Validating the TAM Constructs with Behavioural Usage of Facebook

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ABSTRACT
This article investigates if the TAM (Technology Acceptance Model), which has been a widely used model for predicting user acceptance of innovations, is still effective for the innovation that has long been experienced by the users. The hypothesised relationships were based on certain psychological constructs of TAM for predicting behavioural intention toward using a system. Facebook was selected as the technological instrument for testing TAM. SEM (Structural Equation Modeling), a comprehensive statistical approach, was selected for testing the hypothesised relationships. The results show that the relationships of TAM constructs are still valid when experimented on an innovation that has long been experienced by the users.

KEYWORDS
Facebook, System Acceptance, SEM (Structural Equation Modeling), Technology Acceptance Model (TAM), TPB (Theory of Planned Behaviour), TRA (Theory of Reasoned Action)

1 INTRODUCTION
In system acceptance theories, researchers and organisations in several disciplines strive at pinpointing constant constructs, factors determining an individual’s decisions towards adoption of a system. TAM (Technology Acceptance Model) developed by Davis [13],[14],[15],[17] is the most widely referred model that is constructed from psychological conditions of individuals in response to a system [42]. Psychological constructs used in TAM are based on psychological theories, including TRA (Theory of Reasoned Action) [2],[18] and TPB (Theory of Planned Behaviour) [1]. Until now, TAM has been the only system acceptance model that has received the most attention in the information systems community [8]. TAM was pointed out to be more appropriate than other integrated models that may not have better predictive power for acceptance of innovations [6],[5]. It has been considered as a useful theoretical model in explaining how a user interacts with a system. In addition, the relationships between psychological conditions are also used to forecast the likelihood of a system project being accepted or rejected by users. TAM posits that an individual’s intention to use a system (ITU) is influenced by attitude toward using (ATU) referring to the extent an individual has an unfavourable or favourable assessment or appraisal of a material object [1]. ATU was proposed in [14] as another psychological element that influences actual system use. ATU depends on two constructs, including the perceived usefulness (PU) and the perceived ease of use (PEOU) [12]. According to Davis [13, p.320], perceived usefulness is “the degree to which a person believes that using a particular system would enhance his or her job performance”. The same author defined perceived ease of use as “the degree to which a person believes that using a particular system would be free from effort” [13],[15]. While PU was introduced in TAM constructs as a metric for measuring the extent of a particular system’s utility to an individual, PEOU was also introduced in TAM constructs as a metric for measuring the extent to which a particular system reduces effort used in performing a given task.

Generally, TAM is used to measure the user’s behavioural intention towards using an innovation in order to predict the likelihood of the in-
novation being adopted by the user. However, experimenting TAM on an existing system that has been experienced by users can also be used to investigate psychological constructs underlying how the users interact with the system. According to Davis and Venkatesh [16], “The findings revealed that behavioral intention and perceived usefulness measured before hands-on experience with a software product were highly correlated with, and not significantly different from the same measures taken after one month and three months of hands-on experience with the system”. There have been several TAM applications to study conditions associated with how users accept and use a system [8],[19],[21],[30],[34],[38] and the results still confirm the validity of TAM constructs.

In Roger’s theory [32], nevertheless, user perceptions play a significant role in justifying the condition of an innovation. Many individuals evaluate an innovation through subjective evaluation of close peers who adopted the innovation rather than basing their decisions on scientific research by experts. The innovation in this context is described by Rogers [32] as any initiative, practice or development that is recognized as new by individuals or existing units of adoption. It is the period when the users are deliberate in adopting the innovation. The innovation may be considered as new, even if it were invented long ago if certain individuals perceive it as new [32, 33]. In this case, it is questionable if the structure of TAM constructs is still valid for a system that has long been experienced by the user.

This article investigates if the relationships of TAM constructs are still significantly correlated when experimented on a system that has long been experienced by users. Facebook, launched in February 2004, is the most popular social networking site (SNS) that has migrated to the smartphone and has become part of the communication culture. According to the statistics on Facebook mobile users in January 2013 [10], there are 192 million users on Android and 147 million users on iPhone. In Khalid et al. [26], “Facebook is stage, like fashions, where people share information, ideas, personal feelings, current affairs, upload their information, group discussions and many more that sort of thing” [sic]. Although there have been several TAM applications to study conditions associated with how users accept and use Facebook [7],[26],[28],[31], they were proposed to investigate different conditions associated with the use of Facebook. In other words, they were not specifically designed to investigate the validity of TAM constructs. As such, the following research hypotheses were used in this research.

- **H1**: There is a positive relationship between users’ perceived ease of use (PEOU) and their perceived usefulness (PU) of Facebook.
- **H2**: There is a positive relationship between users’ perceived usefulness (PU) and their attitude toward using (ATU) Facebook.
- **H3**: There is a positive relationship between users’ perceived ease of use (PEOU) and their attitude toward using (ATU) Facebook.
- **H4**: There is a positive relationship between users’ attitude toward using (ATU) and their intention toward using (ITU) Facebook.
- **H5**: There is a positive relationship between users’ perceived ease of use (PEOU) and their intention toward using (ITU) Facebook.
- **H6**: There is a positive relationship between users’ perceived usefulness (PU) and their intention toward using (ITU) Facebook.
- **H7**: There is a positive relationship between users’ intention toward using (ITU) and their actual use (USE) of Facebook.

### 2 METHODOLOGY

This section describes the methodology of the study, including instruments, participants, and measurements.

#### 2.1 Instrument Development

A questionnaire is a quantitative data collection method that has been widely used in TAM. It is used to investigate the correlations in numerical terms consisting of a number of questions...
that the participant has to answer in a set format [35]. This research involved the use of an online questionnaire, since it has been acknowledged as an effective and economical tool for collecting data collection [3]. Participants were asked to answer different sets of questions about their perceptions of Facebook in accordance with TAM constructs (e.g., perceived ease of use, perceived usefulness, attitude toward using, and behavioural intention toward using). In order to establish the construct validity of the content, questions were generated from validated instruments, such as those used in previous TAM research and modified to fit the Facebook context. In addition, the questionnaire followed criteria for questionnaire design [3],[4],[20] to ensure the quality of the questionnaire. For example, all question items were grouped in accordance with the TAM structure in order for participants to follow logically from one question to the other. Technical words were avoided for questions to be clear and understandable for the participants. A pilot of the questionnaire was also tested with colleagues and students.

Since the experiment was conducted in Thailand, the English version of the questionnaire was translated into Thai. When one language is translated to another, however, it may have a direct impact on the validity of the use and meaning of words. In order to validate the compatibility of the questionnaire, the author consulted with other bilingual people from the same university about the use and meaning of words identified as problematic. Where there were mismatches between the translations, the translators cooperated until a consensus was reached. Before implementing the survey, the instrument was reviewed by academics and practitioners knowledgeable of survey design. Particularly, a prominent figure with extensive experiences in TAM experiments was also consulted about question items used in the experiment. Modifications of the survey were made in accordance with the suggestions given.

The aim of the questionnaire was explained to the participants to make sure that they were aware of the ethical implications of the research. As the correctness of the answer can be influenced by participant tension [3],[20], the participants were informed that it was not compulsory to finish the questionnaire and the questionnaire could be abandoned anytime before the point of submitting the questionnaire. The participants were informed that the questionnaire took approximately 20 minutes to complete and their responses would remain anonymous and confidential. Any identifying information such as name, email address, and IP address would not be collected.

2.2 Participants

Participants in this study were students from Phuket Rajabhat University (PKRU), who were capable of getting access to Facebook. The participants were informed that no compensation would be given to them and that the experiment was voluntary. There were 573 participants in the TAM measurement.

2.3 Measurement

The questionnaire contains different questions for measuring participants’ actual usage of Facebook. It is also consisted of question items for measuring participants’ perceptions in accordance with TAM. A Likert scale [29], a popular instrument to measure human perceptions in TAM, was used in the questionnaire. A seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree) was used to measure all question items on TAM factors. In order to ensure the internal consistency of question items, most TAM research depend heavily on Cronbach’s alpha [11],[36].

2.3.1 Perceived Ease of Use (PEOU)

The scales used to measure PEOU were adapted from the highly reliable perceived ease of use scale, with an excellent rate of Cronbach alpha coefficients ($\alpha = .91$), developed by Davis, Bagozzi, and Warshaw [14],[15]. In this experiment, the overall reliability is very high and indicates a strong internal consistency among the five question items for measuring perceived ease of use of Facebook ($\alpha = .893$). This implies that these question items are reliably measuring the same construct. This also confirms the reliability of question items for measuring perceived
ease of use proposed by Davis [13].

In addition, the correlation between PEOU1 and the sum of PEOU2 to PEOU5 is $r = .752$. This means that there is a strong and positive correlation between the scores on the one item (PEOU1) and the combined score of the other four (PEOU2 to PEOU5). This strong and positive correlation is also applicable to other question items such as PEOU2, PEOU3, PEOU4, and PEOU5, where $r = .786, .795, .739, .643$ respectively. This can be used to assess how well one item’s score is internally consistent with composite scores from all other remaining items. Moreover, almost all of the question items excepting PEOU5 would decline with the removal of them, they appear to be useful and contribute to the overall reliability of PEOU. Although Cronbach’s alpha would increase from .893 to .896 if PEOU5 were deleted, all five question items should be retained because the alpha does not significantly increase from deleting PEOU5. In addition, PEOU5 still correlates well with the composite score of other question items (the item-total correlation for PEOU5 is .643). As such, there is no statistical reason to remove PEOU5.

2.3.2 Perceived Usefulness (PU)

Six questions were adapted from the highly reliable perceived usefulness, with an excellent rate of Cronbach alpha coefficients ($\alpha = .97$), developed by Davis, Bagozzi, and Warshaw [14],[15]. The overall reliability of PU question items used in this experiment is also very high, indicating strong internal consistency, among the six question items for measuring perceived usefulness of Facebook ($\alpha = .932$). This indicates that these question items are reliably measuring the same construct, which confirms the reliability of the question items for measuring perceived usefulness suggested by Davis [13]. There is a strong and positive correlation between the scores on the one item and the combined score of the other items ($r > .7$ for PU1 and PU6, and $r > .8$ for PU2, PU3, PU4, and PU5). Please note that the alpha would drop from the overall total of .932 if any question item were deleted. Since Cronbach’s alpha would decline with the removal of any one of the items, they all appear to be useful and contribute to the overall reliability of PU. Therefore, there is no statistical reason to remove any of these question items.

2.3.3 Attitude Toward Using (ATU)

Five questions were developed from the highly reliable attitude toward using, with excellent rate of Cronbach alpha coefficients ($\alpha = .96$), adapted from Ajzen and Fishbein [2] in Davis, Bagozzi, and Warshaw [14]. There is strong internal consistency among the five question items used in this experiment for measuring attitude towards using Facebook ($\alpha = .899$). There is also a strong and positive correlation between the scores on the one item and the combined score of the other items ($r > .7$ for ATU1, ATU3, ATU4, and ATU5, and $r > .8$ for ATU2). All these question items appear to be useful and contribute to the overall reliability of ATU, since the alpha would drop from the overall total of .899 if any question item were deleted. There is no statistical reason to remove any of these question items.

2.3.4 Intention Toward Using (ITU)

Behavioral intention is an indication of an individual’s subjective probability to perform a given behavior. It is widely used in TAM as an immediate antecedent of actual usage of a system [1],[2],[18]. Three question items for measuring intention to use were modified from other validated TAM research. The overall reliability of ITU question items is very high and also indicates a strong internal consistency among the six question items for measuring intention to use ($\alpha = .894$). This implies that these question items are reliably measuring the same construct and confirms the reliability of question items for measuring behavioural intention to use. There is a strong and positive correlation between the scores on the one item and the combined score of the other items ($r > .7$ for ITU1 and ITU3, and $r > .8$ for ITU2). Furthermore, the Cronbach’s alpha would drop from the overall total of .894 if any of these question items were deleted. As such, there is no statistical reason to remove any of these question items, since all these question items appear to be useful and contribute to
the overall reliability of ITU.

2.3.5 Behavioural Usage (USE)

Different criteria can be used to measure USE, since behaviour can be observed at a number of different levels on different aspects and occasions [9]. Questions ranging from location, purpose, period, and frequency can be developed to observe USE. While the main purpose of this research is to investigate the validity of TAM constructs with an existing system that has long been experienced by the users, the period of using Facebook was used as a question to measure USE.

2.4 Procedure

The measurement of TAM constructs in this research is based on SEM (Structural Equation Modeling), which is a comprehensive statistical approach for testing relations among hypothesised (observed and latent) variables [24],[25],[27]. According to Hox [23], “the structural equation model implies a structure for the covariances between the observed variables, which provides the alternative name covariance structure modeling”. This approach is also widely used in the behavioural sciences, including psychometric design and measurements [23]. In Teo and Khine [41], “SEM is commonly known as causal modeling, or path analysis, which hypothesizes causal relationships among variables and tests the causal models with a linear equation system”. There are a number of experiments on causal relationships using SEM in various disciplines [37],[39],[40],[41]

The hypotheses are represented in a causal model that allows the relationships (paths) between psychological constructs in the model to be tested. Then, the model is tested against the data collected from participants in order to evaluate how well the model fits the data (fit indices). Path coefficients, standardised versions of linear regression weights, are represented by SEM to examine the causal influence among the hypothesised constructs. The results of path coefficients are divided into an unstandardised coefficient (B) and a standardised coefficient (β). The CR (Critical Ratio), which is a T-test with a null hypoth-

3 RESULTS AND DISCUSSION

There are 502 from 573 students, who have used Facebook more than one year (87.6 percent). Figure 1 represents the hypothesised model based on TAM constructs. The overall fit indices were assessed for the measurement model by using different common measures: The Chi Square Test (χ2), Normed χ2 (ratio of chi square divided by the degrees of freedom), Tucker-Lewis index (TLI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR). The hypothesised model can be considered as a good model fit. All fit indices were within recommended guidelines [χ2 = 9.897; χ2/df = 3.299; TLI = .945; CFI = .958; RMSEA = .063; SRMR = .0703] [22],[25],[41]. The path coefficients (Table 1) linking all constructs in the model are significant at p < 0.01 level, indicating that these constructs share statistically significant relationship, which are positively related to each other.

The results show that the relationships of TAM constructs are still valid when experimented on an innovation that has long been experienced by the users. A significant positive relationship between PEOU and PU constructs (β = .542) confirms that PU is positively influenced by PEOU. Although both PEOU and PU have a positive causal influence on ATU, the relationship between PU and ATU (β = .463) is significantly stronger than that between PEOU and ATU (β = .272).
The students feel positive towards using Facebook because Facebook is easy to use and useful for them. These results also confirm the validity of TAM constructs that ATU is influenced by PEOU and PU. While TAM enforces that ATU has a direct influence on ITU, there is a positive relationship between ATU and ITU ($\beta = .318$). The students intend to continue using Facebook because they feel positive towards using it. Since PEOU and PU are also hypothesised to be associated with ITU, the results show that the constructs are positively related to ITU. However, the relationship between PEOU and ITU ($\beta = .044$) is obviously less than that between PU and ITU ($\beta = .377$). This implies that the students continue using Facebook mainly because they comprehend that Facebook is useful. A positive relationship between ITU and USE ($\beta = .193$) also indicates that the students, who have been using Facebook more than one year, are minimally influenced by the degree of their intention to use Facebook.

4 SUMMARY

Facebook was selected as the technological instrument for testing TAM. Methodology, including instruments, participants, measurements, and procedures, has been discussed. Question items for measuring participant perceptions towards using Facebook in accordance with TAM were described. Not only the results yield the validity of TAM structure and confirm all the hypotheses, but the results also suggest that perceived usefulness and attitude towards using play a significant role in behavioural usage of an existing system that has long been experienced by the users. This is consistent with Roger’s theory [32] that the innovation is considered as new as long as it is still perceived as new by certain individuals despite the fact that it has long been invented.

However, there are also several limitations in this study. For example, the study employed both offline and online survey that must be carefully interpreted. In addition, the study did not take effects of demographics (e.g., gender, education, computer skills, etc.) into account, since the study emphasised the validity of TAM constructs on an existing system. Further studies should analyse such effects and extend to other specific segments such as students in other colleges inside and outside of the country that may contribute to interesting findings. Other psychological conditions associated with existing TAM constructs may also be interesting for further studies.

5 ACKNOWLEDGEMENTS

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### Table 1. Unstandardised and Standardised Path Coefficients

<table>
<thead>
<tr>
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<th>Unstandardised</th>
<th>Standardised*</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>PU ← PEOU</td>
<td>.624</td>
<td>.542</td>
<td>.040</td>
<td>15.413</td>
<td>***</td>
</tr>
<tr>
<td>ATU ← PU</td>
<td>.477</td>
<td>.463</td>
<td>.039</td>
<td>12.259</td>
<td>***</td>
</tr>
<tr>
<td>ATU ← PEOU</td>
<td>.324</td>
<td>.272</td>
<td>.045</td>
<td>7.220</td>
<td>***</td>
</tr>
<tr>
<td>ITU ← ATU</td>
<td>.399</td>
<td>.318</td>
<td>.052</td>
<td>7.610</td>
<td>***</td>
</tr>
<tr>
<td>ITU ← PEOU</td>
<td>.066</td>
<td>.044</td>
<td>.059</td>
<td>1.119</td>
<td>***</td>
</tr>
<tr>
<td>ITU ← PU</td>
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<td>.377</td>
<td>.055</td>
<td>8.892</td>
<td>***</td>
</tr>
<tr>
<td>USE ← ITU</td>
<td>.077</td>
<td>.193</td>
<td>.016</td>
<td>4.715</td>
<td>***</td>
</tr>
</tbody>
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REFERENCES


