which examine Malaysian SMEs' behavioral intentions toward IR4.0 technology acceptance. Instrument validity, reliability, and data normality were explored and addressed in this pilot study. Furthermore, a huge number of variables were reduced via factor analysis to a fewer number of underlying factors that describes the information provided in each variables. Results showed that the questionnaire is trustworthy, and that the data for the preliminary research is reasonably normal. However, the questionnaire's design was only tested on a limited sample size, and the number of companies participating in this research is fairly modest. Only thirty food and beverage companies responded, and the data was subjected to extremely restricted studies and testing. To confirm the use of this research technique, a bigger sample size should be used in a future study incorporating additional Malaysian food and beverage companies. More statistical analysis, such as multiple linear regressions, path analysis, and t-tests, should be conducted.

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REFERENCES

- 27Group. (2020, February 24). 4IR and IR4 : Do you know the difference? 27 Advisory – 27Group are strategic nation building consultants with a shared vision of rebuilding humanity. <https://27.group/4ir-and-ir4-do-you-know-the-difference%EF%BB%BF/>
- Abdul Wahab, N., Wan Khairuldin, W. M. K. F., & Ismail, M. S. (2020). Fiqh Muamalat Islam: Hukum Dalam Sistem Jual Beli Atas Talian (E-Dagang) Dari Sudut Pandangan Fuqaha [Islamic Muamalat Of Fiqh: Legal System in Selling Online (E-Commerce) From The Fuqaha Islamic View]. *Al-Qiyam International Social Science and Humanities Journal*, 2(1), 24-35. Retrieved from <http://journal.al-qiyam.net/index.php/my1/article/view/36>
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. [https://doi.org/10.1016/0749-5978\(91\)90020-t](https://doi.org/10.1016/0749-5978(91)90020-t)
- Alreck, P. & Settle, R. (1995). *The survey research handbook*. New York: Irwin Press.
- Alves, J. C., Lok, T. C., Luo, Y., & Hao, W. (2020). Crisis management for small business during the COVID-19 Outbreak: Survival, resilience and renewal strategies of firms in Macau. <https://doi.org/10.21203/rs.3.rs-34541/v1>
- An, L., Han, Y., & Tong, L. (2016). Study on the factors of online shopping intention for fresh agricultural products based on UTAUT2. *Proceedings of the 2nd Information Technology and Mechatronics Engineering Conference (ITOEC 2016)*. <https://doi.org/10.2991/itoec-16.2016.57>
- Antara, P. M., Musa, R., & Hassan, F. (2016). Bridging Islamic financial literacy and halal literacy: The way forward in halal ecosystem. *Procedia Economics and Finance*, 37, 196-202. [https://doi.org/10.1016/s2212-5671\(16\)30113-7](https://doi.org/10.1016/s2212-5671(16)30113-7)
- Azmi, F. R., Abdullah, A., Bakri, M. H., Musa, H., & Jayakrishnan, M. (2018). The adoption of halal food supply chain towards the performance of food manufacturing in Malaysia. *Management Science Letters*, 755-766. <https://doi.org/10.5267/j.msl.2018.5.0010>
- Bouey, J. (2020). Assessment of COVID-19's impact on small and medium-sized enterprises: Implications from China. <https://doi.org/10.7249/ct524>
- Cheng, R. J. (2020). UTAUT implementation of cryptocurrency based Islamic financing instrument. *International Journal of Academic Research in Business and Social Sciences*, 10(9). <https://doi.org/10.6007/ijarbss/v10-i9/7880>
- Cheng, R. J. (2020). UTAUT implementation of cryptocurrency based Islamic financing instrument. *International Journal of Academic Research in Business and Social Sciences*, 10(9). <https://doi.org/10.6007/ijarbss/v10-i9/7880>

i9/7880

Department of Islamic Development of Malaysia (2014). Manual Procedure for Malaysia Halal Certification, Third Revision. Retrieve from <http://www.halal.gov.my/v4/images/pdf/MPPHM2014BI.pdf>

DeVellis, R.F. (1991). *Scale Development: Theory and Application - Applied Social Research Methods Series*, London: Sage Publications. Nunnally, J.C. (1978). *Psychometric Theory*, New York: McGraw Hill Publishing Company.

Elias, E. , Mohd Nawawi, M.N., Mahidin, N., & Pozin, F. (2019). Improving 3 RD Party Halal Local Service Providers in Halal Logistics: The Driving Factors from Malaysian F&B Manufacturing Perspectives. *International Journal of Supply Chain Management (IJSCM)*, 8 (1), 644-652. ISSN 2050-7399

Elias, E. , Mohd Nawawi, M.N., Mahidin, N., & Pozin, F. (2019). Improving 3 RD Party Halal Local Service Providers in Halal Logistics: The Driving Factors from Malaysian F&B Manufacturing Perspectives. *International Journal of Supply Chain Management (IJSCM)*, 8 (1), 644-652. ISSN 2050-7399

Elias, E. , Mohd Nawawi, M.N., Mahidin, N., & Pozin, F. (2019). Improving 3 RD Party Halal Local Service Providers in Halal Logistics: The Driving Factors from Malaysian F&B Manufacturing Perspectives. *International Journal of Supply Chain Management (IJSCM)*, 8 (1), 644-652. ISSN 2050-7399

EYs. (2019). COVID-19: Impact on Malaysian businesses. EY US - Building a better working world. Retrieve from https://www.ey.com/en_my/take-5-business-alert/covid-19-impact-on-malaysian-businesses

Gualtieri, L., Rojas, R., Carabin, G., Palomba, I., Rauch, E., Vidoni, R., and Matt, D.T. (2018). Advanced Automation for SMEs in the I4. 0 Revolution: Engineering Education and Employees Training in the Smart Mini Factory Laboratory. In 2018 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), 1111–1115. <https://doi.org/10.1109/IEEM.2018.8607719>.

Hair, J.F., Black, W.C. Jr, Babin, B.J., Anderson, R.E. & Tatham, R.L. (2006). *Multivariate Data Analysis* (6th ed.). Englewood Cliffs, NJ: Pearson Prentice Hall.

Hair, J. F., Anderson, R. E., Tatham, R. L. & Black, W. C. (1998). *Multivariate Data Analysis* (5th ed.). New Jersey: Prentice-Hall Inc.

Hair, J.F., Black W.C., Babin, B.J., Anderson R.E. & Tatham R.L. (2010). *Multivariate Data Analysis* (7th ed.). New Jersey: Prentice-Hall.

Halal Development Corporation. Halal Industry Master Plan 2030. Retrieve from <http://www.hdcglobal.com/wp-content/uploads/2020/02/Halal-Industry-Master-Plan-2030.pdf>

- Horváth, D., & Szabó, R. Z. (2019). Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities? *Technological Forecasting and Social Change*, 146(March), 119–132. <https://doi.org/10.1016/j.techfore.2019.05.021>
- Huawei (2018). Accelerating Malaysian digital SMEs. Retrieve from <https://www.huawei.com/minisite/accelerating-malaysia-digital-smes/index.html>.
- Idris, A., Edwards, H., & McDonald, S. (2017, September). E-commerce adoption in Developing Countries SMEs: What Do the Prevailing Theoretical Models Offer Us? In *Proceedings of the International Conference on E-Commerce [ICoEC 2017]* (pp. 18-20). Retrieve from <http://sure.sunderland.ac.uk/id/eprint/8301/1/ICoEC%20completed%20paper.pdf>
- Igbaria, M. & Iivari, J. (1995). The effects of self-efficacy on computer usage. *Omega*, Vol. 23(6), 587-605. [https://doi.org/10.1016/0305-0483\(95\)00035-6](https://doi.org/10.1016/0305-0483(95)00035-6)
- Jinjarak, Y., Mutuc, P. J., & Wignaraja, G. (2014). Does Finance Really Matter for the Participation of SMEs in International Trade? Evidence from 8,080 East Asian Firms. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2418272>
- Jusop, M., Ismail, R., & Ismail, N. (2017). Halal E-Commerce Measure of Success: A Consideration of Sharia Compliance Business Practice. *World Journal of Islamic History and Civilization*, 7 (4): 79-87. <http://doi.org/10.5829/idosi.wjihc.2017.79.87>
- Jusop, M., Ismail, R., & Ismail, N. (2017). Halal E-Commerce Measure of Success: A Consideration of Sharia Compliance Business Practice. *World Journal of Islamic History and Civilization*, 7 (4): 79-87. <http://doi.org/10.5829/idosi.wjihc.2017.79.87>
- Kergroach, S. (2020). Giving momentum to SME digitalization, *Journal of the International Council for Small Business*, 1:1, 28-31. DOI: 10.1080/26437015.2020.1714358
- Krosnick, J. A. & Fabrigar, L. R. (1997). Designing rating scales for effective measurement in surveys. In L. Lyberg, P. Biemer, M. Collins, L. Decker, E. DeLeeuw, C. Dippo, N. Schwarz, & D. Trewin (Eds.). *Survey Measurement and Process Quality*. New York: Wiley-Interscience
- Lee, J., and E. Lapira. 2013. Predictive Factories: The Next Transformation. *Manufacturing Leadership Journal* 20 (1): 13–24. <https://doi.org/10.3182/20130522-3-BR-4036.00107>.
- Litwin, M. S. (1995). *How to measure survey reliability and validity*. Thousand Oaks, CA: Sage
- Matt, D. T., Modrák, V., & Zsifkovits, H. (2020). Industry 4.0 for SMEs: Challenges,

opportunities and requirements. Springer Nature.

- New straits times. (2020, November 17). Robust digital strategy vital to tap halal industry potential | NST Online. <https://www.nst.com.my/opinion/columnists/2020/11/641670/robust-digital-strategy-vital-tap-halal-industry-potential>
- Olle, W., & D. Clauß. (2015). Industrie 4.0 braucht den Mittelstand–Kurzstudie. Chemnitz Automotive Institute. http://cati.institute/wp-content/uploads/2015/03/Kurzstudie_Endfassung.pdf.
- Ooi, K.-B., Lee, V.-H., Tan, G. W.-H., Hew, T.-S., & Hew, J.-J. (2018). Cloud computing in manufacturing: The next industrial revolution in Malaysia? *Expert Systems with Applications*, 93, 376–394. <https://doi.org/10.1016/j.eswa.2017.10.009>
- Ramdani, B., Chevers, D., & Williams, D. (2013). SMEs' adoption of enterprise applications: A technology-organisation-environment model. *Journal of Small Business and Enterprise Development*. 20. <https://doi.org/10.1108/JSBED-12-2011-0035>.
- Ramli, M.A. (2019). Revolusi Industri 4.0 Dan Potensinya Terhadap Industri Halal. Project: FRGS-FP007-2018A: The Development of Food Defence Model to Address Criminal Threat & Food Terrorism in Halalan Tayyiban Food Chain in Malaysia. Retrieve from https://www.researchgate.net/publication/337292484_REVOLUSI_INDUSTRI_40_DAN_POTENSINYA_TERHADAP_INDUSTRI_HALAL
- Reuters, T., 2015. State of the Global Islamic Economy. Dubai the Capital of Islamic Economy, 1-287. <http://doi.org/10.1017/CBO9781107415324.004>
- Reuters, T., 2015. State of the Global Islamic Economy. Dubai the Capital of Islamic Economy, 1-287. <http://doi.org/10.1017/CBO9781107415324.004>
- Sabidin, F. (2015). Halal Hotels In Malaysia: Certification, Issues and Challenges . *Journal of Tourism and Hospitality Essentials (THE) Journal*, Vol. No.2.2015-897. Retrieve from <http://ejournal.upi.edu/index.php/thejournal/article/viewFile/2000/1382>
- Salama. (2021, January 8). Interview: How technology is putting a stop to halal food fraud. HalalFocus.net - Daily Halal Market News. <https://halalfocus.net/interview-how-technology-is-putting-a-stop-to-halal-food-fraud/>
- Sekaran, U. (2003). *Research Methods for Business: A Skill Building Approach* (4th ed.). Kundli: John Wiley and Sons.
- Sekaran. U. & Bougie. R. (Eds). (2010). *Research Method For Business, A Skill Building Approach*. Southern Gate: John Wiley and Sons.
- Small and Medium Enterprises official website (2020). SME Annual Report 2018/19. Retrieve from

http://www.smecorp.gov.my/index.php/en/?option=com_content&view=article&layout=edit&id=391

Tarmizi, H., Kamarulzaman, N.H., Rahman. A., & Atan, R. (2020). Adoption of internet of things among Malaysian halal agro-food SMEs and its challenges. *Food Research*, 4, 256-265. [https://doi.org/10.26656/fr.2017.4\(S1\).S26](https://doi.org/10.26656/fr.2017.4(S1).S26).

Technavio. (2020, June 24). COVID-19: Significant shift in strategy of halal food market 2020-2024 | Increasing consumer expenditure on halal food to boost growth |. Retrieve from <https://www.businesswire.com/news/home/20200623005774/en/COVID-19-Significant-Shift-Strategy-Halal-Food-Market>

The Malaysian Reserve (2021, February 26). Halal council to discuss meat cartel scandal in mid-march. <https://themalaysianreserve.com/2021/02/26/halal-council-to-discuss-meat-cartel-scandal-in-mid-march/>

Venkatesh, Morris, Davis, & Davis. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27(3), 425. <https://doi.org/10.2307/30036540>

Venkatesh, Thong, & Xu. (2012). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly*, 36(1), 157. <https://doi.org/10.2307/41410412>

Venkatesh, V., Thong, J., & Xu, X. (2016). Unified Theory of Acceptance and Use of Technology: A Synthesis and the Road Ahead. *Journal of the Association for Information Systems*, 17(5), 328–376. <https://doi.org/10.17705/1jais.00428>

Viverita, R. D. K., & Kusumastuti, R. D. (2017). Awareness of halal certification of micro and small enterprises in Jakarta. *International Journal of Economics and Management*, 11(2 Special Issue), 459-471. Retrieve from [http://www.ijem.upm.edu.my/vol11_noS2/\(11\)Awareness%20of%20Hala1%20Certification%20of%20Micro%20and%20Small%20Enterprises%20in%20Jakarta.pdf](http://www.ijem.upm.edu.my/vol11_noS2/(11)Awareness%20of%20Hala1%20Certification%20of%20Micro%20and%20Small%20Enterprises%20in%20Jakarta.pdf)

Voon, Z.Y. (2020). Struggle of Malaysian SMEs During the COVID-19 Pandemic Findings from Webinar: SMEs Beyond the MCO – Lessons from the PRIHATIN Stimulus. Retrieve from <https://kasi.asia/wp-content/uploads/2020/05/KSI-Policy-Brief-Struggle-of-Malaysian-SMEs-During-the-COVID-19-Pandemic.pdf>

Vrsajkovic, D.(2016). "Evaluating Determinants of Cloud Computing Acceptance in Croatian SME Organizations" .Thesis. Rochester Institute of Technology. Accessed from <https://scholarworks.rit.edu/theses/9375>

Waehama, W., McGrath, M., Korthaus, A., & Fong, M. (2014). ICT Adoption and the UTAUT Model. Paper presented at the International Conference on Educational Technology with Information Technology, Bangkok, Thailand. Retrieve from <https://www.semanticscholar.org/paper/ICT->

Adoption-and-the-UTAUT-Model-Mcgrath-
Wachama/b6ce9b07f64c749b6647a7cb81736b58d795f0e4

- Wan Ab Karim Ghani, W. A., Salleh, M. A. M., Adam, S. N., Shafri, H. Z. M., Shaharum, S. N., Lim, K. L., Rubinsin, N. J., Lam, H. L., Hasan, A., Samsatli, S., Tapia, J. F., Khezri, R., Jaye, I. F. M., & Martinez-Hernandez, E. (2019). Sustainable bio-economy that delivers the environment–food–energy–water nexus objectives: The current status in Malaysia. *Food and Bioprocess Processing*, 118, 167–186. <https://doi.org/10.1016/j.fbp.2019.09.002>
- Weber, R. (2012). Evaluating and developing theories in the information systems discipline. *Journal of the Association for Information Systems*, 13(1), 1-30. <https://doi.org/10.17705/1jais.00284>
- Witbrodt, M., & Shapiee, R. (2013). Financial crisis, Fiqh Muamalat and international commutative transactions: An empirical assessment of the value of contemporary currency in light of the prohibition against Gharar. *Jurnal Pengurusan*, 39, 15-29. <https://doi.org/10.17576/pengurusan-2013-39-02>
- Wong, S. C. K., & Ko, A. (2009). Exploratory study of understanding hotel employees' perception on work–life balance issues. *International Journal of Hospitality Management*, 28(2), 195-203. <https://doi.org/10.1016/j.ijhm.2008.07.001>
- Yoo, S. J., Han, S.-, & Huang, W. (2012). The roles of intrinsic motivators and extrinsic motivators in promoting e-learning in the workplace: A case from South Korea. *Computers in Human Behavior*, 28(3), 942–950. <https://doi.org/10.1016/j.chb.2011.12.015>
- Zubairi, S.I., & Ghani, M. (2007). Halal Food: Scenario and Current Status in Malaysia. 10th ASEAN Food Conference (AFC) 2007. <https://doi.org/10.13140/2.1.4800.4803>.
- Zulfamy ,M.U., & Mohamad Fazli ,S.(2016). Kebaikan, kelemahan dan Isu Semasa E-Dagang. *Jurnal Pengguna Malaysia*. Jilid 26, Jun 2016. <http://journal.al-qiyam.net/index.php/my1/article/view/36/30>