

Intention On Adoption Of Industry 4.0 Technology Among Small And Medium Enterprises

Sayed Abdul Wahab Saeedi, Juwaidah Sharifuddin, Kelly Wong Kai Seng

Abstract: Industry 4.0 is a cutting edge technology in both small and large scale industries. The present study was conducted to investigate the level of intention to adopt Industry 4.0 Technologies among small and medium enterprises (SMEs) in Malaysia's dairy manufacturing companies. Using structured questionnaires, a total of 114 companies, out of 156, were respondents to the study. The findings revealed that attitude, subjective norm (SN) and perceived behaviour control (PBC) of Theory of Planned Behaviour (TPB) had positive effects on intention to adopt Industry 4.0 technologies. Usage level of technology (Low, mid and high) had moderating effects where attitude in low, mid and high levels did not impact intention. SN and PBC had impacted intention in low and mid-levels but not in high level usage of technology. The findings supported the assumptions of TPB and suggested managers and higher authority of SMEs to appreciate the impact of Industry 4.0 Technologies in their management of manufacturing industry.

Keywords: Small-medium enterprises (SMEs); Dairy manufacturing companies; Industry 4.0 Technologies; Subjective norms (SN); Perceived behaviour control (PBC); Theory of Planned Behaviour (TPB)

1 INTRODUCTION

Small and medium enterprises (SMEs) play significant roles in the economic growth and development of a country through efficient production of quality products (Ghobadian & Gallea, 1996; Chen, 2009). According to SME Corporation of Malaysia, there are two categories of SMEs: manufacturing (firms with sales turnover of less than USD13 million or full-time employees of 200 staff) and, services and other sectors (firms with sales turnover of not more than USD5 million or full-time employees of 75 staff). Presently, dairy manufacturing appears to be potentially important industry in Malaysia; thus, ensuring quality of dairy products is of absolute necessity. Quality of dairy products in this context refers to specific composition of the products being manufactured including their performances, durability, aesthetic, safety, reliability, nutritional values, hygiene and conformity to specifications that the products meet the requirements of legislation, accepted practices, prescribed rules and regulations and specified standards. In principle, these requirements help to continuously improve the quality of dairy manufacturing products of SMEs (Talib et al., 2009). The dairy manufacturing industry has created opportunities for investments by way of expansion of market, the opportunity which Malaysian SMEs should grasp. Malaysia's retail market especially in dairy food and beverage sectors have experienced substantial changes since mid-1990 (Kaliappan, et al., 2008), which in recent years, entrepreneurs have been trying to create and explore opportunities to adopt Industry 4.0 Technologies.

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2 LITERATURE REVIEW

Industry 4.0 Technologies is a concept dated as far back as 2011 from an idea promoted with the objective of allowing industrial production to experience pronounced strategic influences required for modern day global endeavours. It is a visionary idea serving as means for global interconnectivity through changes created by Information and Communications Technologies (ICT) developments. The advancement in this area of technology has the support from Internet of Things (IoT) and Internet of Services (IoS) which interconnect industrial activities externally and internally based on supply chain network, and cyber-physical systems (CPS) which have encouraged greater output from industrial operations (Kagermann, et. al., 2013; Muller, et. al., 2018). A number of scholars have emphasised on the tight interrelatedness among Industry 4.0, CPS and IoTs (Drath & Horch, 2014; Liao, et. al., 2017). For instance, Liao et al., (2017) in a meta-analysis review on Industry 4.0, affirmed that there were 249 paper publications prior to July 2016, with only three that never associated IoTs and CPS with Industry 4.0 Technologies. However, despite the disagreements in the studies on other internet concepts with respect to Industry 4.0 coverage, Kagermann et al., (2013) observed that IoS, on a broader sense, is inclusive of the abstract concepts of the Internet of Everything (IoE) and Internet of People (IoP). Nevertheless, Lu (2017) after a detailed literature review proposed that IoT did not cover any other internet concepts. Thus, the introduction of the aforementioned technologies to suppliers, manufacturing, and customers in strategic and operational domains, generated particular features that described Industry 4.0. These include digitisation, automation, decentralisation and virtualisation (that is, developing a prototype copy of a plant by connecting sensor data with replicated engineering models and simulation models) (Stock, et. al., 2018). Others are real-time data purchasing and processing and real-time data messaging (that is, a generation of ability for immediate availability of the resultant intuitions) (Kagermann, et. al., 2013). The dairy manufacturing industry is comparatively less susceptible to changes in world economy; therefore, it has

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been estimated that the present worth of US\$3.5 trillions of the worldwide retail sales in food and beverage products are projected to increase further to US\$6.4 trillion in 2020 at an annual growth rate of 4.8 per cent (MITI, 2006). A number of researchers have listed low productivity, shortage of managerial abilities, financial problems and right to use credit, and limited use of modern technology as the challenges faced by SMEs in Malaysia (Abu Bakar, et. al., 2006; Decker, et. al., 2006; Samad, 2007; SMIDEC, 2007; and Muhammad et. al., 2014). However, the contribution of SMEs in enhancing the economic growth of the country is undeniable (Hashim, 2007; Othman, et. al., 2008; and Chelliah, et. al., 2010). The present study was undertaken with the main purpose of determining the level of intention on adoption of Industry 4.0 Technologies in SMEs in Malaysia's dairy manufacturing industry.

3 THEORETICAL FOUNDATION AND HYPOTHESES DEVELOPMENT

The Theory of Planned Behaviour (TPB) is an offshoot of the Theory of Reasoned Action (TRA), developed by Fishbein & Ajzen in 1975. The measures of behaviour and social normative understanding of a particular behaviour which, create an intention to accomplish the behaviour, is a function of the principles of TRA (Montano & Kasprzyk, 2002). In the same context, Theory of Planned Behaviour (TPB) is a follow-up from the principles of aggregation, which describes that the pool of particular attitudes in various situations, provide analytical validity of behaviours and other qualities. In other words, TPB focuses on specific motivational factors within exclusive context to describe occurrence of a particular behaviour (Ajzen, 1991). However, the assumption is that intentions emphasise on the motivational factors that affect behaviour, thus implying that, an intention shows how committed an individual is ready to work, as well the extent of efforts put in, so as to execute the behaviour (Ajzen 1991). On the other hand, a normative belief is a person's opinion of social normative strains and how significant others (i.e. a spouse or partner, parent, nurse, etc.) believe in implementing the behaviour (Ajzen 2011). Nonetheless, the subjective norm is a person's personal opinion of a specific behaviour and the power of impulse to agree, with appropriate others' beliefs. The research framework by which the present study was conceptualised is as shown in Figure 1. Attitude is the level of support or lack of support for an individual's assessment of behaviour. Attitude emphasises on the understanding of results of executing the boldness and, of the examination of the associated outcomes. Purchase intention is the option of consumers' readiness in acquiring an item (Zeithaml, 1988). However, the significant effect of attitude towards intention has the support from several studies (Taylor & Todd, 1995; Korzaan, 2003; May, 2005; Kelly, et. al., 2006). In line with above reviews, the following hypotheses were proposed as follows:

(H1): Attitudes have positive impact on intention to adopt Industry 4.0 Technologies in Malaysia's dairy manufacturing industry.

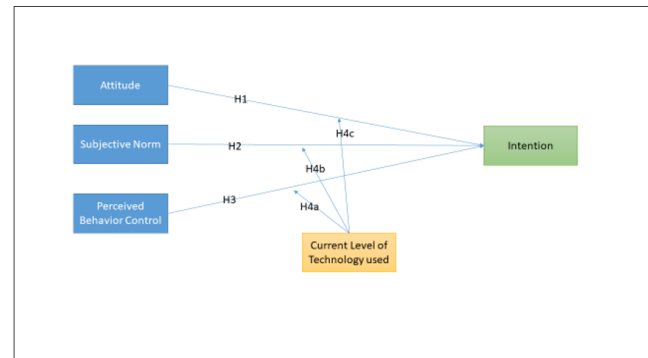


Figure 1: Research framework

Other researchers (Fishbein & Ajzen, 1975; Ajzen, 1991) characterized SN as a person's observation with respect to endorsement or dissatisfaction with his behaviour noteworthy. In a nation like Malaysia, with a culture which emphasizes the needs and goals of the group as a whole over the needs and desires of each individual. The culture is characterized by emphasis on cohesiveness and interconnectedness between people play a central role in each person's identity (Sinha et al., 2001). Subjective norm is controlled by regulating beliefs and motivation to conform to the beliefs. Subjective norm is taken into account as a right away determinant of activity intention in the Theory of Contemplated Activity (Fishbein & Ajzen, 1975) and Theory of Planned Behaviour (Venkatesh & Davis, 2000; Hagger, et. al., 2002). Some investigations (Davis, et. al., 1989; Mathieson, 1991) have shown no help for a right away connection between subjective norm and intention to use. The literature reviews form the basis for the hypothesis as follows:

(H2): Subjective norm has a positive impact on intention to adopt Industry 4.0 Technologies in Malaysia's dairy manufacturing industry.

PBC refers to people's perceptions of their ability to perform a given behaviour. It is associated with a person's awareness of the benefits and issues in acting the behavioural concern, in addition to, assigning the presence or absence of required resources and prospects. Increase within the resources (including time, money) can lead to larger perceived management of the actual behaviour (Ajzen, 1991). PBC is a reliable predictor of intentions and behaviour and can be assessed by the entire set of beliefs regarding presence of things which promote or hinder performance of behaviour. Positive relationships in PBC and intention are found in many studies (Downs & Hausenblas, 2005). However, after resources allocation and one's having the full confidence in the ability of doing things, there is a possibility of individual's positive effect concerning the usage of using Industry 4.0 Technologies. Accordingly, the third hypothesis follows:

(H3): PBC controls positively impact on intention to adopt Industry 4.0 Technologies in Malaysia's dairy manufacturing industry.

Besides behaviour with TPB, utilization of technology, is an instantaneous purpose to use that technology and PBC such that the goal of using the generation is mutually inspired through one's attitude, subjective norm, and PBC. Meta-

analyses, the analyses that combine the results of multiple scientific studies addressing the same question, advise that TPB elucidates approximately 41-50 per cent of the variance in terms of intention. In case of behaviour with non-IT applications, it is about 28-34 per cent of the variance (Godin & Kok, 1996; Albarracin et al., 2001). However, notwithstanding its good sized predictive strength, the model does not account for a big percentage of the variance in purpose and utilization. Consequently, contemporary packages of TPB with respect to organisational technology adoption reveal the impact of extra, applicable moderator variables to describe the additional variance included in the model (Morris et al., 2005). Moreover, a number of studies have reported on the adoption and use of era via the application of TPB (Taylor & Todd, 1995a, 1995b). Al-Gahtani (2003) investigated the technological factors that promoted IT adoption in Saudi Arabia, but failed to assess the organisational degree of factors which had impacted on era adoption. However, there was no investigation as to whether or not the degree of technological usage had any effect on the contents of TPB and adoption of Industry 4.0 Technology in Malaysia. Thus, the following hypothesis is proposed:

(H4): Level of technologies usage moderates the relationship between the components of TPB (attitude, subjective norms and behaviour) and adoption of Industry 4.0 Technologies in Malaysian Dairy firms.

3 RESEARCH METHODOLOGY

SAMPLES AND PROCEDURES

The study adopted a probabilistic sampling technique in which 156 registered Malaysian dairy manufacturing companies were selected as the sampling frame. The study used structured questionnaire to measure constructs in a research model. Email addresses and telephone contacts were collected from a list of organizations' associations. The questionnaires were emailed to all the companies located across the country with a kind request to respond spontaneously. At the conclusion of the exercise, only 86 companies responded. Soft reminders were sent out twice to the companies in person. At the final count, a total of 114 responses were successfully received. The questionnaire had two parts: sociodemographic and specific information. Sociographic information covered information on gender, age, race, religion, educational qualification, number of employees, businesses' operational duration, levels of technology used and sources of raw dairy products. The second part of the questionnaire covered specific information on measures of constructs/dimensions of the study. The measurement items/dimensions of constructs of attitude, SN, PBC and intention to use technology followed as proposed by Mathieson (1991). Questionnaire including measurements items were established in the English language. For better understanding of local respondents, the questionnaire were translated into the Malay language with adequate caution and sensitivity using Brislin's (1986) back translation method. Content validity of the questionnaire was confirmed by professionals and academics. Four constructs were measured using multiple measurement items. The model employed current level of technology used in a company as a moderating variable. The moderating variable from a company's profile had three levels of technology usage such

as low-, mid- and high-levels. The model comprised of three independent variables: attitude to adopt technology subjective norm, perceived behaviour control and one dependent variable namely, that is, intention to adopt technology. Table 1 shows the socio-demographic information of the respondents. Out of a total of 114, there were 89 (78.1%) male respondents and 25 (21.9 %) females. In the ethnic grouping, there were 82 (71.9%) Malays, 14 (12.3%) Chinese, 13 (11.4%) Indians and 5 (4.4%) Others. In the religion category, 95 (83.3%) were Muslims, 6 (5.3%) were Hindus, 8 (7.0%) were Christians, 4 (3.5%) were Buddhist. One respondent was from other religion. Among the respondents, 85 (74%) had tertiary education and only one respondent had non-formal education. A total of 88 of the respondents were within the age of 25 to 45 years. Table 1 also shows that among the four categories on number of employees, 89 (78.10%) of the companies had 1-30 employees which was in the lower range of employees in Malaysia, In the category of 30 to 60 employees, there were 20 (17.5%) employers. In the 60 to 121 employee categories, there were only 5 employers amounting to about 2.40%. The findings showed that 48 (42.10%) of companies had been operating their businesses from one to three years, whereas 43 (37.70%) had 4 to 6 years operational experience. Out of 114 companies, only 8 (7%) companies had seven to nine years of experience and 15 (13.20%) were doing their businesses for more than ten years. Data suggest that SMEs dairy manufacturing companies in Malaysia used various levels of technology. Among them, 37 (32.20%) companies had been using light and low level technology, 15 (13.20%) companies were using high level technology. Surprisingly, 62 (54.40%) companies adopted mid-level technology.

Table 1: Socio-demographic information and company profile

		Number of respondents	% of Total Respondent
Gender	Male	89	78.1
	Female	25	21.9
Race	Malay	82	71.9
	Chinese	14	12.3
	Indian	13	11.4
	Others	5	4.4
Religion	Islam	95	83.3
	Hindu	6	5.3
	Christian	8	7.0
	Buddhist	4	3.5
	Others	1	.9
Educational qualification	Tertiary Education	85	74.6
	Secondary education	27	23.7
	Primary education	1	.9
	Non-formal education	1	.9
Age	15 - 25	8	7.0
	26 - 35	60	52.6
	36 - 45	28	24.6
	46 - 55	13	11.4
	56 - 65	5	4.4
Number of employees	1 - 30	89	78.1
	31 - 60	20	17.5
	61 - 90	2	1.8
	121 and above	3	2.6
Business operation time	1 - 3 Years	48	42.1
	4 - 6 Years	43	37.7
	7 - 9 Years	8	7.0
	10 Years and above	15	13.2
Level of Technology Use	Low	37	32.5
	Medium	62	54.4
	High	15	13.2
Source of Dairy Product	Farm	42	36.8
	Collection Centre	26	22.8
	Overseas	15	13.2
	Mix	31	27.2

4. MEASURES OF RELIABILITY, VALIDITY AND MEASUREMENT MODEL

The present study used SEM-AMOS (Version 20) to test the relationships of the constructs. SEM-AMOS evaluated the properties of measurement model such as reliability, and validity of the scale for measuring each construct which also estimated various parameters of structure model and

measured the strength of the relationship path (Figure 2). The various indicators of the measurement model depicted that the estimates were robust in terms of internal consistency (Table 2). The Cronbach's alpha, an estimate of reliability of a psychometric test, was above 0.95. The Composite reliability, a measure of internal consistency in scale items, was also above 0.95, and the average variance extracted (AVE), a measure of the amount of variance captured by a construct, ranged from 0.84 to 0.91.

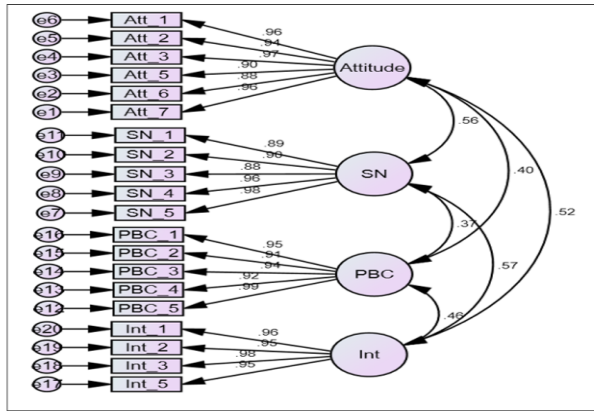


Figure 2: Measurement model

Table 2: Fitness of Model

	RMSEA	GFI	CFI	X ² /df	Discriminant Validity $r \leq 0.9$
Attitude	0.079	0.976	0.982	2.618	
Subjective Norm	0.062	0.976	0.941	2.725	
Perceived behavioural control	0.041	0.994	0.978	1.987	Correlation between a pair of latent exogenous construct was less than 0.90
Intention	0.061	0.973	0.988	1.417	

If the Cronbach's alpha was higher than 0.70 (Cronbach, 1951), and the Composite reliability was greater than threshold value of 0.70 (Nunnally, 1978), the reliability was statistically consistent. Another reliability measure was AVE which was higher than 0.50 showing internal consistency (Fornell & Larcker, 1981). These results show strong evidence that the measurement model was internally consistent. Individual confirmatory factor analysis (CFA) was tested by RMSEA, X²/df, GFI, CFI. The result showed that RMSEA was less than 0.08 (highest value was 0.079 for Attitude and lowest was 0.041 for PBC). The thresholds for GFI and CFI were 0.90 and above. The present study shows that the values of GFI and CFI were more than the acceptable level. Discriminant validity was also tested by calculating matrix diagonal namely square root of AVE and factor loading (Table 3).

Table 3: Reliability and Validity

	CR	AVE	MSV	ASV	Int.	Att.	SN	PBC
Int.	0.978	0.919	0.327	0.270	0.959			
Att.	0.977	0.875	0.318	0.250	0.522	0.935		
SN	0.965	0.847	0.327	0.260	0.572	0.564	0.920	
PBC	0.977	0.893	0.211	0.169	0.459	0.401	0.367	0.945

5 DATA ANALYSIS AND FINDINGS

The present section focuses on structural model to detect path coefficient. After observing the good fit of measurement model,

hypothesis testing was conducted. Figure 3 shows the complete model path coefficient.

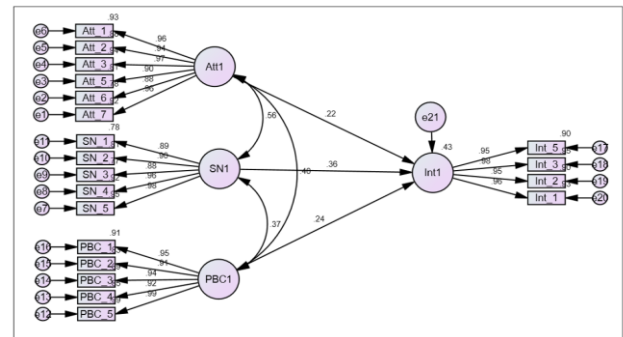


Figure 3: Structural model used to analyse structural relationships

COMPLETE STRUCTURAL MODEL

The structural model outcomes are shown in Table 4, with beta values of the path coefficients revealing direct effects of independent constructs upon dependent latent construct. Attitude towards technology showed a strong positive relationship ($\beta = 0.224$, $B = 0.402$, $p = 0.016$) on behavioural intention to adopt Industry 4.0 Technologies. SN also indicated a strong positive relationship ($\beta = 0.359$, $B = 0.741$, $p = 0.000$) on intention to adopt technology like Industry 4.0. Likewise, PBC exhibited strong positive relationship ($\beta = 0.238$, $B = 0.361$, p value = 0.004) with the intention to adopt Industry 4.0.

Table 4: Complete Model Path Coefficient

DV	IV	Standard Estimate	Nonstandard Estimate	S.E.	C.R.	P	Decision
Intention	Attitude	0.224	0.402	0.166	2.418	0.016	H ₁ is supported
Intention	Subjective norm	0.359	0.741	0.192	3.852	***	H ₂ is supported
Intention	Perceived Behavior Control	0.238	0.361	0.124	2.914	0.004	H ₃ is supported

MODERATION EFFECT

The current level of technology used in SMEs dairy manufacturing companies in Malaysia have been classified into three levels such as lower-, mid- and high-levels. This moderator (multi-group) had significant effect on intention to adopt Industry 4.0 Technologies.

STRUCTURAL MODEL: MULTIPLE MODERATION (COMPANY WITH LOW-LEVEL TECHNOLOGY USAGE)

In case of low-level usage of technology, attitude had no significant effect on intention ($B = -0.02$, $p = 0.869$) which was significant in the complete model. The other two relationships were significant as they were in the complete model (Table 5).

Table 5: Lower level of technology used

DV	IV	Estimate	S.E.	C.R.	P	Comment
Intention	Attitude	-0.039	0.238	-0.165	0.869	H ₁ is NOT supported
Intention	Subjective norm	1.308	0.247	5.285	***	H ₂ is supported
Intention	Perceived Behavior Control	0.51	0.16	3.19	0.001	H ₃ is supported

STRUCTURAL MODEL: MULTIPLE MODERATION (COMPANY WITH MID-LEVEL TECHNOLOGY USAGE)

In case of mid-level of technology used, the present study did not observe any significance in the relationships between

attitude and intention, similar to companies using lower level technology ($B= 0.479$, $p= 0.051$) as shown in Table 6.

Table 6: Mid-level of technology used

		Estimate	S.E.	C.R.	P	Decision
Intention	← Attitude	0.479	0.246	1.947	0.051	H ₁ is NOT supported
Intention	← Subjective norm	0.514	0.241	2.133	0.033	H ₂ is supported
Intention	← Perceived Behavior Control	0.549	0.191	2.882	0.004	H ₃ is supported

STRUCTURAL MODEL: MULTIPLE MODERATION (COMPANY WITH HIGH-LEVEL TECHNOLOGY USAGE)

In the case of high level of technology used in companies, the three hypotheses were rejected. In this category SMEs, the dairy manufacturing companies were not interested in adopting Industry 4.0 Technologies as shown in Table 7.

Table 7: Higher level of technology used

		Estimate	S.E.	C.R.	P	Decision
Intention	← Attitude	0.467	0.426	1.096	0.273	H ₁ is NOT supported
Intention	← Subjective norm	0.444	0.653	0.68	0.497	H ₂ is NOT supported
Intention	← Perceived Behavior Control	0.124	0.327	0.379	0.705	H ₃ is NOT supported

6 DISCUSSION

At the conclusion of the present study, the predictive variables of TPB were found to be valid, as the assumption of the model had been satisfied. Attitude towards adoption of Industry 4.0 Technologies, SN and PBC were statistically significant. In multi-group moderation, attitude became insignificant in case of lower technology user. Malaysia has been developing and on the way to be a developed nation. For this reason, lower level companies have less intention to adopt new technology. The study revealed that attitude ($B= 0.402$, $C.R. = 2.418$ and p value (0.016) < 0.05) positively and significantly affected intention to adopt new technology in SME dairy manufacturing companies. The present findings support that of Al-Ajam & Nor (2013). Baker, et. al., (2007); Smith & Terry (2003); and Park (2000). The effect of attitude on intention is desirable and contributory. With the change of technology, human minds, being curious, have been continuously reshaped. In meeting demand to remain in competition and expansion of business, there is no other alternative but to adopt new technology. The study also affirmed that subjective norm ($B= 0.741$, $C.R. = 2.418$ and P (0.000) < 0.05) had positive and significant relationships with intention to adopt Industry 4.0 Technologies similar to findings of Hartwick & Barki's (1994). The results of empirical studies in the literature support the present findings which are consistent in encompassing the trend in Malaysian business context (Park, 2000; Smith & Terry, 2003; Al- Baker, et. al., (2007); Gahtani & Hubona, (2007) and Al-Ajam & Nor,(2013). The study also revealed that PBC ($B= 0.361$, $C.R. = 2.914$ and p (0.004) < 0.005) had positive and significant relationships with intention to adopt Industry 4.0 Technologies, which corresponded with the findings of Park, 2000; Smith & Terry, 2003; Jaruwachirathanakul & Fink, 2005; MdNor & Pearson, 2006; Baker, et. al., 2007; Al-Majali & Nik Mat, 2010 and Al-Ajam & Nor, 2013. Industry 4.0 Technologies is a buzz word and considering the benefits and control of this new technology, creates a vibrant in the minds of entrepreneurs. Entrepreneurs' knowledge about Industry 4.0 Technologies is undoubtedly contributing to rethink about adoption. The study showed moderating effects of the current level of technological

usage in SME dairy manufacturing companies in Malaysia. Regardless of the direct effect, the moderating effect was the main contribution to the study. The three levels (low-, mid-, high-levels) of usage of technology had moderating roles on intention and while the other two constructs, Subjective Norm and PBC had no contribution. Attitude had direct positive effect but in the case of low- and mid-level technology, usage had no effect. However, in companies using high level technology, attitude had positive effect. This moderating role can be explained that those using high level of technology from the beginning, were found to be more interested to adopt state of art technology. On the contrary, companies which were not using or were using little or mid-level technology, were less interested. This ignorance or abhorrence was due to lack of capital, expert, and infrastructure.

7 CONTRIBUTIONS, LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

The present study is relevant for dairy companies in Malaysia as it provides information on Industry 4.0 Technologies adoption. For the benefits of having a competitive advantage over rivals and for sustainable development, dairy firms should focus on the adoption of Industry 4.0 Technologies. The findings could assist managers and higher authority of small and medium enterprises and policy makers to appreciate the impact of Industry 4.0 Technologies Higher authority of SMEs could also use the information when preparing policies relating to Industry 4.0 Technologies adoption. With continuing globalization, in which countries are coming together as one big global economy, intention to adopt Industry 4.0 Technologies will definitely contributes immensely to the successful technology adoption and implementation throughout various organizations and diverse cultures. Nevertheless, the study had the following limitations: the sampling frame engaged to select 114 SME companies out of 156 may limit generalization of the adoption of Industry 4.0 Technologies in Malaysia. Other sectors identified in the classification by SME Corporation of Malaysia can also be studied with respect to intention to adopt the Industry 4.0 Technologies. From this perspective, it is proposed that the number of respondents and companies used are to be increased for higher coverage of study on the issue at hand. A longitudinal study can be involved in future studies to evaluate the trends in the adoption of Industry 4.0 Technologies and the achievements made in the respective sectors.

8 CONCLUSION

As a model in investigating the influences of the various constructs in the study, TPB has been validated with respect to the Malaysian dairy industries. TPB has accounted for approximately 43 percent of the variance in intention to use Industry 4.0 Technologies by the Malaysian dairy firms' employees. In terms of the three levels of moderation effects with respect to the low- level, mid-level and high-level technology usages, it was revealed that there existed moderation effects in lower and mid-level technology usage. Therefore, intention was influenced by only attitude and not by SN and PBC. In the case of high-scale of technology usage, attitude, SN and PBC had no moderation effect on intention, which, implies that SME dairy manufacturing companies having high scale usage of technology, were not intending to adopt Industry 4.0 Technologies. The findings could assist

managers and higher authority of SMEs and policy makers to understand the impact of Industry 4.0 Technologies on their firms. The findings of Venkatesh et al., (2000) and Morris et al., (2005) were established to be non-relevant, at least with respect to the Malaysian dairy companies' employees. For the sake of earning competitive advantages in the market area, entrepreneurs in SMEs especially the dairy manufacturing firms in Malaysia should focus on the adoption of Industry 4.0 Technologies.

9 ACKNOWLEDGMENT

First of all, I would like to express my most sincere gratitude to Allah who has seen it fit to grant me the opportunity to achieve my educational goal. I know it was nothing but Allah's grace and mercy that brought me through this process, and I owe everything that I have accomplished to him. I would like to take the opportunity to acknowledge the support and help of all who have assisted me in the research. Without their contribution and advice, I would have never been able to progress with the work in the thesis. First, I would like to sincerely thank my supervisor, Dr. Juwaidah Sharifuddin, for her guidance, support, technical knowledge and encouragement in the whole research process and work. Secondly, I would like to thank my co-supervisors: Dr. Kelly Wong Kai Seng for his constructive feedback. His support contributed to the success of this research. With a full my heart, I say thank you all. Finally, I would like to thank you who prayed, encouraged, and supported me in this academic journey especially my respected parents and all members of my family.

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