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Player Attachment to Mobile Social Network Games: An Information Processing View

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ABSTRACT This study applied the information processing view and the concept of fit to improve understanding of how attachment behaviour and continued use in mobile social network game (M-SNG) players is affected by the alignment between their motivation and technological capability. A quantitative method and a cross-sectional study design were used to evaluate the research model. Data were collected for 427 active M-SNG players in Taiwan. The proposed model was tested with fit as a covariation and with fit as a propensity score in matching method. The results of this study verified that (1) coalignment between motivation and technological capability is positively associated with attachment behaviour in M-SNG players; (2) M-SNG players who have a high coalignment between motivation and technological capability have stronger attachment behaviour compared to players with low coalignment; and (3) attachment behaviour is positively associated with continued use of M-SNGs. This study contributes to the literature by improving understanding of the antecedents of attachment and continued use in M-SNG players. For providers and developers, this study also provides insights into how to improve the business performance of M-SNGs.

INDEX TERMS Information processing view, fit, player motivation, technological capability, attachment, mobile social network game.

I. INTRODUCTION

As adoption and use of mobile social networks increase, these networks have emerged as ubiquitous internet-based platforms not only for social networking, but also for entertainment. On Facebook, for example, FarmVille (Zynga Inc.) had as many as over 60 million players worldwide in 2018 [1], [2]. Research indicates that approximately 40% of internet users have experienced attachment during internet use [3]. The attachment experience is often described as a subjective perception of time and a sense of self-transcendence followed by a sense of integration into cyberspace [2], [4]. Csikszentmihalyi [5] described attachment behaviour, e.g., extreme concentration while engaging in an activity, as behaviour that occurs during a highly rewarding mental state. For an individual to experience attachment behaviour during an activity, the activity must satisfy the personal goals of the user and must allow the user to feel in control [5]. Our study applied these concepts in measurements of attachment behaviour and continued use in M-SNG players.

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Three streams of research in attachment behaviour have emerged in the information systems management literature in recent years. The most recent research stream is patterns of attachment in online environments [6]–[9]. The second is the factors that determine individual attachment behaviour in the use of online-based technology and how they do so. The two factors discussed most frequently are motivation to use information systems technology and capability to use information systems technology [10]–[16]. The third research stream integrates patterns of attachment and factors in attachment into a single comprehensive framework for discussing how an information technology (IT) platform can be designed to induce attachment behavior and continued usage of the platform [11], [17]. The important contribution of these studies is their clarification of the different effects of intrinsic and extrinsic factors in the attachment behaviour of IT users.

However, a noted gap in the literature is whether and how the fit between the motivation and technological capability of users affects their perceptions of using information systems. The information processing view (IPV) [18] is that the fit between information processing needs and information processing capability is an antecedent

of performance and determines the range of performance outcomes. Therefore, we propose that an exploration of the attachment behaviour of M-SNG players should include analysis of the fit between their motivation and their technological capability. Including motivation-capability fit in the analysis of attachment behaviour in M-SNG players would provide further insight into their behavioural patterns.

To bridge the above knowledge gap in the literature, this study had three objectives. The first was to investigate whether motivation-capability fit in M-SNG players has a stronger impact on attachment compared to motivation alone and compared to technological capability alone. On other hand, one underlying implication of the fit concept is that performance outcome is a consequence of coalignment between two or more factors [19]. Thus, the second objective was to investigate whether attachment is stronger in M-SNG players who have high coalignment between motivation and technological capability compared to those players with low coalignment. The third objective was to investigate the relationship between attachment behaviour and continued use in M-SNG players.

II. THEORETICAL BACKGROUND

A. INFORMATION PROCESSING VIEW (IPV)

The IPV is widely used in studies of performance outcome, and its validity is well established [20], [21]. Three core concepts of IPV are information processing needs, information processing capability, and the effects of needs-capability fit on performance outcome [18]. The IPV considers the user an information processing unit. Users process information with the aims of decreasing environmental uncertainty and increasing the efficacy of the decision-making behavior [18], [22]. Uncertainty is defined as a state of limited capability in which potential future performance cannot be precisely described [23]. Uncertainty decreases when the information processing needs of individuals have a good match to their information processing capability, which then improves their performance outcomes [4], [24].

In Hsu and Lin [4], IPV was used to examine how the relationship between information need and the technological capability affects the role of cognitive absorption in continued use of social media. They found that users have high cognitive absorption in a social media use when their technological capability and functional technological capacity are well matched with their needs. Gao *et al.* [25] used IPV to explores negative effects of ubiquitous connectivity enabled by smartphone-based social network service (SNS). They found that that ubiquitous connectivity can potentially decrease intention to continue using SNS by raising privacy concerns in users, by contributing to information overload, and by SNS overuse and addiction. In a survey of 128 managers by Moser *et al.* [26], the authors concluded that, when the information processing capability of the managers had a good fit to their information processing requirements, their decision-making performance improved and overall organizational performance improved. That is, the alignment between a business environment and its ideal information processing profile revealed positive associations with between strategic decision making quality and organizational performance, which empirically supported the central tenet of IPV, i.e., that a good fit between information processing capacity and information processing requirements improves organizational performance. Based on above, IPV was considered an appropriate theoretical framework for our study.

To achieve the objectives of this study of M-SNG players, three important IPV concepts were modified as follows: information processing needs was changed to needs of the M-SNG player, information processing capability was changed to the technological capability of the M-SNG player, and the effect of needs-capability fit on organizational performance was changed to the effect of needs-capability fit on attachment behavior.

B. THE CONCEPT OF FIT

Bianco *et al.* [27] defined fit as the mechanism that determines how the intrinsic perceptions and external environmental interactions of individuals affect their general performance. Empirical studies that have applied the fit concept in the management science field have verified that fit affects the actual performance outcomes [4], [26], [28]. Venkatraman and Prescott [28] proposed six conceptualizations of fit: as a moderator, as a mediator, as matching, as a gestalt, as a profile deviation, and as a covariation. Table 1 summarises the characteristics of the six conceptualizations of fit described in Venkatraman [29]. In the approach recommended by Bergeron and colleagues [30], fit as a covariation is suitable for theory texting whereas fit as a matching is applicable for theory building. Thus, this study used both conceptualizations to test the fit effects in this study.

C. M-SNG PLAYER MOTIVATION

An M-SNG is a portable online game played via a social network sites that has multiplayer and asynchronous game platforms [31]. Studies of intrinsic social and individual factors that affect motivation to play online games [12], [13] have reported that predictors of intention to play online games include achievement, enjoyment, and social affiliation. Moreover, the choice of a particular M-SNG depends on whether it fulfils their motivations, which in turn drive their usage [1], [32]. Thus, we propose that an evaluation of M-SNG player motivation should include achievement, enjoyment and social interaction.

D. M-SNGs AND TECHNOLOGICAL CAPABILITY

A mobile social network can become a powerful gaming platform by using mobile technology, web-based technology, and various other technologies to deliver entertainment and enable player interaction [33]. According to IPV, the choice of a particular IT depends on the functional information

TABLE 1. Six conceptualizations of fit.

Conceptualization	Description
Fit as moderation	Criterion-specific conceptualization of fit as an interaction between two variables.
Fit as mediation	Criterion-specific conceptualization of fit as a mediator between antecedent and consequent variables.
Fit as matching	Conceptualization of fit as the result of a natural choice resulting in a theoretically-defined match (i.e., regardless of performance) between two related variables, possibly in the absence of a criterion variable.
Fit as gestalt	Conceptualization of fit as an ordinal or interval level measure that directs the identification of a gestalt, which it defines in terms of the internal coherence among a set of theoretical attributes, instead of searching a limited number of variables for frequently recurring clusters of attributes or gestalts.
Fit as profile deviation	Conceptualization of fit as an interval measure in which an ideal profile is specified. Adherence to the profile is measured against a specific criterion, e.g., an implication.
Fit as covariation	Conceptualization of fit as a pattern of covariation or internal consistency among a set of underlying theoretically-related variables. Fit as covariation is best described via an illustration.

processing capabilities of the user. The existing literature indicates that, although mobile media (including M-SNGs) have widely varying technological capabilities, they consistently exhibit five key technological capabilities: ubiquitous access, interactivity, social connectedness, security mechanisms, and incentive mechanisms [14], [15]. Thus, we propose that an evaluation of the technological capability of M-SNGs should include evaluation of these five capabilities.

E. ATTACHMENT BEHAVIOR

Attachment is defined as an enduring affectional or devotional bond of substantial intensity [7]. The development of Attachment theory (AT) was developed by Bowlby in the 1960s [34]–[36] to explain the essence of close relationships in human behaviour based on his observations of children exhibiting attachment to their primary caregivers. Recent, applications of AT include its use to explore interactive environments in the management and behavioural science fields [8].

Researchers who have applied AT in studies of user behaviour in online environments have identified two main determinants of attachment behaviour in the online environment: congruency of control skills and focus of attention. That is, users experience attachment in an online environment when they perceive a high degree of control in the environment and when their attention is focused on the environment. Attachment then causes them to lose their self-consciousness and their sense of the passing of time [37], [38].

F. CONTINUED USE

Burton-Jones and Straub [39] identified three drivers of continued use of IT: individual passions, satisfaction of specific needs, and performance of specific goals. Duration and frequency of IT usage have also been identified as drivers of continued use of IT [40]. Therefore, continued use of M-SNG was selected as a performance measure in the current study.

Table 2 lists the operational definitions of the terms used in this study.

III. RESEARCH HYPOTHESES

A. PLAYER MOTIVATION, TECHNOLOGICAL CAPABILITY, AND ATTACHMENT BEHAVIOR

Previous studies have verified that both motivation and technological capability can affect attitudes and behaviours related to use of computer-supported communication technology. For instance, studies by Jung and Kang [41] and by Park *et al.* [42] have found that immersion (i.e., attachment) is stronger in internet-based technology users who have high satisfaction with their motivations to use the technology compared to users who have low satisfaction with their motivations. In another study, an empirical analysis of online consumer behaviour found that the emotional responses and attachment behaviour of online shoppers could be increased by designing the online shopping environment to accommodate users with varying technological capability [43]. Rose *et al.* [44] and Huang *et al.* [2] reported similar results.

Moreover, Kim *et al.* [45] stated that coalignment between the motivation and the technological capability of IT users directly affects their IT usage and indirectly affects their development of functional IT abilities. Goodhue and Thompson [46] argued that, according to task–technology fit theory, a good performance outcome requires a good fit of two or more factors. Chang [47] also suggested that a high coalignment between motivation and technological capability positively affects the attachment behaviour in users of an online-based technology; conversely, a low coalignment negatively affects their attachment on the technology. Thus, we propose the following hypotheses:

TABLE 2. Operational definitions of constructs.

Term	Operational definition	Source
Fit	Coalignment between the motivation and the technological capability of an M-SNG player. Fit is positively associated with attachment behaviour.	[30]
Player motivation	The gratification that a player expects to experience by playing an M-SNG and the perception that the expectation has or has not been met.	[12]
Technological capability	An evaluation of M-SNG technological ability at system quality presentation.	[14]
Attachment behaviour	Attachment behaviour by M-SNG players is characterized by a perception of full control of their actions, centralization of focus, loss of self-awareness/self-consciousness, and diminished perception of time passing.	[2]
Continued use	The extent to which a player continues to use an M-SNG because it satisfies his/her motivations.	[40]

H1: Based on the perspective of fit, a coalignment of motivation and technological capability has a greater positive effect on the attachment behaviour of M-SNG players compared to either of these factors acting alone.

H1a: Players with a high coalignment between motivation and technological capability have stronger attachment compared to players with low coalignment.

H1b: Players with low coalignment between motivation and technological capability have weaker attachment compared to players with high coalignment.

B. ATTACHMENT BEHAVIOR AND CONTINUED USE

Chang [17] verified that attachment behaviour is a determinant of continued individual use of M-SNGs. Attachment behaviour can directly affect user satisfaction and continued IT usage [6]. Therefore, this study posits that attachment behaviour positively affects continued use of M-SNGs. We hypothesise the following:

H2: Attachment behaviour positively affects continued use of M-SNGs.

Figure 1 shows all hypotheses in this study.

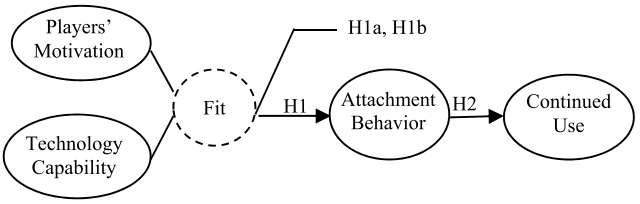

FIGURE 1. The model for research hypotheses.

IV. METHODOLOGY

A. MEASUREMENT DEVELOPMENT

The measurement items for the terms were adopted from the existing literature. Each multiple-choice question was answered using a 5-point Likert scale ranging from 5 (strongly agree) to 1 (strongly disagree). Based on the pilot test results, the final 24-item questionnaire was created according to the context of this study. Player motivation was measured using 7 items adapted from Wu *et al.* [12] and Koo [13]. The items measured seven essential aspects of motivation to play M-SNGs: talking with others, feeling excitement, feeling enjoyment, feeling pleasure, making friends, etc. Technological capability was measured with 11 items adapted from Koivumäki *et al.* [48], Lee [49], Chang [17] and Wu *et al.* [12]. These items measured eleven aspects of M-SNG technological capability: game platform, navigation system and aids, visual display, multimedia user interface, security mechanisms (e.g., encryption and passwords), capability to play the M-SNG cooperatively with a network of friends, etc. Three items used to measure attachment behaviour were adapted from Chang [17], i.e., feeling of control over online activity, spending more time than planned, and feeling of complete captivation. Continued use was measured using 3 items adapted from Wu *et al.* [12], including intention to play M-SNGs when using the Internet, motivation to continue playing M-SNGs based on previous experience, and intention to continue playing M-SNGs in the future.

B. SAMPLE AND DATA COLLECTION

Empirical data for this study were collected by targeting participants with experience in playing M-SNGs. A survey was performed using the online questionnaire tool in Google Forms. The online questionnaire included a hyperlink to a Facebook page. Compared to paper-based surveys, the advantages of online field surveys include their lower expense and shorter response time as well as their lack of geographic restrictions [50]. Questionnaires were distributed to Facebook users on ''friends' lists'' in the Facebook accounts used by the authors. Out of the 427 valid questionnaires retrieved, 31.8% (310) were completed by male, and 68.2% (117) were completed by female. The mean age of the participants was 24.2 years (SD = 4.7), and the largest percentage of participants was 19 to 25 years old (234, 54.8%). Education level was distributed as follows: 51.8% (221) had a bachelor degree, and 20.8% (89) had a graduate degree. Concerning the days/hours of M-SNG use per week, the largest percentages of participants played M-SNGs daily (69.3%, 296) and

for 1 to 3 hours daily (49.6%, 212; mean = 3.1, SD = 1.1). The mean years of experience playing M-SNGs was 1.6 years (SD = 0.8). Table 5 displays the demographic characteristics of the participants.

TABLE 3. Demographic profile of sample.

Measure	Category	Number	Percentage (%)
Gender	Male	310	72.6%
	Female	117	27.4%
Age	Above 36 years old	9	2.1%
	26-35 years old	98	23.0%
	19-25 years old	234	54.8%
	Below 18 years old	86	20.1%
Education	Graduate degree	89	20.8%
	Bachelor degree	221	51.8%
	High School degree or below	117	27.4%
Days per week spent playing M-SNGs	Almost every day	296	69.3%
	4-6 days	39	9.1%
	2-3 days	61	14.3%
	1 day	31	7.3%
Hours per day spent playing M-SNGs	12 hours or more	19	4.5%
	9-11 hours	4	0.9%
	7-9 hours	20	4.7%
	4-6 hours	74	17.3%
	1-3 hours	212	49.6%
	Less than 1 hour	98	23.0%
Years' experience playing M-SNGs	4 years or more	90	21.1%
	2-3 years	61	14.3%
	1-2 years	123	28.8%
	Less than 1 year	153	35.8%

Table 3 displays the demographic characteristics of the participants.

C. RELIABILITY AND VALIDITY

Confirmatory factor analysis was used to measure the reliability and validity of the research model. The reliability analysis obtained a Cronbach α value greater than 0.7 for each item, indicating that the questionnaire had acceptable reliability [51]. The factor analysis used principal component analysis with varimax rotation to test the validity of the results; the loading values for all items were above 0.7, which indicated acceptable discriminate validity [52]. Composite reliability values ranged from 0.786 to 0.957, and average variance extracted values ranged from 0.553 to 0.703, which demonstrated the good reliability of all constructs [50], [53]. Table 4 lists the CFA analysis results.

Table 5 shows that the square roots of average variance extracted values exceeded the inter-construct correlations, which implied that the measurement model had acceptable convergent and discriminant validity [53]. The variance inflation factors were lower than 10 (range, 1.773 to 3.005), which implied that multicollinearity was not problematic in the research model [54].

V. RESULTS

Structural Equation Modelling (SEM) with Smart Partial Least Squares (PLS) was used to test the research model

TABLE 4. Analytical results of items for items used to measure the constructs.

Construct	Item	Factor Loading	Composite Reliability	Average Variance Extracted	Cronbach's α
Player Motivation (PM)	PM1	0.850	0.943	0.703	0.832
	PM2	0.882			
	PM3	0.853			
	PM4	0.797			
	PM5	0.893			
	PM6	0.773			
	PM7	0.814			
Technological Capability (TC)	TC1	0.846	0.957	0.669	0.840
	TC2	0.812			
	TC3	0.826			
	TC4	0.833			
	TC5	0.823			
	TC6	0.814			
	TC7	0.858			
	TC8	0.873			
	TC9	0.820			
	TC10	0.721			
	TC11	0.756			
Attachment Behavior (AB)	AB1	0.732	0.841	0.639	0.765
	AB2	0.824			
	AB3	0.837			
Continued Use (CU)	CU1	0.665	0.786	0.553	0.876
	CU2	0.734			
	CU3	0.823			

TABLE 5. Correlations between constructs with reflective measures.

Constructs	Mean	SD	PM	TC	AB	CU
PM	4.032	0.691	***0.838***			
TC	3.725	0.741	0.299**	***0.817***		
AB	4.252	0.543	0.393***	0.421***	***0.799***	
CU	4.150	0.709	0.361***	0.309**	0.249**	***0.743***

Notes: For each latent construct. The square root of average variance extracted is italicized. **p<0.01, ***p<0.001; n=427

and hypotheses because it minimizes restrictions on sample sizes, measurement scales, and residual distributions [55]. Thus, this study considered PLS an appropriate tool for data analysis. Bentler and Bonett [56] suggested that the variance explained (R^2) value is an appropriate measure of the goodness of fit of the data to the model. In the study, the proportions of R^2 value were 40.0% for attachment behaviour and 36.3% for continued use. The values exceeded 10%, the threshold recommended by Correia Loureiro *et al.* [57] which indicated that the research model had acceptable goodness of fit.

For analysis of fit as covariation, the preferred tool is confirmatory factor analysis [58]. Tenenhaus *et al.* [59] suggested that the geometric mean of the average communality and the average R^2 is limited between values of 0 to 1 as overall good-of-fit measures in PLS. In accordance with the above, this study compared coefficients of determination in the two models (R^2) to test goodness-of-fit in the research model.

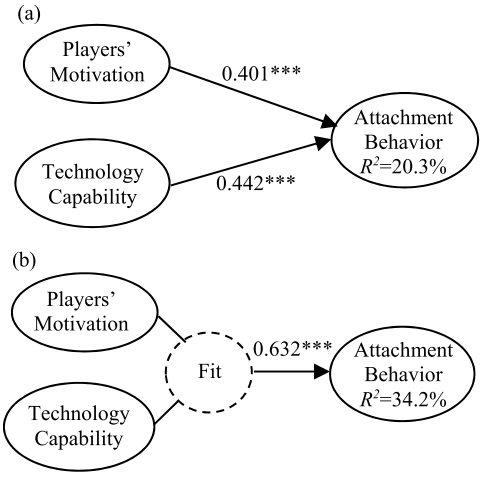

FIGURE 2. **(a) The results of the direct effects model. (b) The results of fit model.**

Figure 2 (a, b) presents the results. The direct effects model explained 13.9% less of the variance in attachment behavior (R^2 = 20.3 versus 34.2). In both models, the R^2 values exceeded 10% [58], which suggested an acceptable fit to the main effects model. Moreover, the coalignment between motivation and technological capability in M-SNG players had a significantly stronger effect on attachment behaviour ($\beta = 0.632$, t-value = 5.606, $p < 0.001$) compared to the individual effect of motivation ($\beta = 0.401$, t-value = 3.998, $p < 0.001$) and compared to the individual effect of technology capability ($\beta = 0.442$, t-value = 4.122, $p < 0.001$). Thus, H1 was supported.

Regarding fit as matching, Venkatraman [29] stated that an alignment or misalignment is indicated by one independent variable being deducted from another. Thus, the median numerical value for attachment behaviour (Me = 3) was used to separate the players into a high-attachment group (n = 319) and a low- attachment group (n = 108). In correlation analysis, the correlation coefficient for motivation and technological capability was r = 0.498 ($p < 0.01$) in the high attachment group and r = 0.363 ($p < 0.01$) in the low attachment group. Thus, H1a and H1b were supported. Additionally, attachment behaviour had a significant positive relationship to continued M-SNG use ($\beta = 0.322$, t-value = 2.613, $p < 0.005$); thus, H2 was supported.

Finally, the use of self-reported data raises the possibility of common method bias (CMB). Thus, the Harman one-factor test was used to examine whether the research model was affected by common method variance [60]. According to the literature, the presence of a single factor or a general factor that accounts for more than 50% of the covariance is considered an indication of CMB [61]. In the current study, the first factor accounted for 33.6% of the total variance in the current. Thus, CMB did not affect the data analysis results.

VI. DISCUSSION

The results of this study reveal that the fit between the motivation and the technological capability of M-SNG players considerably impacted their attachment behavior. Specifically, a good fit between the motivation and the technological capability of an M-SNG player resulted in high attachment and high continued use of the M-SNG. Hence, all hypotheses were supported.

This study has several theoretical and practical implications that can help researchers and M-SNG providers understand attachment behaviour and continued use in M-SNG players. Concerning the theoretical implications, previous applications of IPV have mainly explored how the relationship between information processing needs and information processing capability affect performance outcomes [23]–[25]. This study verified that IPV is an effective framework for measuring players' attachment behaviour in M-SNG players. Additionally, this study is apparently among the first to discuss this relationship in terms of how the coalignment between motivation and technological capability in M-SNG players affects their attachment behaviour and continued use of M-SNGs.

In terms of practical implications, this study found that attachment behaviour in M-SNG players is positively related to the coalignment between their motivation and technological capability and also that the effect of this coalignment on attachment behavior is greater than the direct effect of any single factor. We suggest that, to gain a profound and comprehensive insight into M-SNG use, researchers and M-SNG providers should consider the concept of computer-human fit when developing M-SNGs and when evaluating user performance (e.g., attachment behaviour and continued use). Secondly, this study found that M-SNG players in the high-attachment group perceived a higher coalignment between their motivation and technological capability compared to players in the low-attachment group. Thus, we suggest that M-SNG providers clarify the various motivations of players before developing an M-SNG rather than focusing only on technological innovation and on the environmental richness of M-SNGs. As stated in Wu *et al.* [12], the intrinsic motivations of individual players affect their choice of online games. Implementing these recommendations can increase attachment behaviour and continued use in M-SNG players.

Three main limitations of this study must be recognised. First, national, cultural, and socioeconomic differences have important roles in the patterns of use behaviour in M-SNG use behavior [62]. Thus, the results may not be representative of M-SNG players in other countries or regions. Second, this study emphasized the effects of coalignment between motivation and technological capability on attachment behaviour and continued use in M-SNG players. Other factors (e.g., perceived interactivity) that may influence attachment behaviour in M-SNG players should be examined in future research. A final limitation is the potential for sample selection bias. Since the authors selected the study participants by convenience sampling, the findings might have been influenced by selection bias because all participants were recruited from friends' communities in Facebook. Thus,

this limitation should be considered when interpreting and applying the results of this study.

DECLARATION OF CONFLICTING INTERESTS

The authors have no current conflicts of interest or potential conflicts of interest in this research in its authorship, or in the publication of this article.

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