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E-wallet: The Mediating Effect of Innovation Characteristics on the Relationship between Network Externalities, Attitude and Brand Image

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Abstract **–** Technology development has brought about an innovation known as e-wallet that simplifies how financial transactions operate nowadays. This paper aimed to explore the effects of network externalities (NE) by incorporating innovation characteristics from diffusion of innovation (DOI) theory as a mediating factor in analyzing the parallel relationship of NE with attitudes and the serial relationship of NE with brand image. The data was analyzed using the PLS-SEM technique. The findings concluded that NE significantly and positively influences the attitudes and brand image of e-wallet. Furthermore, the results show that relative advantage, compatibility, and perceived ease of use derived from DOI all positively and significantly mediate the relationship of NE with attitudes and brand image of the e-wallet. Among these, compatibility is the most impactful factor in mediating all the defined relationships. However, observability and trialability are found to be insignificant as mediators in either parallel or serial mediation of this study. The outcomes of this study contribute to the literature on e-wallet that explores the relationship of NE with attitudes and the study of brand image as well as the mediation effect of innovation characteristics in these relationships.

Keywords – E-Wallet; Network Externalities; DOI; Brand Image; Attitudes

I. INTRODUCTION

Virtual wallet known as electronic or e-wallet is one of the technological innovations within financial environment that turns conventional payment system into digital. It is a type of prepaid account in which users can deposit and store money for future online transactions [1]. E-wallet are becoming one of the most popular payment methods, leading Southeast Asia in digital wallet usage at 40 percent ahead of the Philippines, Thailand and Singapore [2]. This growth gives rise to the formation of Network Externalities (NE) concept.

NE is a term from economics concept that refers to situations where the value of a good or service changes as the number of users rises or falls [3]. It is expected that the value of e-wallet increases with the rise in the number of users causing a positive NE effect. Further, NE also emerged as a key in an enterprise marketing strategy for brand promotion [4]. Not only that, the relationship between adoption rate and brand image is an ongoing cycle since brand image fosters trust, which in turn increases people's propensity to adopt a particular brand's innovation. This properly captures the essence of NE and adoption rate towards brand image.

Nevertheless, the influence of NE on technological adoption and the establishment of particular brand image can be different, depending on the innovation characteristics of the product. In reality, there is still a dearth of research on the existence of a mediating effect of innovation traits that affect the link between constructs.

Therefore, this study intends to create and empirically test a theoretical framework that combines NE, innovative characteristics, and technological acceptance on potential Malaysian

adopters' intentions to embrace an e-wallet, in which characteristics from diffusion of innovation (DOI) theory act as a mediator between the linkages. Additionally, this study also aims to answer the following: (1) how do NE affects consumers' attitude towards adopting e-wallets and brand image? (2) How do NE and attitudes change image of e-wallets brands? (3) Does innovation characteristics of DOI have a mediating strength in between the relationship of NE, attitudes towards e-wallets adoption and brand image? As a result, this study seeks to support the significance of NE and the DOI theory in affecting attitudes about e-wallet adoption and brand perception.

II. Literature Reviews

Several researchers have studied and predicted the attitude towards the adoption of mobile wallet in the past [5]-[6]. Some of the scholars developed a model based on a single theory to look into the direct effects of the factors on e-wallet adoption [7]-[8], while others employed a combination of theories to study consumers' attitude or behavioral intentions towards the adoption of e-wallet [9]-[10].

Technology acceptance model (TAM), unified theory of acceptance and use of technology (UTAUT), theory of reasoned (TRA), and diffusion of innovation (DOI) are among the theories frequently used I e-wallet research. These theories play a crucial role in understanding the elements that affect technology adoption decision [11]. Despite that, there is little to no known researches that emphasize the role of the theories in mediating the relationship between NE, adoption rate, and brand image. Hence, this research went a step further to assess the degree to which the innovation features from the prevailing hypothesis mediated the association between the defined components.

A. Diffusion of Innovation (DOI)

Diffusion is the process by which an innovation spreads over time through particular social systems or channels [12] and DOI asserts that the perceived features of an innovation are important determinants of its adoption rate [13]. According to Lechman [14], various diffusion channels are used by technological innovation to connect with the social, economic, and institutional environment. With such interlink relationships, it is necessary to analyse the effect of NE on attitude towards e-wallet adoption and brand image when it is mediated by the constructs of DOI.

Rogers [12] in his work mentioned that that the primary innovation features that account for nearly half of the diversity in adoption rates are relative advantage, complexity, compatibility, trialability, and observability. The present article suggest to integrate and contrast previous studies using the theoretical framework that positions all five constructs of DOI theory as a mediator.

Although complexity is also an element of DOI theory and is often utilized in evaluating the adoption of IT related research [9], [15], in this study, complexity is being substituted with perceived ease of use (PEOU). The idea was supported by Moore and Benbasat [16], where complexity is similar to PEOU in technology acceptance model. An equivalent approach has been employed in prior studies [17]-[18], with the conclusion that PEOU can be used to substitute complexity assessment.

III. Research Framework and Hypothesis Development

A. Network Externalities

Technologies have been able to propagated even more quickly due the emergence of network effects [14]. When a specific innovation has a sufficient user base, the value rises to directly benefit potential adopters. Information dissemination is accelerated and shaped through information transfer. Hence, NE is essential for the process of innovation's diffusion. NE can be categorised into two types: direct and indirect [19].

Direct NE refers to the benefits obtained from the increased size of the user base [20] and it positively affect consumers' attitude toward e-wallet adoption [21]. This positive NE may have a "bandwagon effect," whereby potential adopters' opinions are influenced by "mass behaviour". On the other hand, indirect NE occurs when the value of a specific service or product increases as a result of an expansion of the user base, ultimately causing an increase in the availability of complementary goods and services [22]-[23]. Potential consumers' attitudes regarding the use of e-wallets may be positively influenced by these additional services and offers. Thus, the following hypothesis is put forth:

H1: NE significantly and positively influences attitude towards e-wallet adoption.

As the size of NE can have both direct and indirect effect on innovations perceived value, these values will become the foundation of the brand image establishment that represent the identity of the product itself among the public. Thus, NE is crucial in deciding how customers perceive a brand, which led to the following hypothesis:

H2: NE significantly and positively influences brand image.

B. *Mediation Effect of Innovation Characteristics*

Not only direct effect, the relationship between NE and attitude could be mediated by different innovation characteristics of DOI. Multiple studies has been conducted to understand consumer behaviour in technology adoption and found that innovation characteristics play an influential role to mediate the relationship between NE and attitude [13], [24].

NE and relative advantages (RA) from DOI are positively correlated. The criteria of e-wallets that able to speed up and make the payment process more convenient provide unbeatable experiences to the users. As the number of users increase, more improvement and services will be offered, increasing the value of the product even more which in turns signifying the RA characteristic. It is proven that the existence of RA influence consumers to express positive attitude towards adopting the innovation such as e-wallets [5]. Also, with larger user base, word-of-mouth (WOM) becomes a powerful tool to spread the information about RA of certain product efficiently throughout social circles.

Likewise, the perspective of people on brand image can also be conveyed effectively through WOM [25]. In this sense, once consumers discover the RA traits and develop positive attitude towards the brand, they tend to share and proclaim brands that are found to be satisfying their needs. This will eventually give more recognition towards the brand within the industry. Thus, the following mediation hypotheses are proposed:

H3: RA significantly and positively mediates the relationship between NE and attitude.

H8: RA and attitude significantly and positively mediate the relationship between NE and brand image.

Within the theory of DOI, perceived compatibility (PC) is one of the fundamental aspects deemed to affect consumers' behaviour towards innovation. It reflect the degree to which a new technology meets the habits, values and needs of the potential adopter [12]. Individuals tend to use the technology if the innovation is consistent with their current habits or lifestyle, previous experiences, values, and beliefs. Prior studies also support the significant influence of PC on the intention to adopt e-wallets [26]-[27].

As a social marker, brands serve as a driving force behind consumer behaviour and consumers frequently favour and stick with the brand that compatible with their actual or ideal preferences [28]. This point towards new value creation to the brand in which positive attitude towards the adoption of e-wallets formed via NE [29] and compatibility leads to the enhancement of the brand image. Hence, the following hypotheses are proposed:

H4: PC significantly and positively mediates the relationship between NE and attitude.

H9: PC and attitude significantly and positively mediate the relationship between NE and brand image.

Previous studies revealed a profound impact of perceived ease of use (PEOU) on the formation of a positive attitude towards the adoption of mobile wallets [30]-[31]. Given that NE could give users the impression of easy to use with the amount of people using the service, it could also further influence others to adopt e-wallet [32]. Seeing firsthand how the technology being extensively used in public with such a vast user base, potential users will have the impression of being easy to adapt to such change.

There have been researches that showed PEOU as having influence in increasing the value of innovation [9],[18]. Besides, an e-wallet brand that is simple to use could foster a favourable attitude among potential consumers than an e-wallet product that is difficult to use [5]. With the existence of multiple brands that offer e-wallet service, majority of users often further compare the ease of use before deciding on which brand to adopt. In the end, brand

image can ultimately be enhanced as more people become aware of which brand offer PEOU. In accordance with that, the following hypotheses are proposed:

H5: PEOU significantly and positively mediates the relationship between NE and attitude.

H10: PEOU and attitude significantly and positively mediate the relationship between NE and brand image.

Diverse authors have stated that obsevability (OB) of DOI helps to improve the visibility of e-wallets [33],[18]. When consumers get the impression that e-wallets are being widely used in the society, it could establish a false critical mass phenomenon [10]. This situation would encourage and urge non-users to adopt e-wallets because observing the increase in usage within society makes them consider e-wallets as a necessity.

In regards to the functionality of OB that affects the diffusion of innovation more significantly when the user base is large [4], the impact could also shine the brand image in a positive light. This is because, prospective customers gain confidence and certain level of brand trust on brand that garnered high number of users. This study suggests the important criterion of OB in optimizing the value of NE and consumers' attitude towards adopting e-wallets and influence brand image. Therefore, the following hypotheses are proposed:

H6: OB significantly and positively mediates the relationship between NE and attitude.

H11: OB and attitude significantly and positively mediate the relationship between NE and brand image.

Consistent with the claim of Rogers [12], trialability (TR) characteristic of an innovation reassure potential adopters to embrace new technology as they are allowed to experience and experiment with it before an actual adoption. Consumers' fears of the unknown may be lessened if given the chance to test out the new product, giving them more room to build confidence on implementing the innovation. This sense of confidence gives rise to the development of positive attitude towards e-wallet innovation. Moreover, TR has demonstrates the ability to speed up the diffusion process of an innovation through the formation of a positive attitude amongst consumers [15], [18] and eventually increase the number of e-wallet adopters [34].

Trial periods enable potential customers to determine which of the e-wallet brands is compatible with their present habits because different brands offer different services through their platform [23],[35]. With consumers preferring to adopt an e-wallet that provides a trial period, any brand that offers such functionality will lead to positive sentiments towards the innovation and eventually improve the brand image in the eyes of consumers which direct them to try out e-wallets of certain brands instead of others. Hence, the following hypotheses are proposed:

H7: TR significantly and positively mediates the relationship between NE and attitude.

H12: TR and attitude significantly and positively mediate the relationship between NE and brand image.

Figure 1 show the proposed theoretical research framework derived from all the proposed research hypotheses.

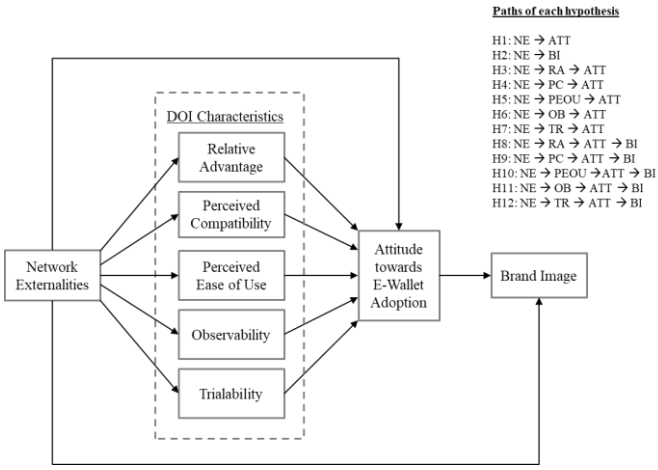

Fig. 1 Theoritical research framework

IV. METHODOLOGY

To accomplish the goal of the study, a structured questionnaire based on the eight identified elements (NE, RA, PC, PEOU, TR, OB, ATT and BI) was created and distributed to Malaysian consumers. The questionnaire was divided into three segments: a brief introduction, a segment covering respondents' general demographic data, and the last

one covers the construct measures of identified variables. All measuring constructs adopted a 7-point Likert scale ranging from "Strongly Agree" (7) to "Strongly Disagree" (1). Each construct is represented by its own measurement items in the questionnaire.

The items for NE were drawn based on Lin and Lu [36], and Top et.al [37]. Items for RA and PC were adapted from Lok [38], and Moore and Benbasat [16]. PEOU items were derived from the work of Davis [39], OB from Moore and Benbasat [16] with TR taken from the research of Karahoca et.al [15] and BI comes from Sasmita and Mohd Suki [40]. Lastly, items for ATT were constructed based on the study of Taylor and Todd [41].

The minimum requirement of the participant of the study is that they must have at least heard of e-wallets and understand their primary purpose. However, avid users of e-wallets were excluded to avoid bias and focus more on potential adopters. The data collection process was carried out through online and offline survey. Through judgemental sampling method, the responses are being filtered out to only Malaysian respondents who are aware of the e-wallet but haven't used it or aren't actively using the service. Combining online and offline replies, the exercise yielded a total of 365 valid responses. Based on the 'five times' rules by Goodhue et.al [42], the sampling size for this study is already sufficient and beyond the minimum requirement.

Out of the 365 participants, 172 participants (47.1%) were male, and the rest of the 193 participants (52.9%) were female. Among those, 282 respondents (77.3%) reported using e-wallet occasionally; 54 respondents (14.8%) responded that they had never used an e-wallet; and 29 respondents (7.9%) did not have an e-wallet account. Majority have experiences in using e-wallet but not as their main cashless payment option. Hence, based on their usage behaviour, their participation within the study is accepted.

V. RESULTS

The analysis of the data was conducted using Partial Least Square-Structural Equation Modelling (PLS-SEM) via SmartPLS software. Compared to other methods, PLS-SEM has the advantage of handling both reflective and formative indicators to construct and able to accommodate small sample size [43]. The analysis was carried out using the suggested two-step analytical procedures that consist of measurement model validation and structural model testing. Finally, the structural model is further validated via path coefficient analysis on direct and mediating hypothesis relationships.

A. Measurement Model Evaluation

In order to ensure that all items are good indicators of the latent variables, a test for reliability, convergent validity and discriminant validity were conducted. Table 1 reveals that all factor loadings met the minimum requirement of at least 0.7 [44], except for item RA6. Since the value does not achieve the minimum of recommended threshold, item RA6 was eliminated from the scale of RA and revised values were captured after the correction. Thus, the convergent validity of the measurement instruments is confirmed.

The inner reliability of the measurement instruments is assessed using Cronbach's Alpha, composite reliability, and AVE coefficients. Based on Table 1, these statistic surpass the recommended value of 0.7[45], [46] and 0.5 [43], respectively, demonstrating the constructs' reliability.

With respect to analysing the discriminant validity, this study makes use of HTMT method that measures the similarity between variables. Table 2 shows that the HTMT values for all constructs met the requirement by not exceeding 0.85 [47], ensuring that discriminant validity has been established between two reflective constructs.

B. Common Method Variance (CMV)

CMV is defined as systematic variance found in measurements when different variables are measured with the same method or source. In this study, measured latent marker variable (MLMV) is used to detect CMV. Multiple unrelated measures are collected concurrently during data collection.

These MLMVs should not have any relationship with other measures to reflect the common method. The simplest way of detecting CMV using MLMV is by comparing the R^2 before and after inserting MLMV. The changes in R^2 should be limited to 10% in order to avoid the CMV issue. Referring to Table 3, the changes of R^2 in this study were less than 10%, indicating that CMV was not an issue.

Table 1 Measurement model

	Items	Initial Loadings	Revised Loadings after Removal	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Attitude (ATT)	ATT1	0.935	0.934	0.973	0.978	0.883
	ATT2	0.915	0.915			
	ATT3	0.952	0.952			
	ATT4	0.944	0.944			
	ATT5	0.946	0.946			
	ATT6	0.945	0.945			
Brand Image (BI)	BI1	0.892	0.892	0.955	0.964	0.818
	BI2	0.916	0.916			
	BI3	0.85	0.85			
	BI4	0.9	0.9			
	BI5	0.946	0.946			
	BI6	0.918	0.918			
Network Externalities (NE)	NE1	0.854	0.854	0.929	0.946	0.779
	NE2	0.909	0.909			
	NE3	0.881	0.881			
	NE4	0.891	0.891			
	NE5	0.878	0.878			
Observability (OB)	OB1	0.82	0.82	0.913	0.932	0.697
	OB2	0.76	0.76			
	OB3	0.875	0.875			
	OB4	0.848	0.848			
	OB5	0.852	0.852			
	OB6	0.852	0.852			
Perceived Compatibility (PC)	PC1	0.903	0.903	0.97	0.976	0.87
	PC2	0.934	0.934			
	PC3	0.963	0.963			
	PC4	0.954	0.954			
	PC5	0.921	0.921			
	PC6	0.918	0.918			
Perceived Ease of Use (PEOU)	PEOU1	0.931	0.931	0.951	0.963	0.838
	PEOU2	0.906	0.906			
	PEOU3	0.896	0.896			
	PEOU4	0.901	0.901			
	PEOU5	0.941	0.941			
Relative Advantage (RA)	RA1	0.737	0.746	0.858	0.898	0.639
	RA2	0.809	0.823			
	RA3	0.848	0.857			
	RA4	0.705	0.724			
	RA5	0.827	0.837			
	RA6	0.688	-			
Trialability (TR)	TR1	0.879	0.879	0.893	0.922	0.704
	TR2	0.888	0.888			
	TR3	0.881	0.881			
	TR4	0.788	0.788			
	TR5	0.749	0.749			

Table 2 Heterotrait-Monotrait Ratio - (HTMT)

	ATT	BI	NE	OB	PC	PEOU	RA	TR
ATT								
BI	0.707							
NE	0.701	0.635						
OB	0.57	0.638	0.659					
PC	0.721	0.435	0.59	0.431				
PEOU	0.766	0.565	0.63	0.485	0.735			
RA	0.691	0.505	0.659	0.417	0.648	0.704		
TR	0.588	0.527	0.608	0.648	0.478	0.607	0.519	

Table 3 Assessment of CMV by MLMV

	R Square	**After CMV**	**Percentage of Changes**
ATT	0.683	0.686	0.44%
BI	0.505	0.511	1.19%
OB	0.371	0.383	3.23%
PC	0.315	0.318	0.95%
PEOU	0.353	0.363	2.83%
RA	0.354	0.356	0.56%
TR	0.308	0.324	5.19%

C. Structural Model Assessment

Using bootstrapping technique via SmartPLS software, the study assess the structural model. It is vital to ensure that collinearity between constructs is not an issue before assessing mediating effects [48]. Thus, the variance inflation factor (VIF) was assessed prior to the analysis to measure collinearity. High collinearity should be avoided and Table 4 shows that VIF values for all constructs are well less than 3.3 [49], implying the non-existent of collinearity issues between constructs and free from common bias issues.

Table 4 Assessment of Variance Inflation Factor (VIF)

Construct	**Variance Inflation Factor (VIF)**
Relative Advantage	2.015
Perceived Compatibility	2.215
Perceived Ease Of Use	2.649
Trialability	1.876
Observability	1.859
Network Externalities	2.317
Brand Image	1.000
Attitude	1.807

D. Hypotheses Testing

In accordance to the nature of this research, the hypotheses among constructs are tested in two blocks as in direct and indirect effect. Figure 2 summarises the path coefficient of the structural model.

1) Direct Effect: The finding in Table 5 demonstrates the direct hypothesised association between constructs. The outcomes stated that the direct hypotheses of H1 (b = 0.178, t-value = 3.146) and H2 (b = 0.257, t-value = 3.853) are reinforced as the individual t-values are greater than 1.96 at $p < 0.05$ significance level, indicating that the items are significantly and positively able to predict e-wallet adoption.

Apart from that, except for the direct impact of OB and TR on ATT, all items are significantly and positively influencing one another based on the predetermined path. Due to the failure of achieving the minimum requirements of t-value > 1.96 and p-value < 0.05, these two innovative characteristics conclusively demonstrate an insignificant direct impact on ATT.

2) Mediation Effect: Mediation analysis assesses the indirect effect of the independent variable on the dependent variable via an intervening variable. With the inclusion of innovation characteristics as a mediator, there are two types of mediation examined in this study. Parallel mediation represents the linkage of NE and the construct of attitude with DOI characteristics as the mediators (H3-H7). On the other hand, serial mediation signifies the role of DOI characteristics and attitude as the mediator in between the construct of NE and brand image of e-wallet (H8-H12).

Table 6 depicts the outcomes of examining the parallel and serial mediating effects of constructs.

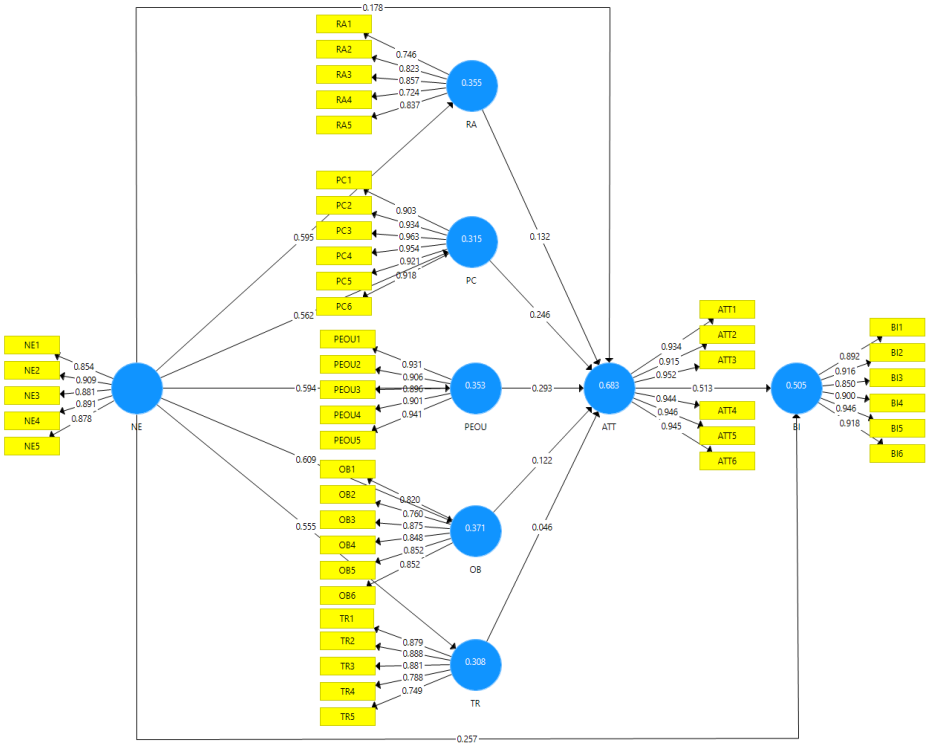

Fig. 2 Path coefficient of structural model

The findings show that H3 to H5 of parallel relationships positively and significantly mediates the relationship between NE and ATT as t-values are greater than 1.96, and corresponding p-values are less than 0.05 significant levels. Nevertheless, the results revealed that the parallel association of OB and TR fails to meet the standard threshold, which means both do not significantly mediate the relationship between NE and ATT. Hence, the proposed H6 and H7 were not supported.

The findings also support H8 to H10 as positive and significant serial mediation relationships. However, the two constructs consisting of OB and TR that were found to be insignificant and not supported by the previous analysis, also do not meet the requirements here. Hence, H11 and H12 are excluded.

Table 5 Direct Effects

Path	Hypothesis	Path Coefficient (b)	Standard Deviation	t-value	p Values	Findings
NE -> ATT	H1	0.178	0.057	3.146	0.002	Significant & positive
NE -> BI	H2	0.257	0.067	3.853	0	Significant & positive
NE -> OB	-	0.609	0.044	13.757	0	Significant & positive
NE -> PC	-	0.562	0.038	14.874	0	Significant & positive
NE -> PEOU	-	0.594	0.04	14.86	0	Significant & positive
NE -> RA	-	0.595	0.037	15.971	0	Significant & positive
NE -> TR	-	0.555	0.048	11.642	0	Significant & positive
OB -> ATT	-	0.122	0.063	1.946	0.052	Insignificant
PC -> ATT	-	0.246	0.061	4.005	0	Significant & positive
PEOU -> ATT	-	0.293	0.055	5.321	0	Significant & positive
RA -> ATT	-	0.132	0.055	2.396	0.017	Significant & positive
TR -> ATT	-	0.046	0.049	0.939	0.348	Insignificant
ATT -> BI	-	0.513	0.062	8.236	0	Significant & positive

Table 6 Indirect/Mediating Effects

Path	Hypothesis	Path Coefficient (b)	Standard Deviation	t-value	p Values	Findings
NE -> RA -> ATT	H3	0.079	0.033	2.361	0.018	Significant & positive
NE -> PC -> ATT	H4	0.138	0.037	3.721	0	Significant & positive
NE -> PEOU -> ATT	H5	0.174	0.035	5.03	0	Significant & positive
NE -> OB -> ATT	H6	0.074	0.04	1.884	0.06	Insignificant
NE -> TR -> ATT	H7	0.025	0.027	0.933	0.351	Insignificant
NE -> RA -> ATT -> BI	H8	0.04	0.019	2.175	0.03	Significant & positive
NE -> PC -> ATT -> BI	H9	0.071	0.018	3.851	0	Significant & positive
NE -> PEOU -> ATT -> BI	H10	0.089	0.022	4.056	0	Significant & positive
NE -> OB -> ATT -> BI	H11	0.038	0.023	1.688	0.091	Insignificant
NE -> TR -> ATT -> BI	H12	0.013	0.014	0.938	0.348	Insignificant

VI. Discussion

This study presents an integrated theoretical framework that explores the mediating effect of innovation characteristics in parallel and serial relationships of NE with attitude and brand image of e-wallet. Overall, the results suggest that the perception of a large number of e-wallet users will lead to a positive attitude on the product and better perception on how consumers view the brand. Indeed, NE enriches with significant mediating factors present solid reasons to persuade potential e-wallet adopters.

The findings of this study provide clarity regarding the direct effect of NE on the attitude and brand image of e-wallet. Since NE able to create such bandwagon effect, consumers will perceive large number of users as being trusted by many, which induces a favourable view on the adoption of e-wallet, proving H1. Moreover, with NE, consumers tend to feel more familiar with a certain e-wallet brand as it is widely used amongst people in their social circles [4], encouraging them to opt for the same brand, leading to H2 being accepted.

As previously hypothesised, RA has a mediating effect on attitudes towards e-wallet adoption and brand image in the existence of NE. When potential adopters observe the large number of e-wallet users, they tend to think that e-wallets are superior compared to other payment methods, which improves their attitude towards e-wallet adoption. Existing users are seen as a good indicator of a product's or service's quality, and this may also influence how consumers perceive the brand image. This is because RA is closely related to attitude [50] and showed positive mediation between NE and brand image.

With regards to PC, under NE, the factor has a positive mediating effect on attitude and brand image. This indicates that a positive attitude is formed when the service offered by e-wallet is compatible with the masses and on the road to creating new trends. It hinted towards the possibility of becoming a necessary payment method rather than just an option in the future, which urges users to be acquainted with e-wallet. Compatibility is also created when there are more complementary services invented for e-wallet [19]. Each brand offers distinctive complementary services. Thus, any brand that offers complementary services that suit the preferences of the public will be more well-known compared to others.

Furthermore, the findings also suggest that PEOU plays a role in mediating the influence of NE on the attitude of e-wallet usage and brand image. The large network size enabled potential adopters to connect with more existing users, which further ease the process of learning and being familiar with e-wallet functionality [51]. At the same time, the increased demand and ease of use encourage more retailers to incorporate the service into their operations. Thus, this interaction helps users become accustomed to the e-wallet and motivates

them to use it on a frequent basis. Seeing the popularity of e-wallets soar, potential adopters may perceive e-wallets as easy to use and change their attitude towards the technology. This change will greatly affect the brand image for consumers depending on how certain e-wallet services facilitate and simplify their actions to be more user-friendly.

Contrary to the expectation that all innovation characteristics have a significant moderating role that magnifies the influence of NE on the attitude to use e-wallet and brand image, OB and TR are found to be insignificant. This is in opposition to previous research [52], [15]. The respondents of this study may consider OB irrelevant because online financial transactions emphasize on the privacy of users. Therefore, observing others using the service may prove difficult, and doing it without permission is considered against the law.

Concerning TR, the reason could be due to the trait of e-wallets that do not provide any trial period where users can observe and explore the functionality before actual adoption. Furthermore, because all e-wallet platforms do not allow for trial, it has no significant impact on how consumers perceive the brand image, regardless of the size of the user base. Therefore, all constructs related to OB and TR, were determined as non-substantial mediating factors in determining the state of the relationships.

Lastly, among all the innovation characteristics, PC has the greatest impact as the mediator. Based on the t-value obtained, the order of importance is led by PC, followed by RA and PEOU respectively. Knowing and make use of the most appealing value to consumers within the product offered is vital as those factors able to influence and give weight to their decision.

VII. CONCLUSION

This paper examined the mediating effect of innovative characteristics derived from DOI theory on the relationship between network externalities (NE), attitude (ATT), and brand image (BI) of e-wallets among Malaysian consumers. NE has been hypothesised to have a direct significant effect on ATT and BI, which was conclusively established based on the outcomes. Meanwhile, innovative characteristics are expected to significantly and positively mediate the parallel relationship of NE and ATT along with the serial relationship of NE and BI. Undeniably, it is found that DOI plays an important part in mediating these relationships. However, it is also revealed that relationships that consist of either OB or TR as mediators were found to be unsupported as they failed to achieve the minimum requirements from previous analysis.

Theoretically, this study makes a profound contribution by creating a model that describes the innovation traits of DOI in mediating the relationship between NE, attitude and brand image of e-wallet. Even if NE effect can be seen in the growing values of online platforms, it is seldom been discussed in e-wallet studies especially with the inclusion of brand image. With such connection, it adds to the research interest and provides new domain to be explored.

Not only that, the study also made practical contributions in multiple perspectives. For instance, this knowledge might help service providers increase their user base by focusing on the characteristics that should be highlighted in an e-wallet innovation to attract users. In the aspects of managerial implications, it provides valuable insights into what complementary services to offer and how to take advantage of the large network size to strategize their plans and properly market their product. Last but not least, understanding the determinants that trigger the public to accept an e-wallet innovation will assist government and policy makers in promoting and accelerating the rate of adoption to achieve the goal of digital society.

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